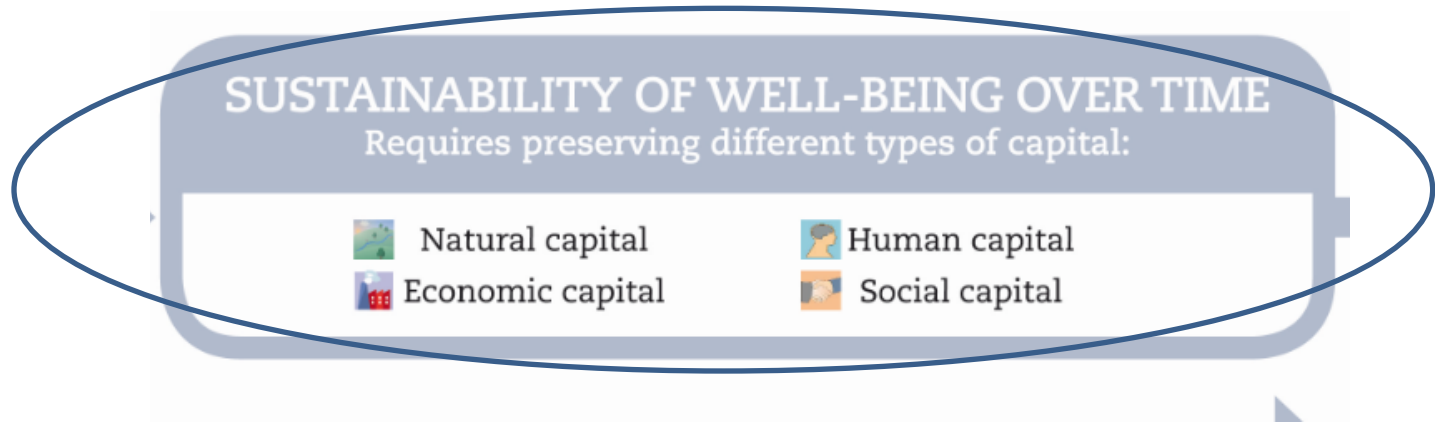# Better Policies for Better Lives: Policy for Well-being and Social Progress

Lesson 5. Social Welfare over Time: Sustainability

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Sustainability in the OECD well-being framework

SUSTAINABILITY OF WELL-BEING OVER TIME
Requires preserving different types of capital:

- Natural capital
- Economic capital
- Human capital
- Social capital

*"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Two key concepts: i) the concept of **needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; ii) the idea of **limitations** imposed by the state of technology and social organization on the environment's ability to meet present and future needs"*

World Commission on Development and the Environment (Brundtland, 1987)

Structure of this lesson

A. The 'capital stock' approach to sustainability

B. Different types of capital

- – Economic capital

- – Human capital

- – Social capital

- – Natural capital

C. Weak and strong sustainability

D. Sustainability and policy making

A. Capital approach (1)

Key ideas

- Communities and policy-makers do not care only about current well-being, but want well-being that lasts over time (sustainability)

- For this to happen, you need to focus on 'drivers' supporting various well-being outcomes (i.e. instrumentally important)

- Some of these drivers have features of persistence: they last over time but shaped by today's actions and behaviours, i.e. capital stocks

- While resources differ depending on the well-being outcome considered, some are important for many outcomes at the same time

- These resources are embedded in 'systems' shaping people's life (e.g. natural system, economic system, social system)

A. Capital approach (2)

Sustainable income. Roots in Fisher's (utility-based) income: "*flow of consumption that could be harvested from a nation's capital stock*"

- Conventional (Hicksian) income would rank an economy with GDP pc of 20K USD, but where people live short lives, as equivalent to an economy with the same GDP pc where people live much longer lives

What are the relevant 'capital stocks'? Well-beyond economic capital

- Resources for future well-being are 'capitals' that last over time, dissipate quickly if not attended to, shaped by investment and depreciation occurring now

$$K_t = K_{t-1} + I_t - D_t$$

- Several types of capital (economic, natural, human and social capital) are important for future well-being of individuals and societies

$$SW_{t+n} = F(Ke_t, Kh_t, Ks_t, Kn_t, ...)$$

A. Capital approach (3)

What are the relevant 'prices' for all these resources?

- Not prices observed on the market, but "shadow prices" that reflect the contribution of various capitals to human well-being today and in the future

- These prices reflect all the negative externalities associated to economic activities, missing markets, and increase when stocks of capital approach "tipping points"

What is the necessary condition for 'sustainability'?

- Stock of total capital per capita that is non-declining

$$0 \leq (\Sigma_i) \ K_i * P^s_i$$

What does it require?

- The maximum rate of C_t consistent with maintaining C_{t+n} is Net National Product, i.e. yield generated by society stock of capital

- "*Output-sustainability correspondence principle*", i.e. in "idealised conditions" (i.e. markets capture full social value of all inputs, and accounts include all stocks of capital) NNP and sustainable income are identical. Corollary:

  ➢ *To the extent that SNA omit important components of consumption and of net capital accumulation, they provide misleading measure of sustainable income*

A. Capital approach (4)

In thinking about capital, we are interested in

- **Stocks**, i.e. the amount of capital available at a point in time, generally expressed on a per capita basis

- '**Net' stocks**, i.e. the difference between assets and liabilities of a country/community, based on comprehensive balance sheet

- **Flows**, i.e. investments, depreciation and depletion that lead to changes in the stock available at a given point in time

- **Risks**, i.e. likelihood that a change in a given stock of resources will translate into changes in well-being outcomes for people

A. Capital approach (5)

Example: climate system

- Climate change is due to accumulation in atmosphere of different types of GHG gases, each with its warming potential (carbon-equivalent), and impacts on future welfare

- Concentration of GHGs is the main driver of climate change and its impacts on people's well-being: concentrations as 'hidden debt to nature' → Stock

- Concentrations are driven by flows of man-made emissions (negative investment) and natural decay of warming potential (depreciation) → Flows

- GHG concentrations translate into higher temperatures with different probabilities →Risk

GHG concentration levels and temperature increase

	Temperature increase					
Stabilisation level	2 C	3 C	4 C	5 C	6 C	7 C
450 ppm	78%	18%	3%	1%	0%	0%
550 ppm	99%	69%	24%	7%	2%	1%
650 ppm	100%	94%	58%	24%	9%	4%
750 ppm	100%	99%	82%	47%	22%	9%

8

Source: Stern Review

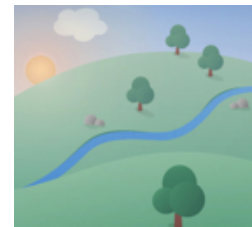# B. Different types of capital

B1. Economic capital

B2. Human capital

B3. Social Capital

B2. Natural capital

B1. Economic capital (1)

Dual nature of economic capital

- "_stores of value_ over which ownership rights are enforced by institutional units.. _from which economic benefits may be derived_ by their owners by holding .. or using them, over a period of time_" (SNA 2008)

The 'wealth' and 'capital' perspective

- Related concepts (value of an economic asset should reflect is its current and future productive capacity) but not identical
- Market prices for wealth may reflect 'bubbles' or 'rent extraction' unrelated to productive use

B1. Economic capital (2)

Scope of economic capital in SNA

- Machines, buildings, infrastructure (fixed, produced, material)
- Inventories (not-fixed, produced, material)
- Land and natural resources (fixed, non-produced, material; part of 'economic capital' when delivering economic benefits)
- R&D, intellectual property/knowledge capital (produced, immaterial)
- Net foreign asset position of a country (financial capital)

Measured through

- Balance sheets (opening and closing stocks; assets/liabilities/net worth), for the total economy and various institutional sectors
- Accumulation accounts, i.e. changes in the stock of assets/liabilities/net worth between two dates (flows)
  - Capital accounts (transactions in non-financial assets, savings, capital transfers)
  - Revaluation accounts (nominal holding gains/losses, split into real and neutral)
  - Other changes in volumes accounts (effects of exceptional events causing changes in volumes of assets/liabilities, e.g. earthquakes)

B1. Economic capital (3)

Main purposes for measuring economic capital in SNA

- Computing consumption of fixed capital (GDP/NDP)
- Measuring capital services (productivity analysis, TFP)
- Establishing balance sheets for economy and institutional sectors

Measures
- Investment, depreciation, and stocks of economic capital
- Methodological guidance OECD (2009), *Measuring Capital*

Limits
- OECD countries differ in the frequency and comprehensiveness of their flow-of-funds and balance sheet data
- Limited information on non-financial assets by sectors (e.g. land, structures)

