

Education and Human Capital

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All Education Levels

- **Fraumeni (2007) “Measuring the Education Output of Government Using a Human Capital Approach: What Might Estimates Show?” in United Nations Economic Commission for Europe and Statistics Netherlands, *Measuring Capital Beyond the Traditional Measures, Proceedings of the Seminar Session of the 2007 Conference of European Statisticians.***
- **Use the rate of growth of the volume of J-F investment in education to determine education output**

Below Tertiary Education

- **Fraumeni, Reinsdorf, Robinson, and Williams (2009)**
“Price and Real Output Measures for the Education Function of Government: Exploratory Estimates for Primary and Secondary Education,” in John Greenlees and Charles Hulten, eds., *Price Index Concepts and Measurement*.
 - If direct measures of outcome are unavailable, use the expected change in outcomes that would arise from changes in the input volume or quality
 - A preliminary enrollment based Fisher volume index for education using teacher quality and class size as quality adjusters is presented

Tertiary Education

- **Chapter 4 of Panel on Measuring Higher Education Productivity: Conceptual Framework and Data Needs, Theresa A. Sullivan, Christopher Mackie, William F. Massy, and Esha Sinha, eds. (2012) *Improving Measurement of Higher Education Productivity*.**
 - **Used Tornqvist indexes, instruction focus**
 - **Output index uses credit hours with a sheepskin effect for completions**
 - **L is employees, K is capital input based on book value**

Tertiary Education

- **Research universities vs, other broken out as professor cost includes research time**
- **Problem with colleges not being competitive**
- **Difficulty in assessing quality**
- **Distinctions between types of faculty and types of majors discussed**
- **Warnings about comparing productivity of one institutions vs. another**

UNECE Participation

- **United Nations Economic Commission for Europe,
Conference of European Statisticians**
- **Task Force on Measuring Human Capital, 2014-2016.**
- **Task Force on Satellite Accounts for Education and
Training, 2016-2018.**

HC Measures

- **Fraumeni, ed. (2021) *Measuring Human Capital*, co-author of the introduction and one chapter, and sole author of two chapters**
- **Fraumeni and Gang Liu (2020) “A Brief Introduction to Human Capital Measures,” with Gang Liu, National Bureau of Economic Research working paper #27561**

Monetary Measures of HC

- **World Bank, Changing Wealth of Nations (CWON) series**
 - *The Changing Wealth of Nations, Revisiting the Measurement of Comprehensive Wealth (2024)*; chapter 9 by Karakulah
- **United Nations, various UN entities, Inclusive Wealth Report series**
 - **United Nations Educational, Scientific and Cultural Programme Organization, Mahatma Gandhi Institute of Education for Peace and Sustainable Development *Inclusive Wealth Report 2024: Special Issue on Social Emotional Capital Accounts (2024)*; chapter 2 by Fraumeni, Liu, and Managi**

Jorgenson-Fraumeni HC

- $h_{a,e} = p_{a,e}^m w_{a,e}^m + (1 - r_{a,e}^{e+1}) * \varphi * v_{a+1} * h_{a+1,e} + r_{a,e}^{e+1} * \varphi * v_{a+1} * h_{a+1,e+1}$ for the working aged population, ages 15 to 65
 - $h_{a,e}$ = lifetime income for an individual with age of 'a' and education of 'e';
 - $p_{a,e}^m$ = probability to be employed;
 - $w_{a,e}^m$ = received compensation of employees when employed;
 - $r_{a,e}^{e+1}$ = school enrolment rate for taking one more year's education from education of 'e' to one-year higher level of 'e+1' (assuming equal to 0 for those aged 25-65);
 - φ = adjustment factor;
 - v_{a+1} = survival rate (probability of surviving one more year).
- φ is defined in terms of the real rate of labor income growth (g) and a discount rate (σ), i.e. $\varphi = (1 + g)/(1 + \sigma)$.

J-F Investment in Education

- **Compare individuals who are of the same age and gender**
- **But one individual is enrolled in school and the other is not**
- **Investment in education is the difference in lifetime income between these two individuals**
- **Investment in education can only occur during school enrollment periods**

Some Issues with J-F

- From an individual's point-of-view
- Choice of the real rate of labor income growth and the discount rate
- Time it takes to complete college
- High school dropouts
- Education quality
 - Barro and Lee (2015) *Education Matters, Global Schooling Gains from the 19th to the 21st Century*
- On-the-job-training

Inclusive Wealth Report

$$h_E = \left(e^{\rho E} * P_{5+E} * \int_0^T w(\tau) e^{-\delta \tau} d\tau \right) / P, \text{ where}$$

- h_E = human capital per capita with the average years of total schooling ‘ E ’;
- ρ = rate of return on education (assumed to be 8.5%);
- P_{5+E} = population who has had education equal to or greater than ‘ E ’;
- w = average compensation to employees;
- T = expected working years;
- δ = discount rate (assumed to be 8.5%);
- P = total population.

