Discussing Fraumeni et al. & Corrado et al.

Session 7: Human Capital, Growth and Productivity in the SNA

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2015 IARIW-OECD Conference: "W(h)ither the SNA?"
Paris, April 16-17, 2015

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DES POLITIQUES MEILLEURES POUR UNE VIE MEILLEURE

What growth & productivity without HC?

Knowledge is embodied in people =>
In knowledge-based economies increases in growth and productivity, and investment in KBC mainly results from investment in human capital.

HC: set of knowledge and skills obtained through schooling, training and experience that are useful in the production of goods, services and further knowledge (de la Fuente and Ciccone, 2003; Wright and McMahan, 2011).

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Investment in HC takes forms (eg. education, training, health) that differ in nature, characteristics and expected returns :

- Human capital emerges from workers' knowledge base, skills and abilities (Ployhart and Moliterno, 2011);
- Performance on the job is positively related to workforce endowment in education, abilities and skills (Kaplan et al, 2012; Ng and Feldman, 2009)
- Public sector behaviours matter for growth (Rodrik, 2005)

=> Need to bring HC at the centre of growth and productivity analysis

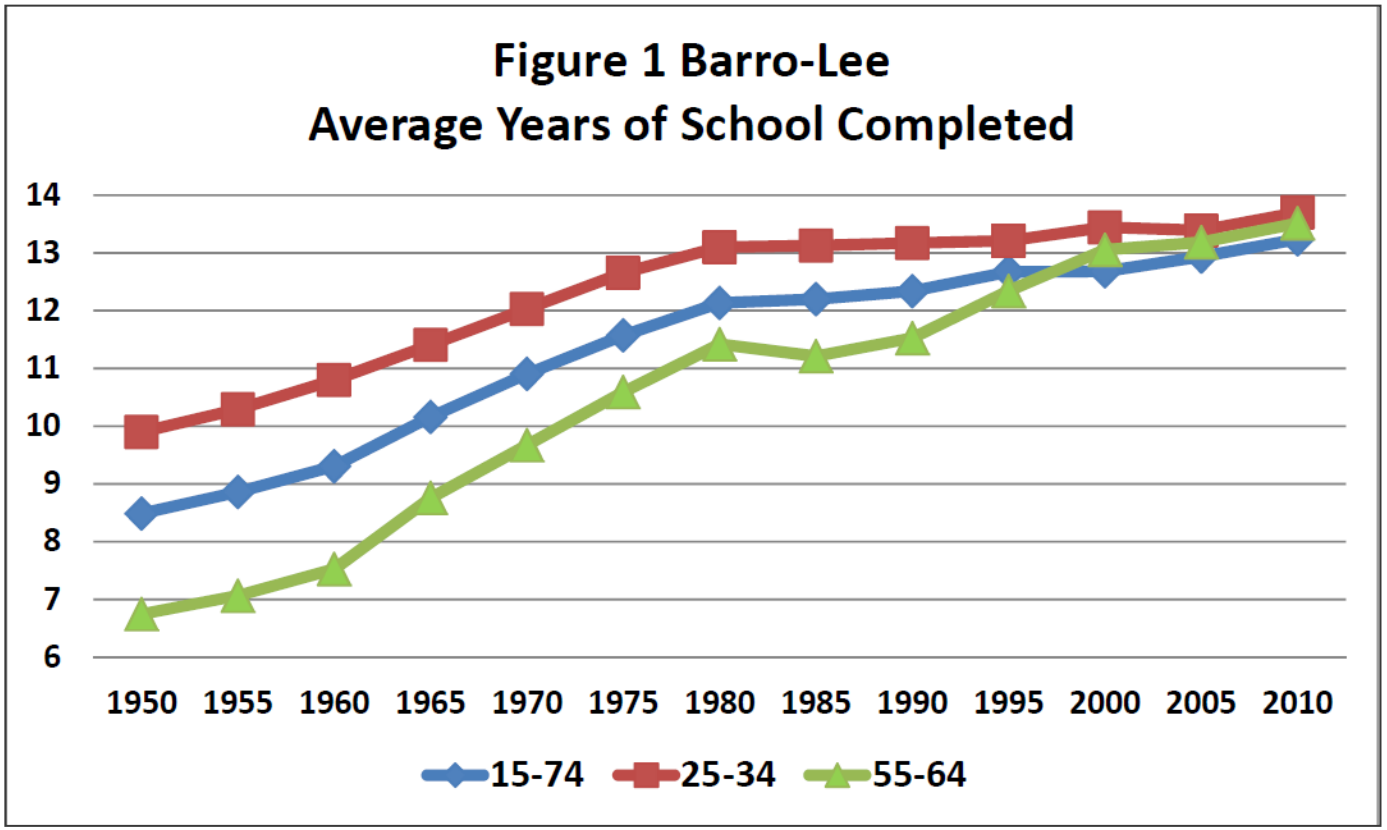
Fraumeni, Christian and Samuels

- Trace effects on human capital of changes in educational attainment using Jorgenson-Fraumeni's lifetime income approach.
- Integrate HC estimates with SNA.
- Relate HC accumulation to economic growth.
- Aim: provide policy makers with tools to address questions as:
  - Should US encourage investment in HC?
  - How will the decrease in the contribution of HC affect future economic growth?

Jorgenson-Fraumeni in a nutshell (1989, 1992)

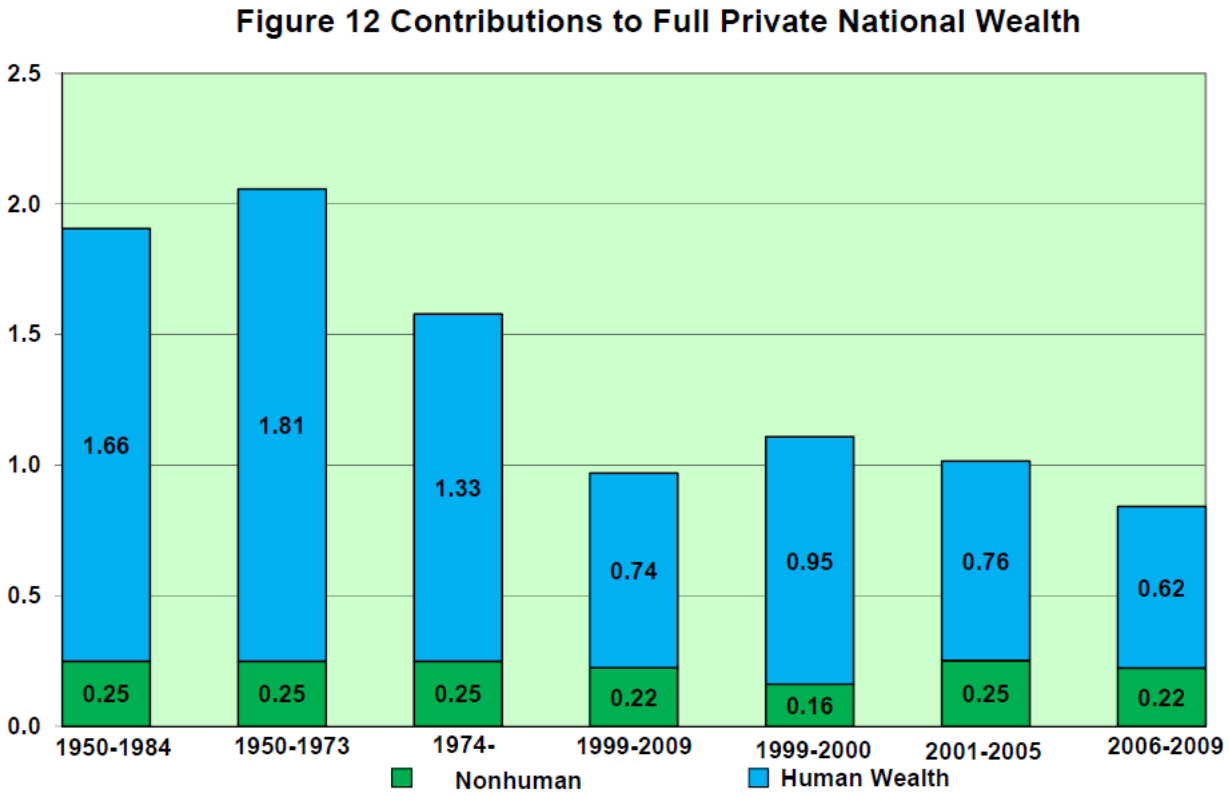
- Measures stock, investment and depreciation of HC:
  - Stock: populations' current and future earnings in present discounted value.
  - Investment in HC: events having +effect on HC stock, such as births, formal education, immigration;
  - Depreciation of HC, events having –effect on HC stock, such as deaths, ageing, emigration.
- Accounts for market and non-market HC:
  - Market HC is valued using lifetime earnings;
  - Non-Market HC measured as opportunity cost (i.e. tax-adjusted market wage) of activities other than market work, schooling or personal maintenance.
- Population stratified by age, sex, education.
- Lifetime split in 5 stages: 0-4; 5-13(14); 14(15)-34; 35-74; ≥75