B1. Economic capital (4)
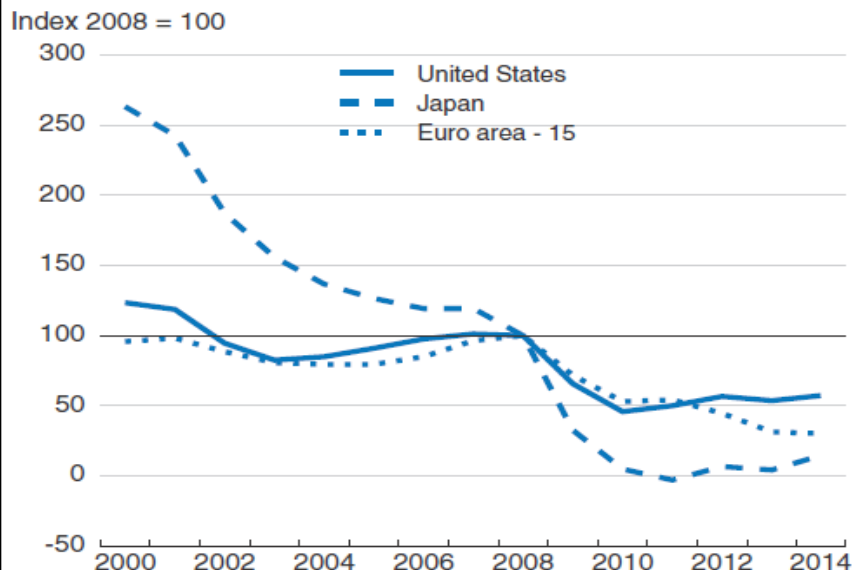
Economic capital and GDP growth

- Classical economists: capital accumulation as main driver
  - Accumulation driven by 'normal' rate of profit (higher wage rate lowers normal profitability of investment)
  - But 'incentive to invest' also depends on utilisation of productive capacity, which influences the 'actual' rate or profit

- Neo-classical economists: technical progress as driver
  - Growth accounting
    - Solow-model: (exogenous) technical progress
    - Endogenous growth models: technological progress embodied in new machines and human capital
  - Investment (in economic capital) determined by (full-employment) savings, interest rates as equilibrating mechanism
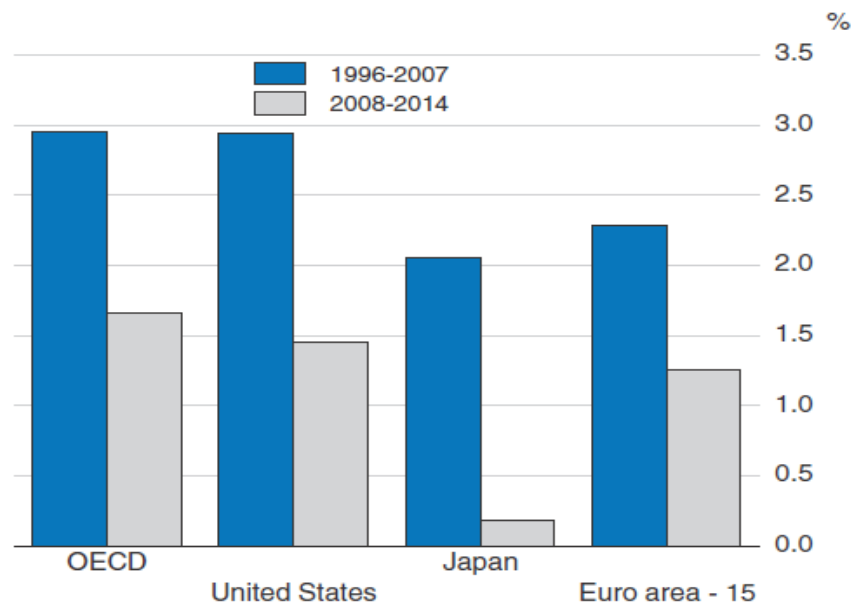
B1. Economic capital (5)

Concerns on sustainability are partly linked to weak accumulation of economic capital in aftermath of crisis

Figure 3.3. **Net investment and capital stock growth have been weak following the crisis**

A. Net investment

Index 2008 = 100

- United States
- Japan
- Euro area - 15

B. Average annual capital stock growth

%

- 1996-2007
- 2008-2014

OECD, United States, Japan, Euro area - 15

Source: OECD Economic Outlook 97 database; and OECD calculations.

StatLink http://dx.doi.org/10.1787/888933221408

B1. Economic capital (6)

➢ Investment and accumulation of economic capital depend on unused capacity: recessions impact on both 'actual' and 'potential' output, i.e. effects of crisis become permanent

Growth in potential GDP in different OECD projections, 2007=100

United States

Euro area 13

EO 99 (2016)

EO 81 (2007)

EO 81 (2007)

EO 99 (2016)
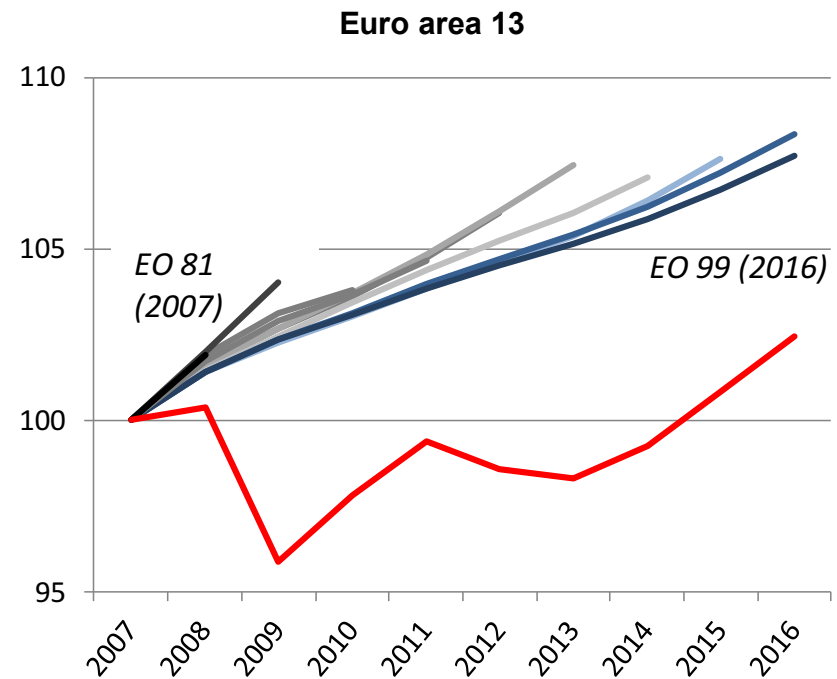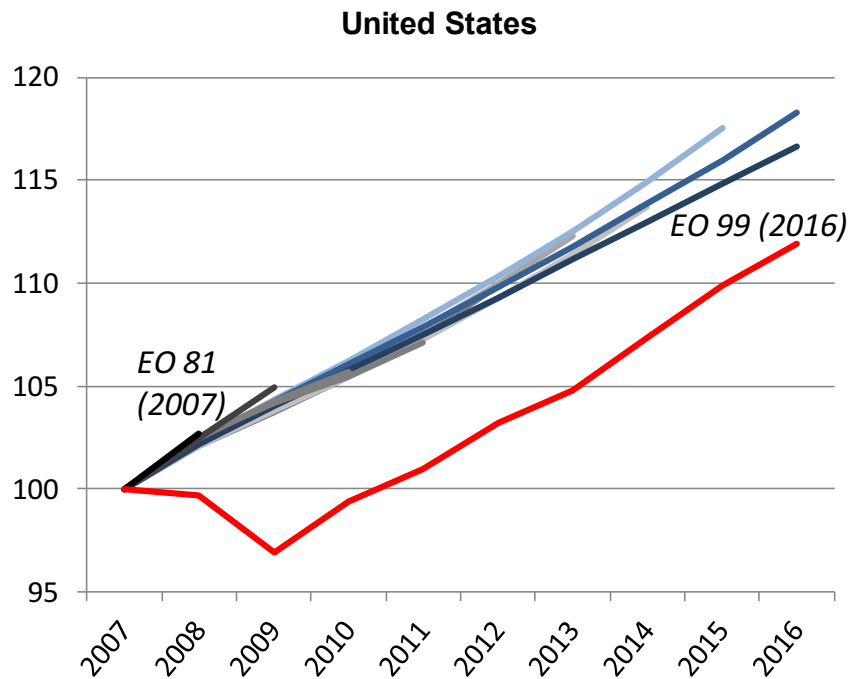
Source: OECD Economic Outlook June versions from 2007 to 2016

B1. Economic capital (7)

Distribution of economic capital matters for sustainability

- Concentration of risks in one institutional sector may threaten whole system
  - Gross debt and financial net worth of government
  - Household debt
  - Leverage of the banking sector
- Distribution also important within each sector
  - Over-indebted households
  - Over-exposed financial institutions ('stress tests')

B2. Human capital (1)

Definition

– *"the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being"* (OECD, 2001)

- **Recognised since A. Smith**
  - **Valuation:** *"A man educated at the expense of much labour or time.. must be expected to earn over and above the usual wages.. the whole expenses of his education, with .. ordinary profits of an equally valuable capital"*
  - **Depreciation:** *"A man whose whole life is spent performing a few simple operations.. has no occasion to exert his understanding.. He naturally loses.. the habit of such exertion and becomes as stupid and ignorant as it is possible for a human creature to become"*
  - **Under-provision:** *"This is the state into which the labouring poor, i.e. the great body of the people, must necessarily fall, unless government takes some pain to prevent it"*

B2. Human capital (2)

Features
- Non-market (embodied in individuals)
- Depletes when non used (contrary to economic capital)

Measurement
- Outside the SNA asset boundary (non-material, no ownership rights, no transferability across economic units)
- Measured through physical indicators of its various elements
  - Highest level of education completed
  - Mean years of schooling
  - Share of workforce receiving on-the-job training
  - Unemployment and withdrawals from labour force
  - Health conditions

> *Distinction between current well-being (i.e. skills, health) and human capital becomes blurred unless you take forward-looking view (e.g. children) or focus on risks (e.g. obesity)*

B2. Human capital (3)

An overall measure of the human capital stock?