Issues with IWR

- Wage rate held constant over the whole time period
- Male and female wage rates assumed to be equal
- 8.5% assumptions
- Average years of schooling
- Less data than World Bank estimates

Inserting HC into National Accounts

- **Gu “Human Capital Satellite Account: An Example for Canada”**
chapter 6 of UNECE (2016) *Guide on Measuring Human Capital*,
2010 figures
 - **GDP increase: Income approach 30%, cost approach 10%**
 - **Capital formation increase: Income approach 150%, cost approach 76%**
 - **Final consumption decrease: Income approach 7%, cost approach 7%**
 - **GOS increase 3.8%, mixed income increase 95.2%**
- **Liu (2015) “A Stylized Satellite Account for Human Capital,”**
made-up example
 - **GDP increase 41% fully accounted for by the increase in GOS**

Cost Approach - Kendrick

- **Kendrick (1974) “The Accounting Treatment of Human Investment and Capital,” *Review of Income and Wealth***
- **Tangible – child rearing costs**
- **Intangible**
 - **Education, training, and medical, health & safety expenditures**
 - **Mobility costs**

Nonmarket HC accounts

- **Fraumeni (2000) “The Output of the Education Sector as Determined by Education’s Effect on Lifetime Income,” Brookings presentation at the Workshop on Measuring the Output of the Education Sector.**
- **If you exclude leisure, investment from births and nonmarket investment in education, J-F nonmarket is similar in size relative to GDP as other household sector estimates**

J-F Nonmarket vs. Household Production

SIZE ESTIMATES FOR HOUSEHOLD OR NONMARKET ACCOUNTS AS A % OF CURRENT\$ GDP

**Landefeld and Howell
(1997)**

41.6-51.2%

Eisner (1989)

54.8%

Ironmonger (1996, 1997)

74.6%

Jorgenson and Fraumeni

312.7%

**FURTHER DECOMPOSITION OF THE
JORGENSEN AND FRAUMENI ESTIMATES
AS A % OF CURRENT\$ GDP**

Investment in Human Capital: Formal Education	87.4%
+ Investment in Human Capital: Births	80.1%
+ Time in Household Production & Leisure	145.2%
= TOTAL	312.7%
Excluding Nonmarket from Investment in Education	-36.7%
Excluding Leisure	-73.8%
= REVISED TOTAL	202.2%
Excluding the Rest of Investment in Human Capital	-130.8%
= FINAL REVISED TOTAL	71.4%

Deflation & Comparisons Across Countries

- A Tornqvist or a Fisher index incorporates the MP characteristics of workers into the volume measure
- Use of a CPI or a PCE deflator determines the volume of HC by the volume of goods and services that the income earned can buy
- To analyze an individual country, J-F uses an index
- To compare HC across countries, PPPs should be used
- But some use market exchange rates (MERs), which can clearly be impacted by the monetary policies of countries

MER vs. PPPs Effect on Rankings & ROGs

- **World Bank 2024 CWON**
 - Total wealth is constructed using a Tornqvist index – chapter 2, annexes 1 and 2 to that chapter
- **World Bank 2018 CWON**
 - Used MER's, but stated PPPs are preferable, Box 1.1 and text preceding it
- **Mallatt (2026) “An Accounting Framework for Human Capital,” BEA working paper 2026-6**
 - I used a Christian (2017) Fisher price index to compare to the Mallatt results, which used a PCE deflator
 - .98% (Fisher) vs. 1.72% (PCE deflator) for the ROG of real HC 1975-2013

Indicators-Based Measures

- **World Bank HC Index (2020 or 2023)**
- **UN Human Development Index (2023)**
- **Institute for Health Metrics and Evaluation (2016)**
- **World Economic Forum Global HC Index (2017)**

UN HLEG

Proposal for Moving Beyond GDP

- **27 indicators: well-being, equity & inclusion, sustainability**
- **Rob Smith led effort to respond, proposed instead**
 - **Expanded wealth measures: natural, human, produced, financial and social/institutional capital**
 - **Slightly expanded version of GDP**
 - **A set of biophysical indicators of key natural systems.**

Disappointment with the forthcoming SNA