Average educational attainment



Source: Fraumeni et al. (2015)

Contributions to Full Private National Wealth



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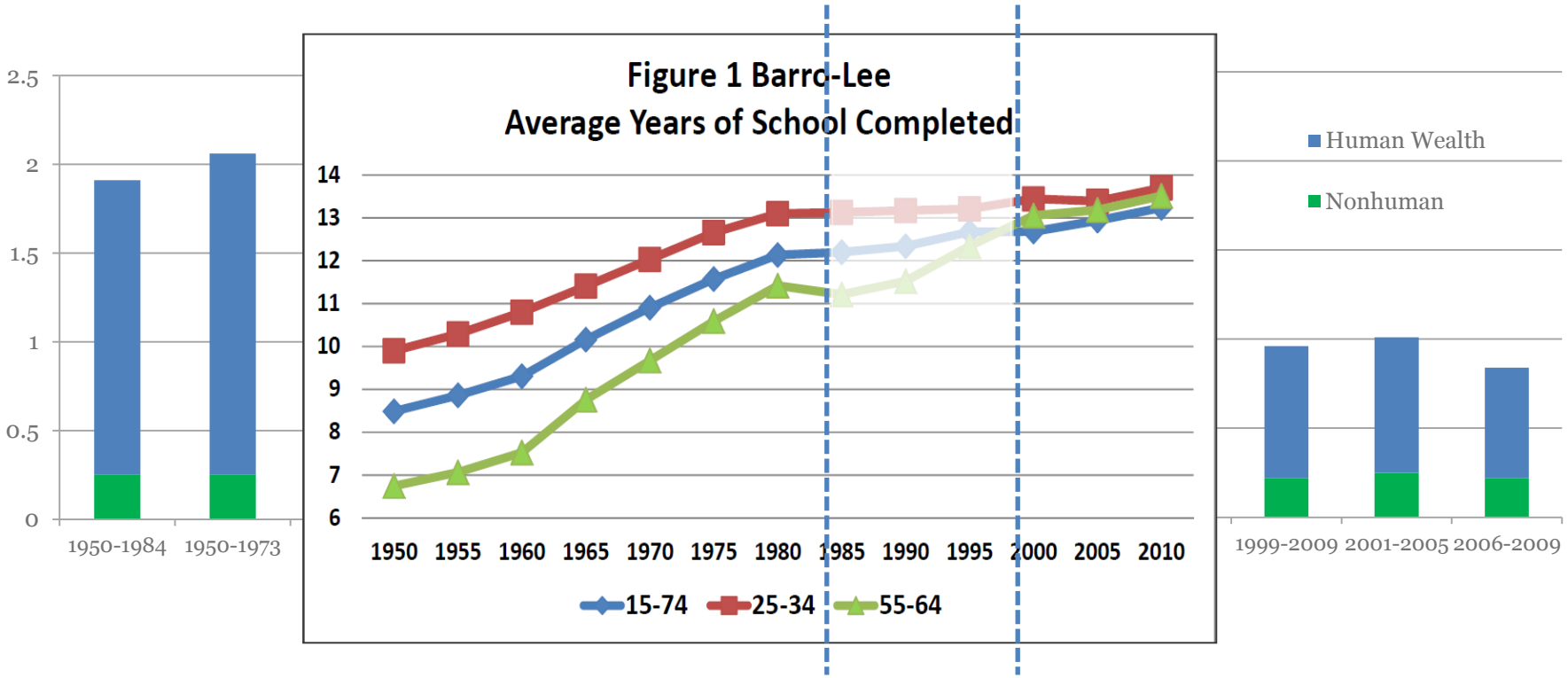
Educational attainment & FPNW



Source: modified from Fraumeni et al. (2015)