- Jorgenson-Fraumeni approach (monetary valuation)
  - Discounted present value of future earnings that could be generated over the life-time of people currently living
  - Depend on education, mortality, labour market conditions
 - Recursive system:

$$LIN \ {}_{age}^{edu} = EMR \ {}_{age}^{edu} \ AIN \ {}_{age}^{edu} + SUR \ {}_{age+1} \ LIN \ {}_{age+1}^{edu} \left\{ (1 + r)/(1 + \delta) \right\},$$

- Lifetime earnings of a person of given education aged 64 (1 year before retirement) equal their annual earnings at that age
- Lifetime earnings of person aged 63 is the sum of their annual earnings at 63 plus the (discounted) earnings he/she may expect to receive upon reaching 64
- .. and so on until you reach school age

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B2. Human capital (4)

What do these monetary estimates show?

Figure 4. Stock of human capital relative to GDP and to the stock of physical capital, 2006

Panel a. Stock of human capital to GDP

Panel b. Stock of human capital to physical capital
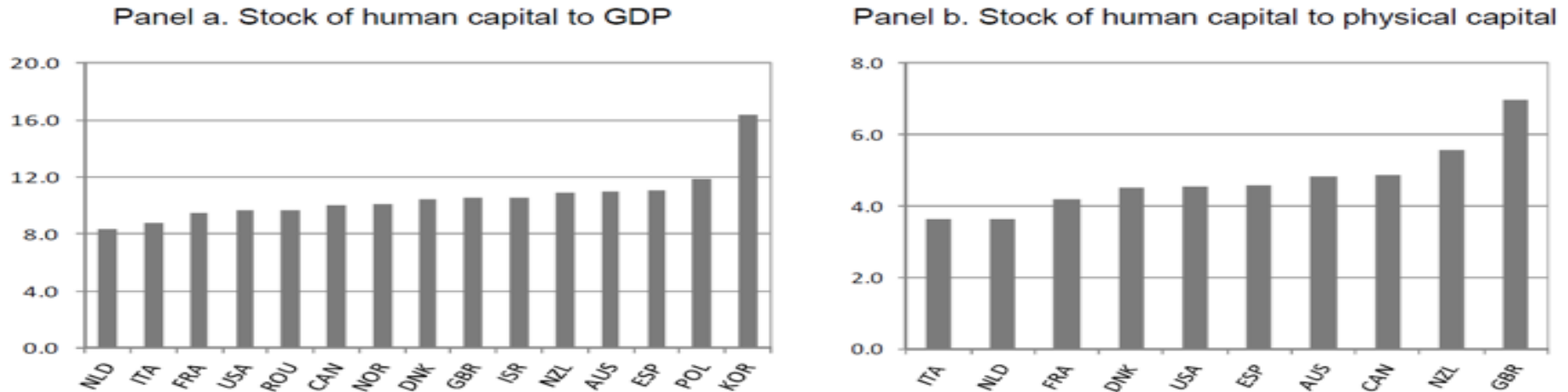
Note: Estimates for Australia refer to 2001, those for Denmark to 2002.

Source: OECD human capital project.

- **Evidence:** Size of human capital in rich countries is significantly higher than that of economic capital
- **Implication:** we undermine future well-being by treating expenditures in education, training, health-care as consumption rather than productive investment

B2. Human capital (5)

What are these monetary estimates missing?

- Permanent effects of recessions on human capital
  - Firms reduce on-the-job training, and loose experienced workers when cutting jobs: effects not captured by JF-type measures
  - New graduates entering labour market in a recession may experience higher unemployment and lower earning that will permanently scar their future prospects

- Assumptions of future growth and discount rate
  - Earnings growth in recent past may be poor guide to future earnings growth (labour share has been falling over time)

- Efforts towards constructing human capital satellite accounts are pursued by NSOs/researchers

B3. Social capital (1)

- *"Networks together with <u>shared norms, values and understandings that <u>facilitate cooperation</u></u> within or among groups"* (OECD, 2001)

- Features
  - Non-material, non-market asset
  - Value increases with use
  - Relations between people rather than individual feature

B3. Social capital (2)

Different (orthogonal?) concepts of social capital

- Pierre Bourdieu: individuals' access to networks, transmission of advantage across generations

- James Coleman: *'variety of entities'* shaping people's behaviours and results (e.g. education)

- Robert Putnam: network of support, civic engagement and norms of reciprocity (horizontal and vertical relationships), regional development in Italy
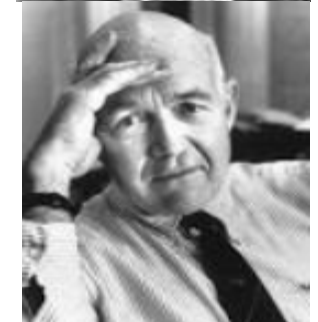
B3. Social capital (3)

Elements

- Social network support (e.g. having someone you can count upon in case of need)
- Personal relations (frequency and density of relations, e.g. how often do you meet families and friends?)
- Civic engagement (e.g. participating or membership of various organisations)
- Trust and cooperative norms (e.g. honesty, attitudes to strangers, propensity to cooperate)

.. All can be measured through surveys and other means

➢ No statistical standards, but methodological work pursued on some aspects (e.g. OECD Guidelines on Measuring Trust) and in some countries (e.g. ONS consultation on SC)

B3. Social capital (4)

➢ Much of the international evidence on social capital is based on survey-measures of trust in strangers: what does this shows?

- Data from ≠ waves WVS
- 'Cluster' of high-trust (Nordic) and low-trust (South Europe) countries
- Divergence: NOR, NLD move further up; UK, US move further down

Source: UK Behavioural Insight Unit

B3. Social capital (5)

- ## Governance as a type of social capital?
  - No agreement. But, whether they included in SK or not, much consensus that governance matters for a wide range of development outcomes
  - What is "governance"?

    - "the exercise of political, economic and administrative authority necessary to manage a nation's affairs" (OECD, 2013)
    - the "sum of the many ways individuals and institutions, private and public, manage their common affairs... a continuing process through which conflicting and diverse interests may be accommodated and co-operative action taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest"(CGG, 1995)

  - Development of institutions follows its own logic, separate from economic and social development

B3. Social capital (6)

Concept of 'governance' is ill-defined

- Focus on public institutions (i.e. judiciary, executive, legislative branches) but other institutions (e.g. media) are also important

What does governance do? A. Smith on 'sovereign's duties'

- "_protecting society from the violence and invasion of other independent societies_"
- "_protecting .. every member of the society from the injustice or oppression of every other member of it, or the duty of establishing an exact administration of justice_"
- "_erecting and maintaining those public institutions and public works which, though they may be in the highest degree advantageous to a great society, are, however, of such a nature that the profit could never repay the expense to any individual .. (those that) cannot be expected that any individual or small number of individuals should erect or maintain_"

B3. Social capital (7)

- Principles: "*what is expected from public institutions?*" Answer: frame their actions under shared values, e.g. safeguarding freedom, maintaining peace, respecting democratic process
- Processes: "*how do public institutions perform their role?*" Answer: due process, competence, integrity, transparency (steering)
- Outcomes: "*what do they deliver that improves people's life?*" Answer: quality services, responsiveness to people's need, access on a non-discriminatory basis

B3. Social capital (7)

Measurable aspects of 'governance'

