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Human capital accounting

• Presents a human capital account for United States for 1994-2006
  – Adaptation of Jorgenson-Fraumeni approach

• Human capital stock is huge
  – 16 times size of stock of physical assets

• Issues with data, education investment
Jorgenson-Fraumeni model

• Human capital is expected lifetime incomes in PDV of all persons in U.S.
  – Lifetime income measured as per capita average by age, sex, and education
  – Market income: value of time spent at work
  – Non-market income: value of time not spent at work, school, or personal maintenance
  – Time valued at wage rate, with adjustments for taxation
Measuring lifetime income

• Lifetime income at a given age computed using lifetime income the next age older

\[
life_{y,s,a,e} = y_i_{y+1,s,a,e} + [(1+r)^{-1}(1+g)sr_{y,s,a+1}] \times [senr_{y+1,s,a,e} life_{y,s,a+1,e+1} + (1 - senr_{y+1,s,a,e})life_{y,s,a+1,e}]
\]

- Lifetime income = Yearly income + Time preference, income growth, survival probability \( \times \)
- Probability of schooling \( \times \) Lifetime income one year older
- Probability of not schooling \( \times \) Lifetime income one year older
- Lifetime income one more year ed
Measuring lifetime income

• Start with lifetime income at oldest age and work backward
  – Original J-F accounts: lifetime income 0 at 75
  – Here: PDV of constant income stream at 80
  – Gets lifetime income for every age/sex/ed cell

• Yearly income only earned at ages 15+
• Schooling only takes place at ages 5-34
Human capital stock

• Stock of human capital sums per capita lifetime incomes over persons in a year

\[ hc_y = \sum_s \sum_a \sum_e \text{pcount}_{y,s,a,e} \text{life}_{y,s,a,e} \]

Human capital stock = \[ \sum \text{No. persons by sex, age, education} \times \text{Per capita lifetime income by sex, age, education} \]

• Can be broken down into market, non-market components
Human capital stock

• Changes in human capital break down into revaluation and net investment

\[ \Delta h_{cy} = \sum_{s,a,e} p_{count_{y,s,a,e}} \Delta life_{y,s,a,e} + \sum_{s,a,e} \Delta p_{count_{y,s,a,e}} \text{life}_{y+1,s,a,e} \]

Change in human capital = Revaluation: change due to change in lifetime incomes + Net investment: change due to change in size and distribution of population
Human capital net investment

• Changes in net investment break down across causes of changes in population

\[ \sum \Delta p_{\text{count}_{y,s,a,e}} \text{life}_{y+1,s,a,e} \]

\[ = \sum \text{births}_{y,s,a,e} \text{life}_{y+1,s,a,e} \]

\[ + \sum \text{education}_{y,s,a,e} \text{life}_{y+1,s,a,e} \]

\[ + \text{etc} \ldots \]

Net investment

Investment from births:

\[ = \text{change in human capital due to change in population from births} \]

Investment from education:

\[ + \text{change in human capital due to change in population from schooling} \]

+ Deaths, aging, migration, etc.
Data required for model

- Population
- Average yearly market income
- Average yearly non-market income
  - Work hours, school hours, hourly wage rate
- School enrollment rate
- All by year, age, sex, education
- All from CPS in this application
- Survival rate from CDC
Adaptations to J-F

• Net investment broken down into 5 parts
  – Investment from births
  – Depreciation from deaths
  – Investment from education net of aging of enrolled
    • Net of aging because gross was unrealistic
  – Depreciation from aging of non-enrolled
  – Residual net investment
Adaptations to J-F

• Level of education
  – CPS no longer measures education by year
  – Year of education imputed from ages 0-34
  – Five levels for 35+ (<HS, HS, some, BA, MA)
  – Wage rates only rise across the five levels

• Investment before revaluation
• Pre-tax wage used for market income
• Oldest people age 80, can earn income
Human capital stock is huge

- Stock is $738 trillion in 2006
  - $536T non-market, $212T market
  - Non-market share consistently about 70%
  - 16x stock of physical assets

- Real growth is 1.1% annual 1994-2006
  - Population growth is the cause
  - Slower than physical assets (19x in 1994)
Real human capital stock
(in trillions of 2006 dollars)

Combined human capital
Non-market human capital
Market human capital
Investment in human capital

• In 2005:
  – Investment from births: $9.7 trillion
  – Investment from education net of aging: $6.9 trillion
  – Depreciation from deaths: $2.7 trillion
  – Depreciation from aging of non-enrolled: $9.5 trillion
  – Residual net investment: $2.0 trillion
Net human capital investment (in trillions of 2005 dollars)
Investment in education

- Investment in education is net of aging
  - Combined effect of moving up a year in education and of becoming one year older
  - Effect of moving along age-ed profile

- Why not measure gross investment?
  - Effect of education separate from aging
Gross education investment

• Actual stock minus counterfactual stock in which nobody attends school for a year
  – What would human capital stock be if nobody went to school?
  – What would people who went to school have done if they missed a year?

• Measures of gross educational investment sensitive to answer to second question
If we all missed a year of school

• CF1: We would become like people who actually missed a year of schooling
  – We all fall “off track”
  – Become much less likely to finish school
  – Huge impact on human capital: $16T market

• CF2: We would enroll in school next year with the same probability as a year ago
  – We mostly stay “on track” and finish school
  – Smaller impact: $3.1T market
Net educational investment

- Does not require strong counterfactual
  - Follows people along the course they followed

- Safer route, at least given this data set
  - Gross investment may be OK if there were more direct payoffs to non-degree years; importance of being “on track” weaker
Avenues for future work

• Better adapting to available data
  – Improve imputation of education
  – Some data in the basic CPS I did not use

• Resolving education issue
  – Smaller payoffs to diplomas and degrees
  – Some direct payoff to intermediate years