From very good to great: refining the analysis

- Refine estimates of lifetime earnings: use of current income as proxy for long-run income can generate errors-in-variables biases, as estimation based on standard assumptions leads to inconsistent estimates (e.g. Haider & Solon, AER, 2006).
- Skill-neutral income growth: how to reconcile this with evidence about skill-biased technological change rates and related growth in relative demand for (some) skills?
  - Goldin & Kats (Brookings, 2007): technology has been racing ahead of education in recent years because growth in educational attainment has been sluggish.
  - Baltagi & Rich (J of Etrics, 2005) establish an unconstrained time path for non-neutral technical change between production and nonproduction labor in US manufacturing industries over the 1959–1996 period.
- Survival rates differ by age and sex but not by education:
  - Can we really expect that e.g. a mine worker and a professor will die at same age?
- Looking beyond the US: adapting the methodology to allow for cross-country analysis.

Corrado, Haskel and Jona-Lasinio

- Propose a theoretical framework to analyse the contribution of public and non-profit sectors (i.e. “nonmarket”) to growth:
  1. Public administration & defence
  2. Education
  3. Human health & social work activities
  4. Scientific R&D
  5. Arts, entertainment & recreation.
- Build on SNA data and approach to propose satellite accounts to capture investment in public sector.
- Identify 2 broad categories of public investment:
  - Information, scientific and cultural assets;
  - Societal competencies.
- Exclude non-market production by households.
- List a series of *desiderata* for the features of the Spintan database.

Market & Non-market KBC

Table 3: **Knowledge Capital in a Total Economy**

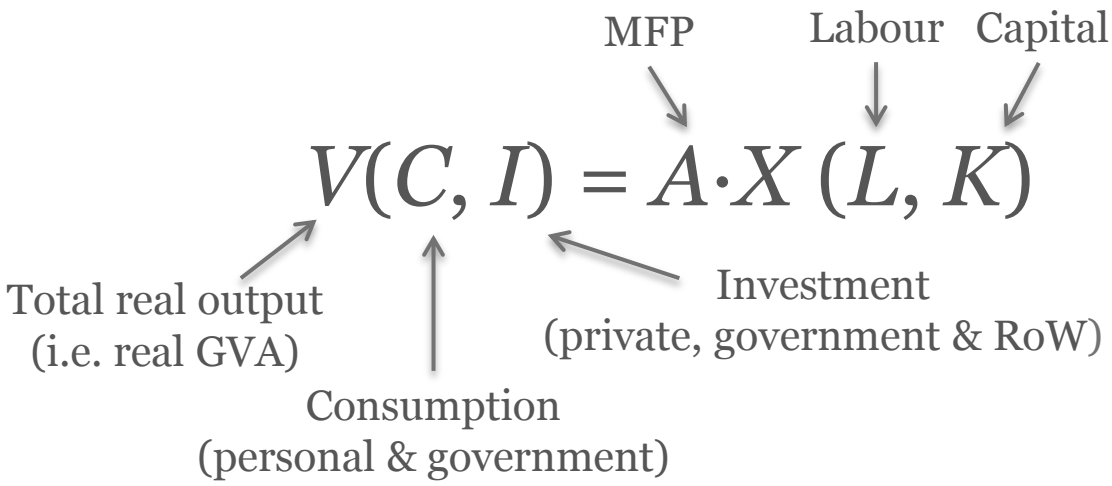
Market Sector	Nonmarket Sector
Computerized Information	Information, Scientific, and Cultural Assets
1 Software	1 Software
2 Databases	2 Open data
Innovative Property	
3 R&D, broadly defined to include all NPD costs	3 R&D, basic and applied science
4 Entertainment & artistic originals	4 Cultural and heritage, including arch. & eng. design
5 Design	
6 Mineral exploration	5 Mineral exploration
Economic Competencies	Societal Competencies
7 Brands	6 Brands
8 Organizational capital	7 Organizational capital
(a) Manager capital	(a) Professional and manager capital
(b) Purchased organizational services	(b) Purchased organizational services
9 Firm-specific human capital (employer-provided training)	8 Function-specific human capital (employer-provided training)

NOTE—NPD=New Product Development, including testing and spending for new financial products and other services development not included in software or conventional science-based R&D.

Source: Corrado et al. (2015)

The CHJL framework

- Follows Jorgenson & Landefeld (2006); incorporates social welfare.
- Considers both sources and uses of economic growth. Evaluates to what extent they are affected by inclusion of private AND public intangible assets.