- peace and security
- functioning of the judicial system
- people's rights
- absence of discrimination
- transparency and rule of law
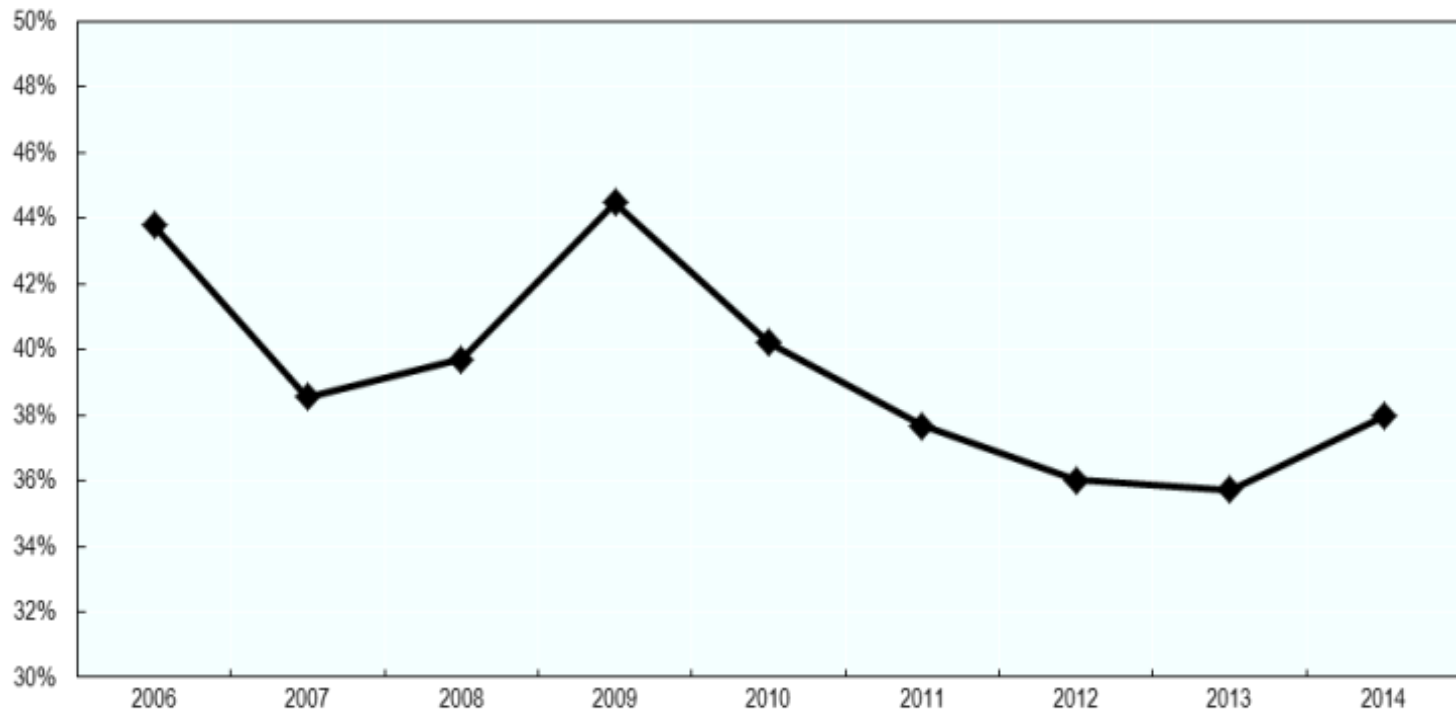- accountability and legitimacy

Statistical instruments

- Administrative data
- Expert opinions
- Household surveys

B3. Social capital (8)

➢ Lower legitimacy of institutions in aftermath of Great recession

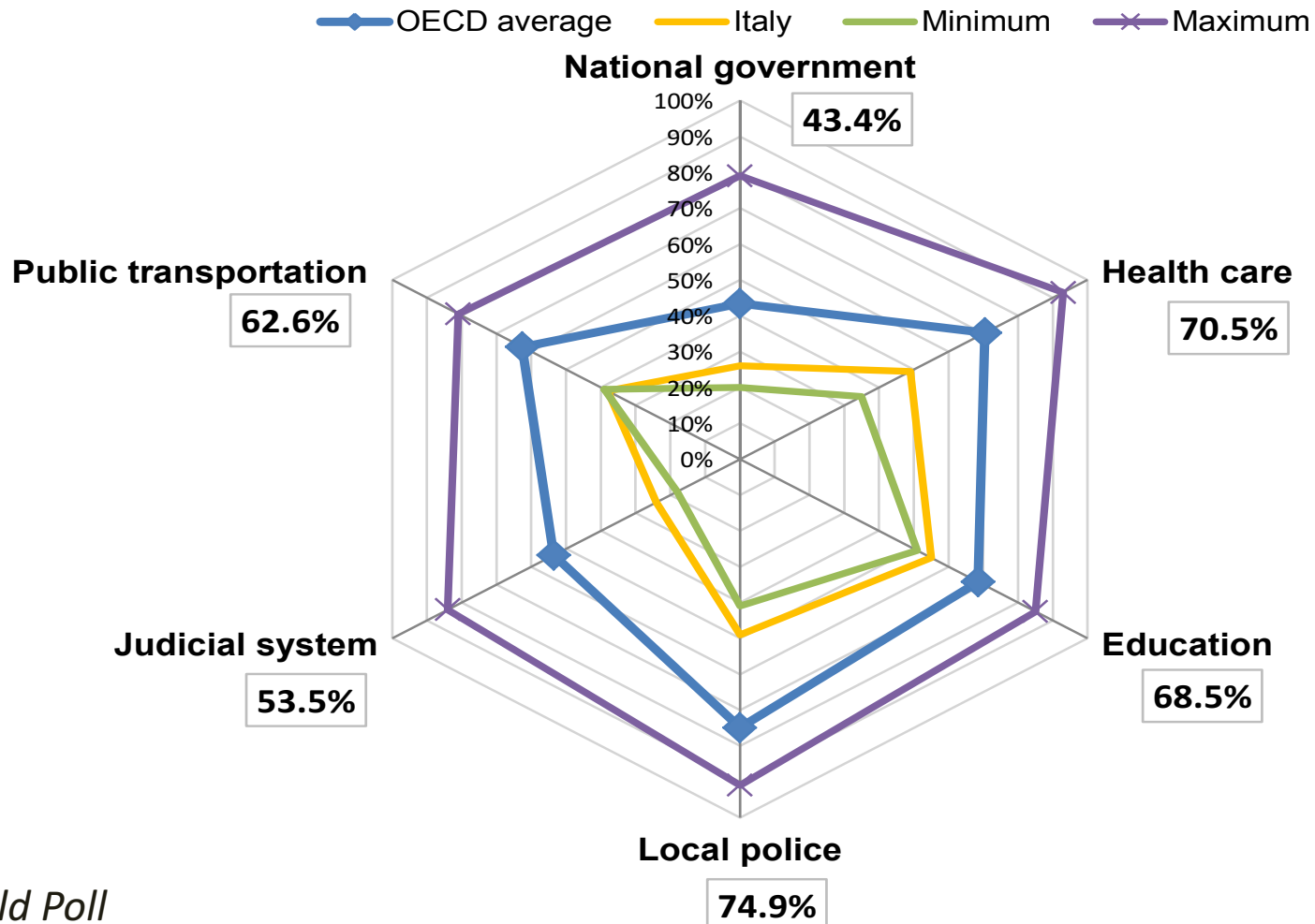**Trust in governments, average of 28 OECD countries**

Percentage of the population reporting confidence in the national government, 2006-2014

Source: Gallup World Poll, www.gallup.com/services/170945/world-poll.aspx.

B3. Social capital (9)

➤ Trust in institutions: .. Large differences across countries

Legend: OECD average | Italy | Minimum | Maximum

National government — 43.4%

Health care — 70.5%

Education — 68.5%

Local police — 74.9%

Judicial system — 53.5%

Public transportation — 62.6%

Axis: 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Gallup World Poll

B4. Natural capital (1)

"Naturally occurring living and non-living components of Earth .. the bio-physical environment that may provide benefits to humanity"(UN SEEA, 2012)

Scope

- Natural resources entering in & flowing from economic production
- Ecosystem services provided to humans
  - Supporting services (nutrient recycling)
  - Provisioning services (providing food, genetic resources)
  - Regulating services (carbon sequestration, flood regulation)
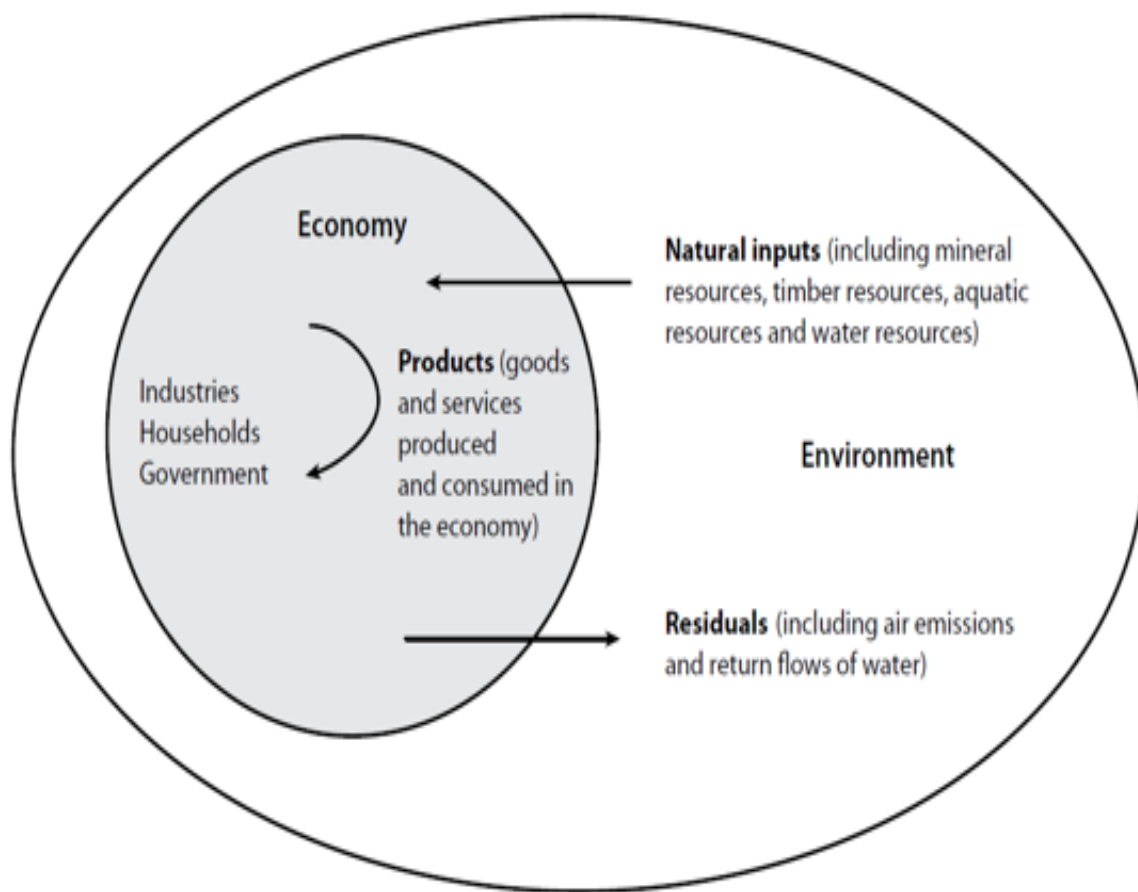 - Cultural services (recreation, heritage, religion)

Measurement: System of Economic and Environmental Accounts (SEEA)
  - Core accounts (e.g. natural resources), stat. standard since 2012
  - Experimental accounts (ecosystem services)

B4. Natural capital (2)

SEEA core accounts

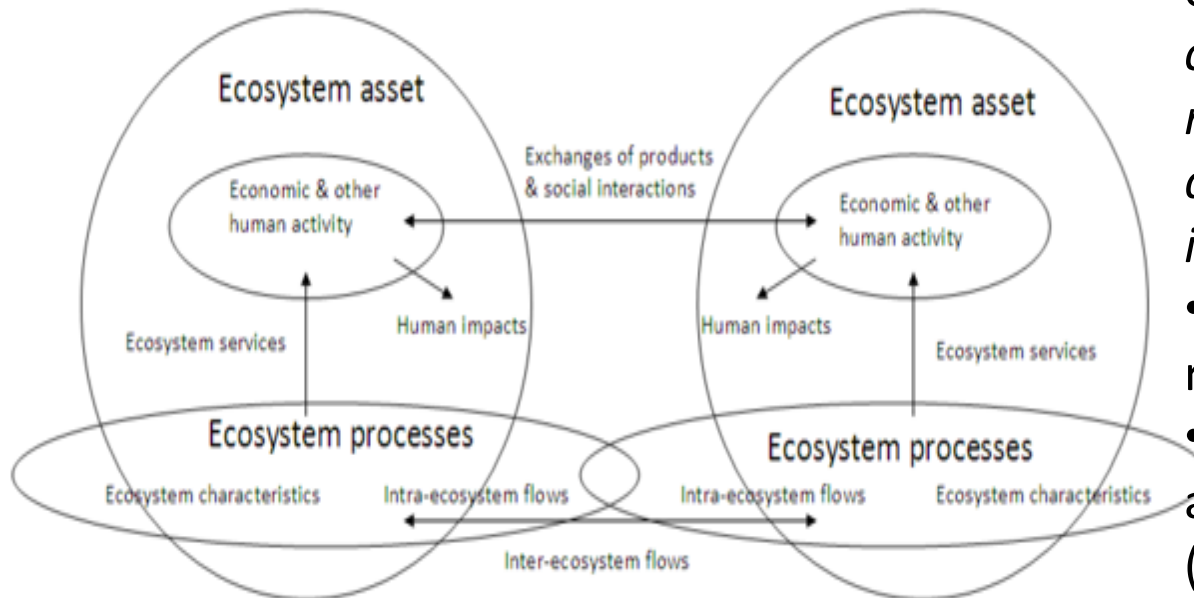Physical flows of natural inputs, products and residuals

- Applies SNA accounting concepts, structures principle
- Starts from economic perspective
- Includes physical supply-use-tables, functional accounts (e.g. environmental protection expenditure), asset accounts for natural resources
- Both monetary (based on SNA asset boundary) and physical accounts (beyond)
- Assets covered:
i) minerals and energy res.;
ii) land; iii) soil resources;
iv) timber resources;
v) aquatic resources;
vi) other biological resources;
vii) water resources
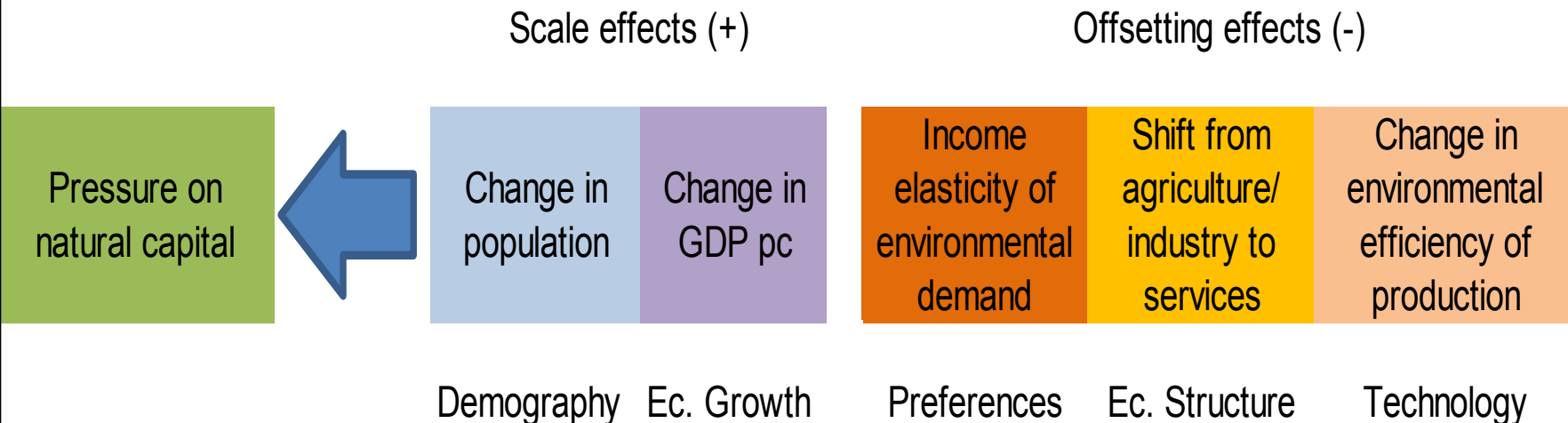
- SEEA ecosystem experimental accounts

- Applies SNA accounting concepts, structures, principles
- Starts from the perspective of ecosystems *("dynamic complex of plant, animal and micro-organism communities and their living environment interacting as functional unit")*
- Each ecosystem asset represent distinct spatial area
- Two types of flows: i) within and between ecosystem assets (e.g. wetland depends on river-flows from river-basin); ii) flows between ecosystems and human activities

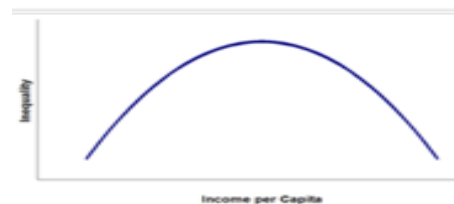**Figure 2.1 Basic model of ecosystem stocks and flows**

Ecosystem asset — Economic & other human activity — Exchanges of products & social interactions — Ecosystem services — Human impacts — Ecosystem processes — Ecosystem characteristics — Intra-ecosystem flows — Inter-ecosystem flows

B4. Natural capital (5)

Drivers of depletion / degradation of natural capital

Scale effects (+)   Offsetting effects (-)

Pressure on natural capital	←	Change in population	Change in GDP pc		Income elasticity of environmental demand	Shift from agriculture/ industry to services	Change in environmental efficiency of production

Demography   Ec. Growth   Preferences   Ec. Structure   Technology

Environmental Kuznets curve?