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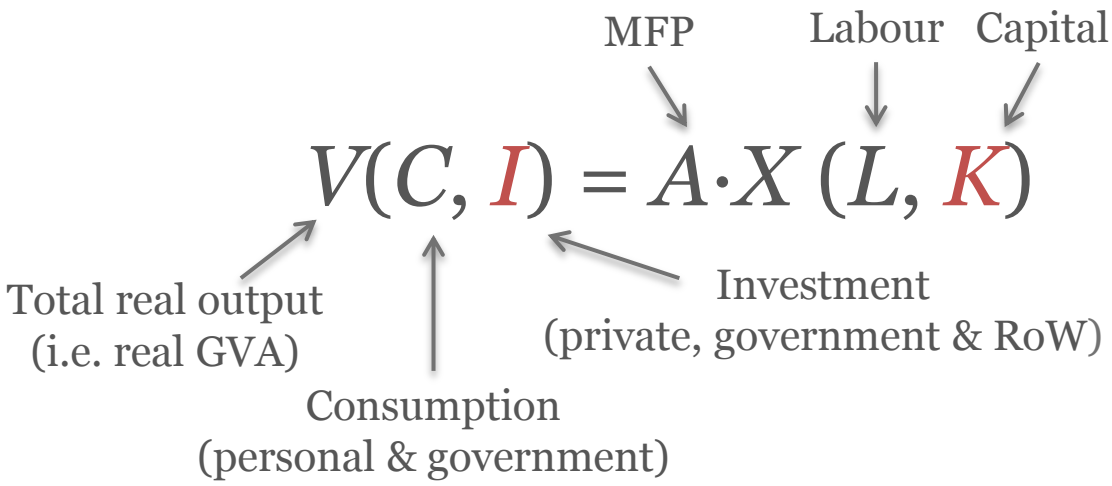
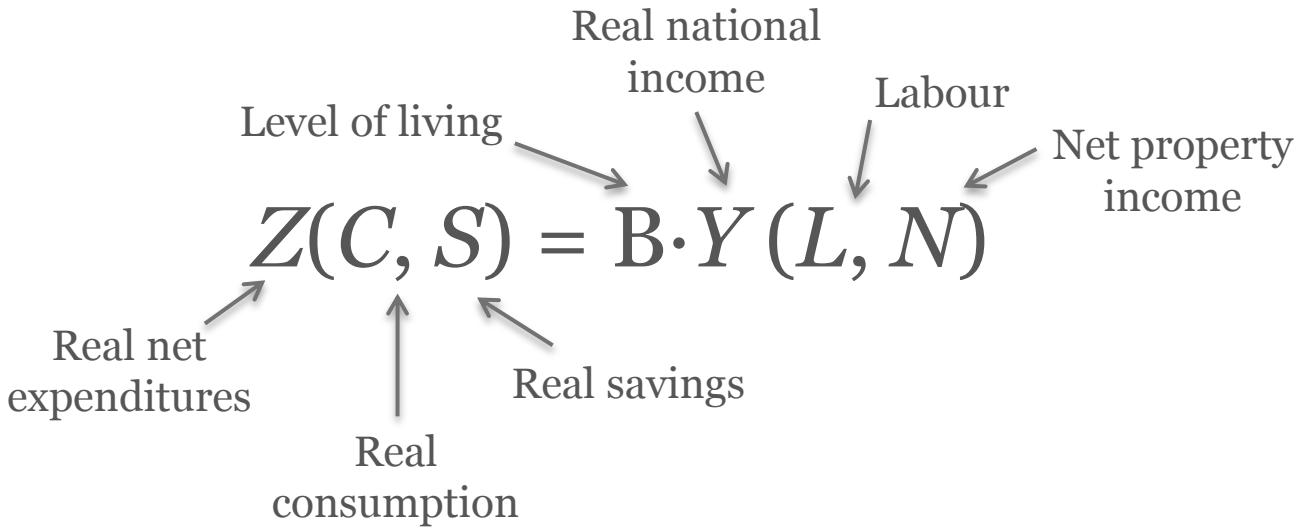
- Capitalising KBC impacts the sources of growth via I & K



The CHJL framework (continued)

- Economic growth creates opportunities for future and present consumption (real net expenditures), through expansion of real national income (both labour and net property income), augmented by changes in the level of living.