- **Hypothesis:** Environmental pressures increase due to higher economic growth until point reached at high level of GDP pc , after which relation between economic development and environmental degradation becomes negative
- **Historical evidence**: mixed
  - Per capita emissions of CO_2 and SO_2 show a positive correlation with GDP pc (i.e. <u>richer</u> countries have <u>higher</u> emissions), rising for CO_2 (up to 1970s), falling for SO_2
  - Bio-diversity loss (MSA) is negatively correlated with GDP pc (i.e. bio-diversity loss is <u>higher</u> in <u>poorer</u> countries), weakining over time
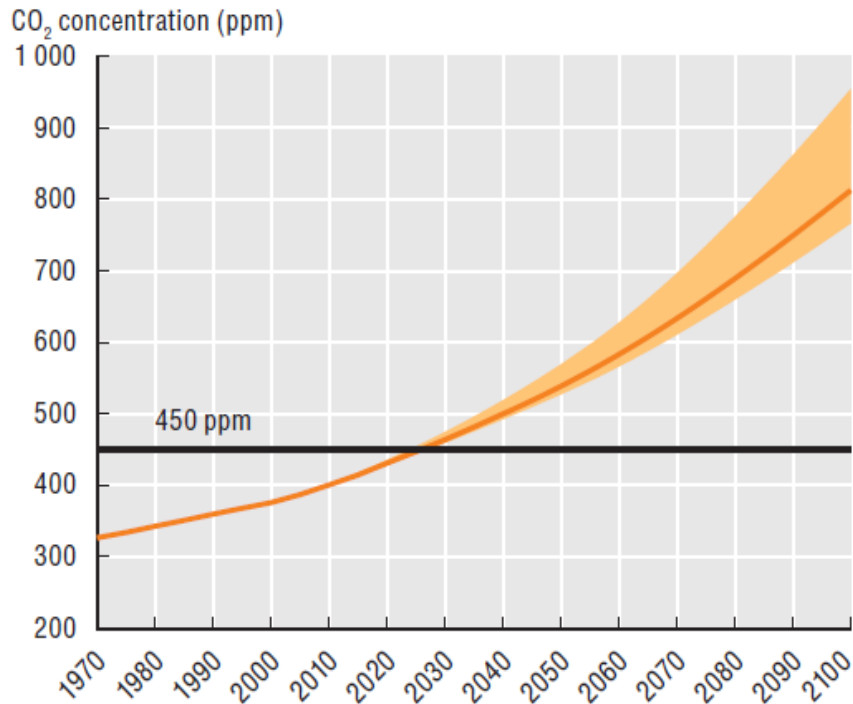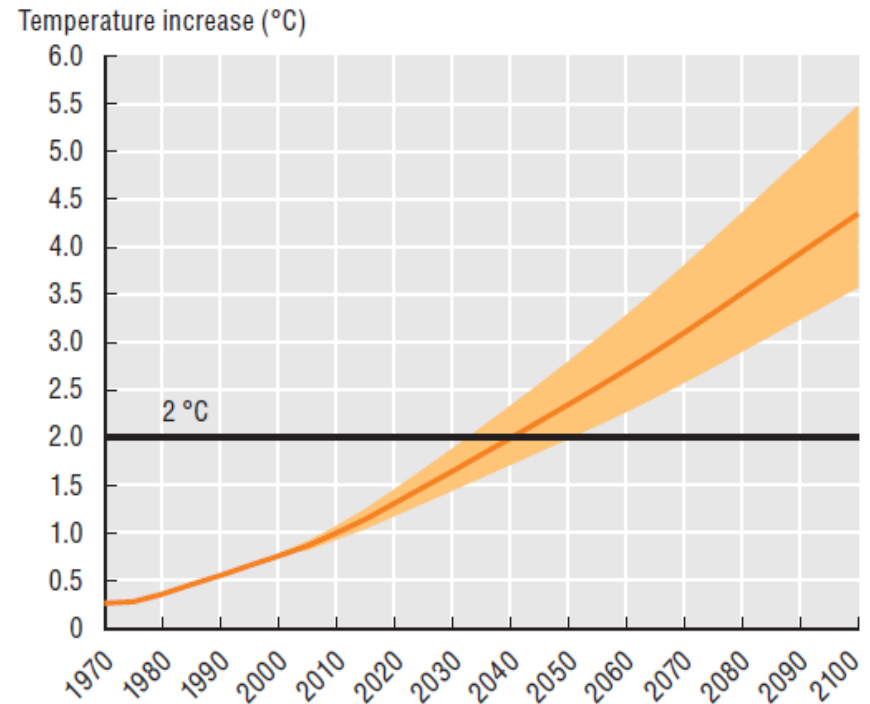
B4. Natural capital (5)

Evidence

➢Climate change

Long-run CO$_2$-concentrations and temperature increase: *Baseline, 1970-2100*[1]

Panel A. CO$_2$ concentrations
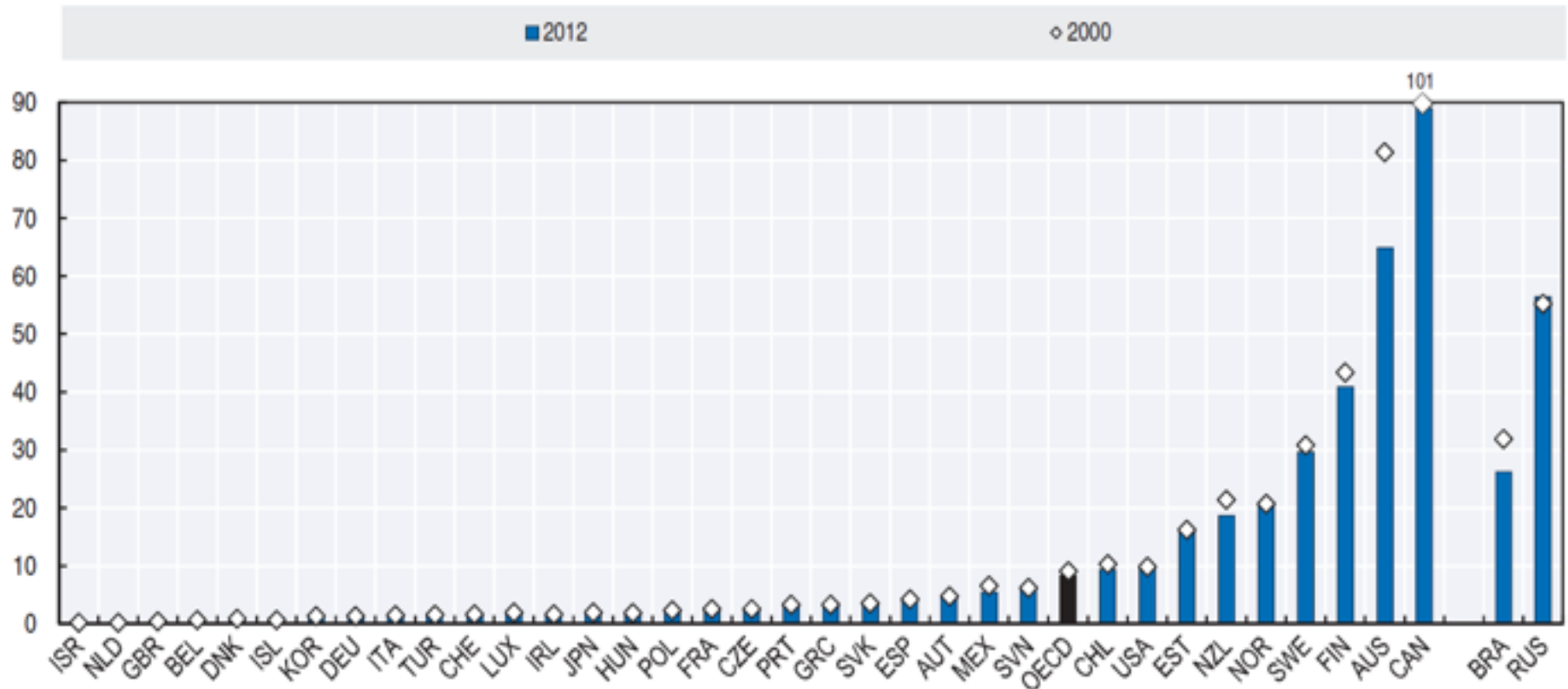
Panel B. Temperature increase

1. Uncertainty range (orange shading) is based on calculations of the MAGICC-5.3 model as reported by van Vuuren *et al.*, 2008.

Source: *OECD Environmental Outlook Baseline*, output from IMAGE.

B4. Natural capital (6)

➢ Forests

Figure 3.2. **Forest area**
Forest area in square kilometres, per thousand people
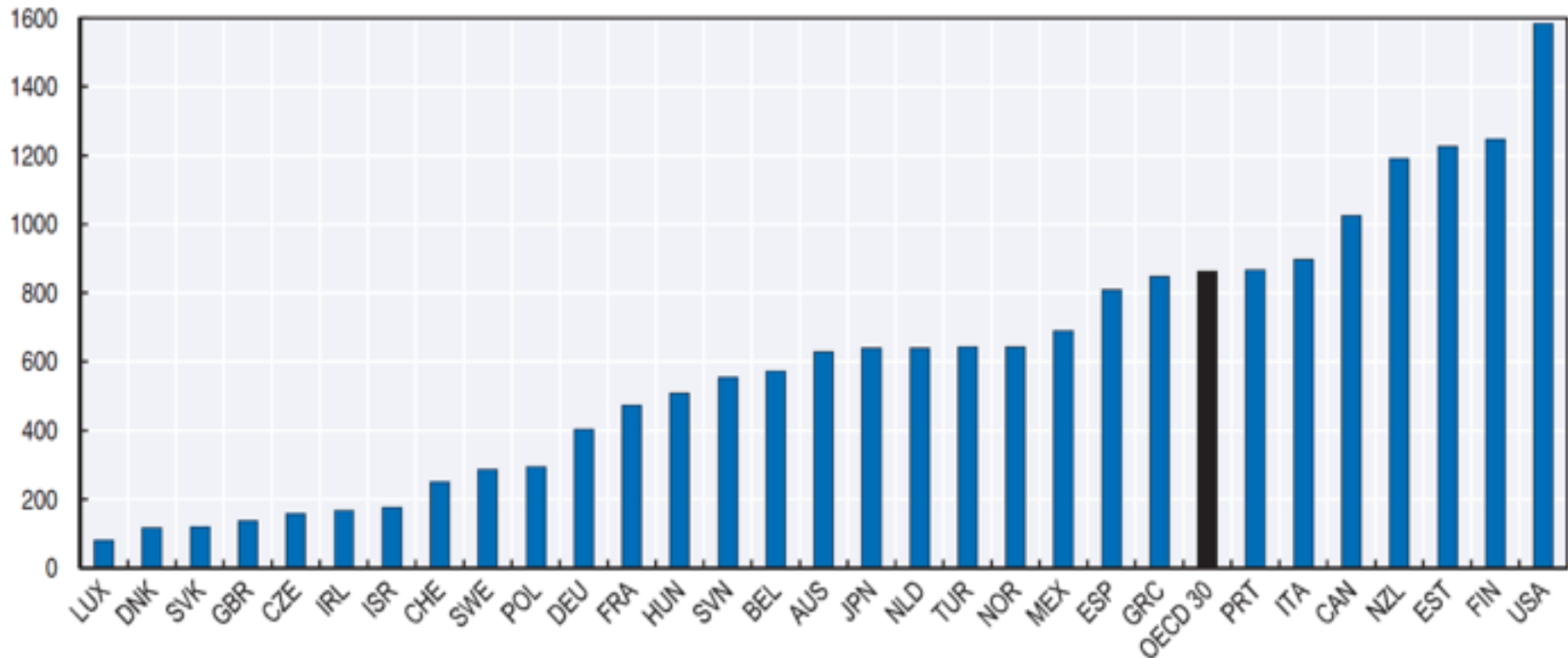
■ 2012   ◇ 2000

Notes: The first available year is 2009 for the United States. The OECD average is population-weighted.

B4. Natural capital (7)

➢Water abstractions

Freshwater abstractions
Cubic metres per capita, latest available year after 2006

B4. Natural capital (8)

Nine "critical thresholds" of natural capital (Rockstrom et al.)

- **Stratospheric ozone layer** in atmosphere filters out ultraviolet (UV) radiation from the sun. When layer decreases due to CFC emissions, more UV reach ground level, causing skin cancer in humans, damage to terrestrial/marine eco-systems
- **Biodiversity loss,** due to higher demand for food, water and natural resources, cause biodiversity loss and changes in ecosystem services
- **Chemical pollution** (toxic and synthetic organic pollutants, heavy metal compounds and radioactive materials) have irreversible effects on living organisms and physical environment (affecting atmospheric processes and climate) including reduced fertility and permanent genetic damage

B4. Natural capital (9)

Nine "critical types" of natural capital

- **Climate Change**. GHG concentrations (now passing 400 ppmv), due to higher emissions and weakening/reversal of terrestrial carbon sinks, reached a point where loss of summer polar sea-ice is certainly irreversible.

- **Ocean acidification**. ~ quarter of the CO2 emitted dissolves in oceans, forming carbonic acid which alter ocean chemistry and rise pH of the surface. Beyond a threshold, rising acidity makes it hard for corals, shellfish and plankton species to grow and survive. Surface ocean acidity increased by 30% from pre-industrial times.

- **Freshwater cycle,** strongly affected by climate change; human pressure as dominant driving force shaping functioning and distribution of global freshwater. consequences include both global-scale changes in river flows and shifts in vapour flows. By 2050, ½ billion people are likely to be subject to water scarcity

B4. Natural capital (10)

Nine "critical types" of natural capital

- **Land** converted to human use when forests, grasslands, wetlands and other vegetation types are converted to agricultural land; effects on biodiversity, water flows and biogeochemical cycling of carbon, nitrogen and phosphorus. Forests play important role in controlling land use and climate.

- **Nitrogen and phosphorus flows to the biosphere and oceans** due to industrial and agricultural processes. Nitrogen and phosphorus are essential elements for plant growth. Human activities lead to emissions that pollutes waterways and coastal zones or accumulates in the terrestrial biosphere. When they end up in aquatic systems, algae grow in response to high nutrient supply, and then makes its way to the sea

- **Atmospheric aerosol loading:** important role in hydrological cycle affecting cloud formation, patterns of atmospheric circulation, direct effect on climate, by changing solar radiation that is reflected or absorbed in the atmosphere. Humans change aerosol loading by emitting atmospheric pollution and through land-use change that increases release of dust and smoke into the air. Inhaling highly polluted air causes roughly 800,000 people to die prematurely each year.

Boundaries and tipping points
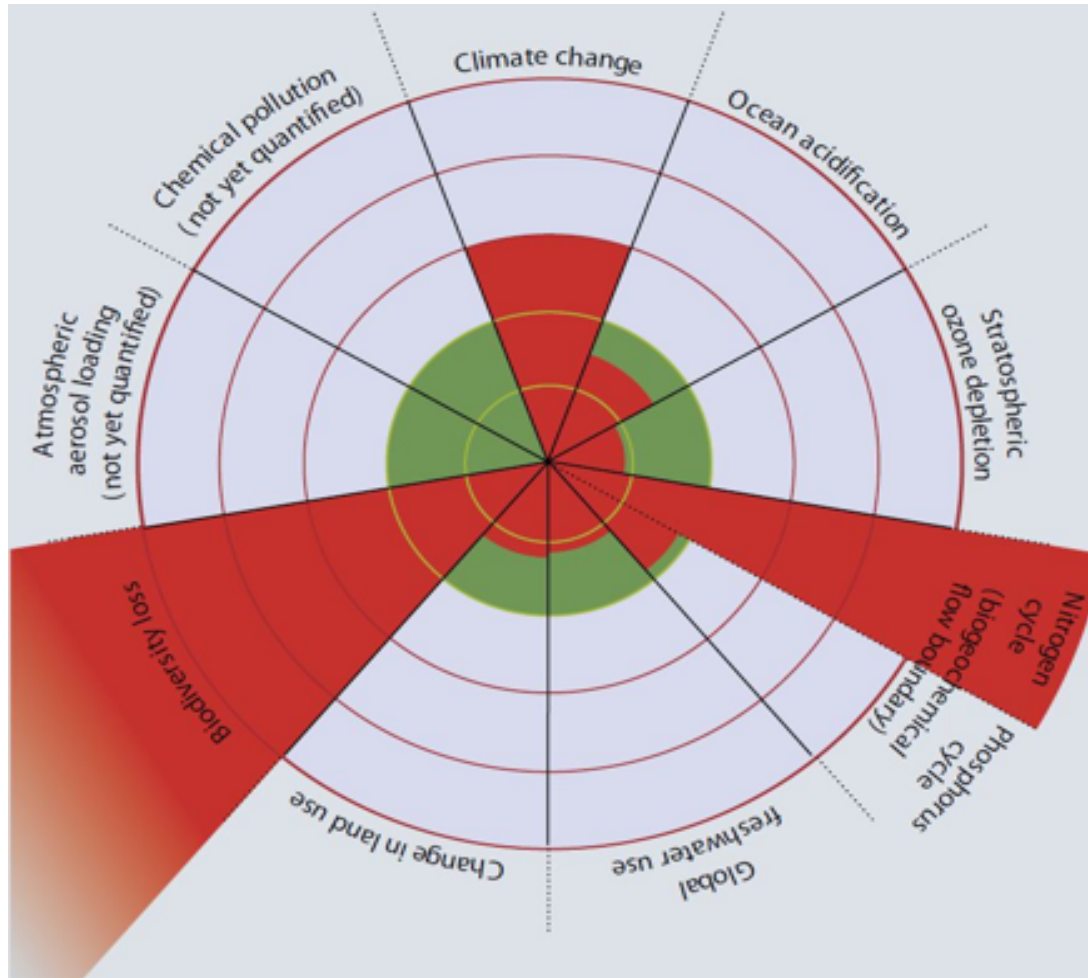
Status of control variables for 9 planetary boundaries (not quantified for 2, chemicals, aereosols)