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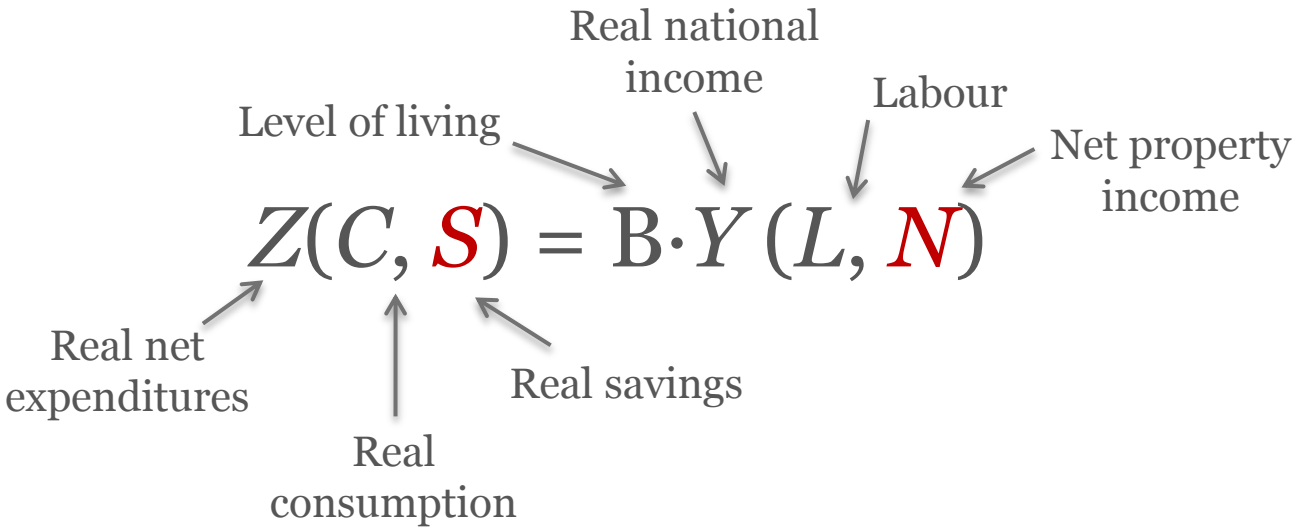

- Social welfare is affected by the capitalisation of KBC via changes in real savings and net property income.

MFP & Level of living

MFP- measures productive efficiency

$$V(C, I) = A \cdot X(L, K)$$

Capital services contribution to MFP ≠
Net property income contribution to level of living
(B excludes capital consumption)

$$Z(C, S) = B \cdot Y(L, N)$$

Level of living – measures the opportunities for present and future consumption that a given supply of factor services that generates L and N.

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Investment shares by asset type:

- If stable over time, ΔlnA ~ ΔlnB
- In shift towards short lived assets, ΔlnA > ΔlnB during transition period
- If shift towards long-lived assets, ΔlnB > ΔlnA during transition period

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Education as a societal asset

- CHJL Propose an “inventory’ approach for the inclusion of changes in value of “schooling knowledge assets” (SKA) in saving and wealth.
- Define SKA as present discounted value of expected wages of graduates upon entry in labour market:
  - follows JF; does not factor in labour market conditions;
  - consumption decreases and net savings increase by cost of net acquisition of knowledge;
  - nominal GDP-neutral definition;
  - The price index used to obtain the quality index for SKA production needs reflecting quality of outcome of educational system (graduates vs drop-outs).
- Capitalising investment in education depends on trends in price index for education services.
- Recognising SKA as societal wealth has a great effect on net savings and possibly real net expenditures (relative to real GDP).

Gov't in GDP, national income & industry output

- SNA concept of industry GVA @ basic prices, may create issues, especially for some industries, as:
  - Taxes and subsidies on production vs taxes and subsidies on products
- R&D gross domestic expenditures (GERD) vs gross output measures
  - Capitalisation of R&D in SNA will make GO measures available;
- Funder vs performer based R&D measures

An excellent start: we want more!

- **KUDOS** to the authors: they move on an unexplored, complex and very vast terrain.
- Very rich paper: maybe worth considering to unpack it (e.g. broad framework and specific assets as R&D);
  - Open data: open or big? Or both? Or big but not open?
  - Social infrastructure vs cultural and heritage: which relationship?
  - Brands
  - R&D: input vs output measures (see wp STI(2013)3)
- Address overlaps between KBC types, minimise double-counting, investigate complementarities before identifying policy implications:
  - Within public KBC
  - Between public and private KBC
- Deal with prices, depreciation….