- Green zone is the safe operating space
- Red (high-risk): climate, biodiversity, nitrogen cycle)

C. Weak and strong sustainability (1)

Two views on sustainability, informing two measurement approaches

- **Weak sustainability**, i.e. different types of capital can be substituted with each other (e.g. higher human interference with climate system becomes "sustainable" when accompanied by higher level of economic or human capital)
  - Requires single index, i.e. common numeraire

- **Strong sustainability**, i.e. some types of capitals are 'unique', what is lost when some elements of critical capital fall below tipping point cannot be replaced with higher levels of another capital type
  - Requires dashboard of indicators, each with its own unit

C. Weak and strong sustainability (2)

OECD Dashboards

	"Stock" indicators	"Flow" indicators	Risk factors
Natural capital	• Concentration of greenhouse gases in the atmosphere • Land assets: forest cover • Freshwater resources	• Greenhouse gas emissions • Annual exposure to air pollution (PM2.5) • Freshwater abstractions	• Threatened species
Human capital	• Educational attainment of 25-34 year • Adult competencies (PIAAC) • Cognitive skills among 15 year-old students (PISA) • Life expectancy at birth	• Educational expectancy (at age 5-39)	• Smoking prevalence • Obesity prevalence • Long-term unemployment
Social capital	• Trust in others • Trust in public institutions	• Voter turnout • Volunteering rates • Government stakeholder engagement	
Economic capital	• Net wealth of households • Net financial wealth of households • Net fixed assets • Knowledge capital • Financial net worth of whole economy	• Gross fixed capital formation • Investment in R&D	• Household indebtedness • Financial net worth of general government • Leverage of the banking sector

C. Weak and strong sustainability (3)

Single indexes: theory (Arrow et al.)

- Inter-temporal social welfare $$V(t) = \int_t^\infty e^{-\delta t} U[c(u)] du$$
  i.e. inter-temporal social welfare of any generation depends on utility from current consumption and on utility of future generations

- Sustainability criterion $$dV/dt \geq 0.$$

  i.e. inter-temporal social welfare of any generation is not lower than that of the preceding generation

- Necessary condition $$dV/dt = \sum_{i=1}^n (\partial V/\partial K_i)(dK_i/dt) > 0.$$

  i.e. the total sum of the changes in different types of capital (valued at their shadow prices) must be positive (i.e. different types of capital are perfectly substitutable)
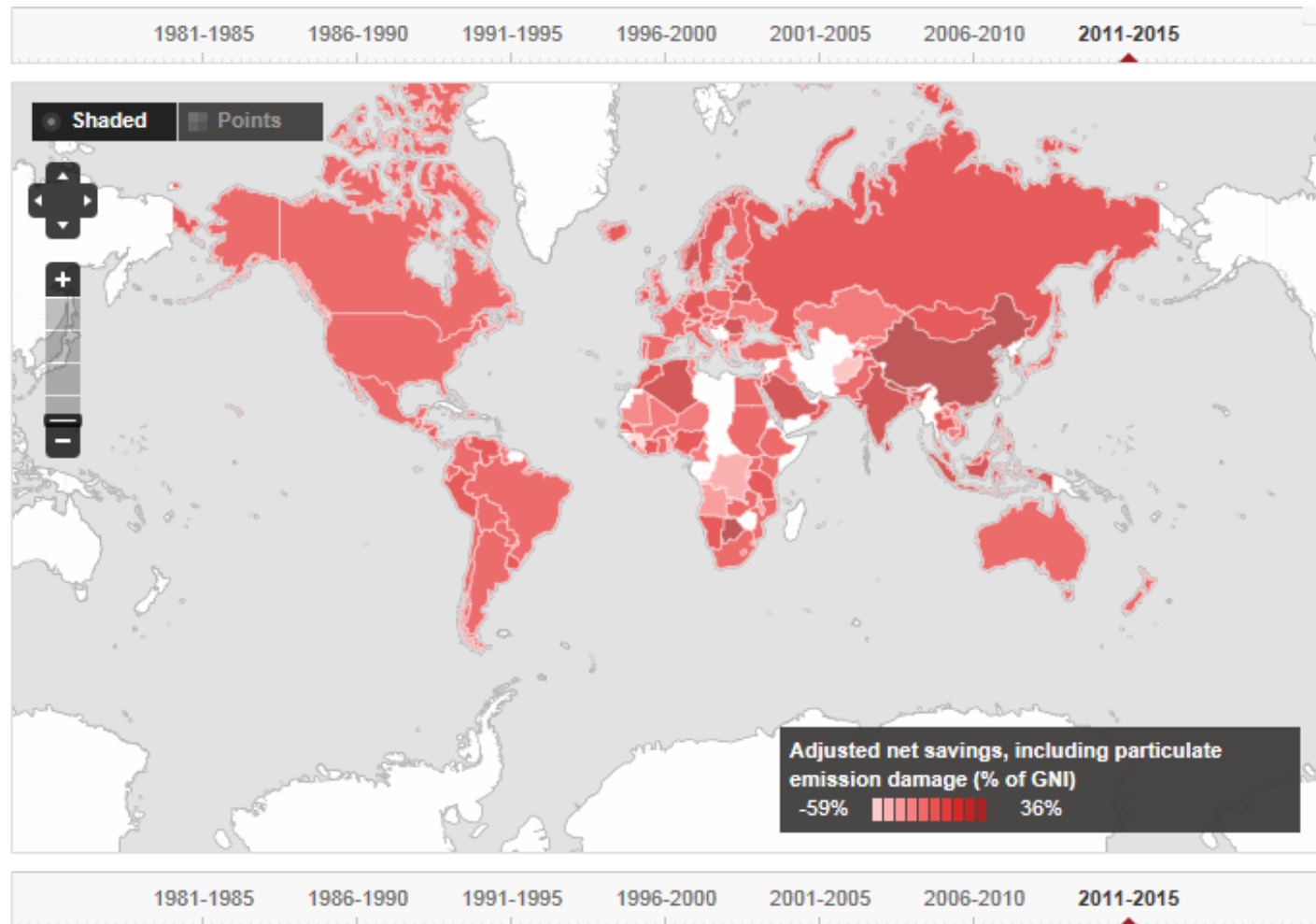
C. Weak and strong sustainability (4)

Single indexes: applications

- Genuine (adjusted net) savings (the World Bank)
  - Conceives sustainability as requiring maintenance of a constant stock of "extended wealth"
  - Genuine savings as change in total wealth over a period, e.g. year

- In practice:
  - Deducts from gross national savings the capital consumption of produced assets, to get net domestic savings
  - Adds current expenditures on education to net domestic savings, to capture investment in human capital
  - Deducts monetary value of depletion of many natural resources, to reflect decline in asset values due to extraction and harvest

C. Overall assessment of 'sustainability'? (5)

Genuine savings rate: empirical evidence

C. Weak and strong sustainability (6)?

- **What are single indexes of sustainability missing?**
  - Limited coverage of assets
  - Market valuation
  - High saving rates may depress capital formation by lowering rates of capacity utilisation
  - Global responsibilities (consumption patterns in rich countries affect resources in other parts of the world)

D. Sustainability and policy making (1)

- **Externalities**. Many of the negative effects on capitals are consequences of economic activities imposing costs on others: 'polluter pays' principle

- **Public goods**. Most types of capital take the form of 'public goods' (under-provided by markets)

- **Risks and insurance**: the 'precautionary principle'

- **Time discounting.** Pay-off of todays' actions depends on how future benefits are 'discounted', i.e. 'time preference' and assumptions on future well-being

- **Wealth management perspective.** "Resource curse" (and ways of avoiding it)

Suggested reading

- OECD (2015), "Resources for future well-being", chapter 3 in *How's Life* 2015, OECD Publishing

- UNECE (2014), *Conference of European Statisticians Recommendations of Measuring Sustainable Development*, chapter 1 to 7, Geneva