

Net Investment and Stock of Human Capital in the United States: 1975-2013

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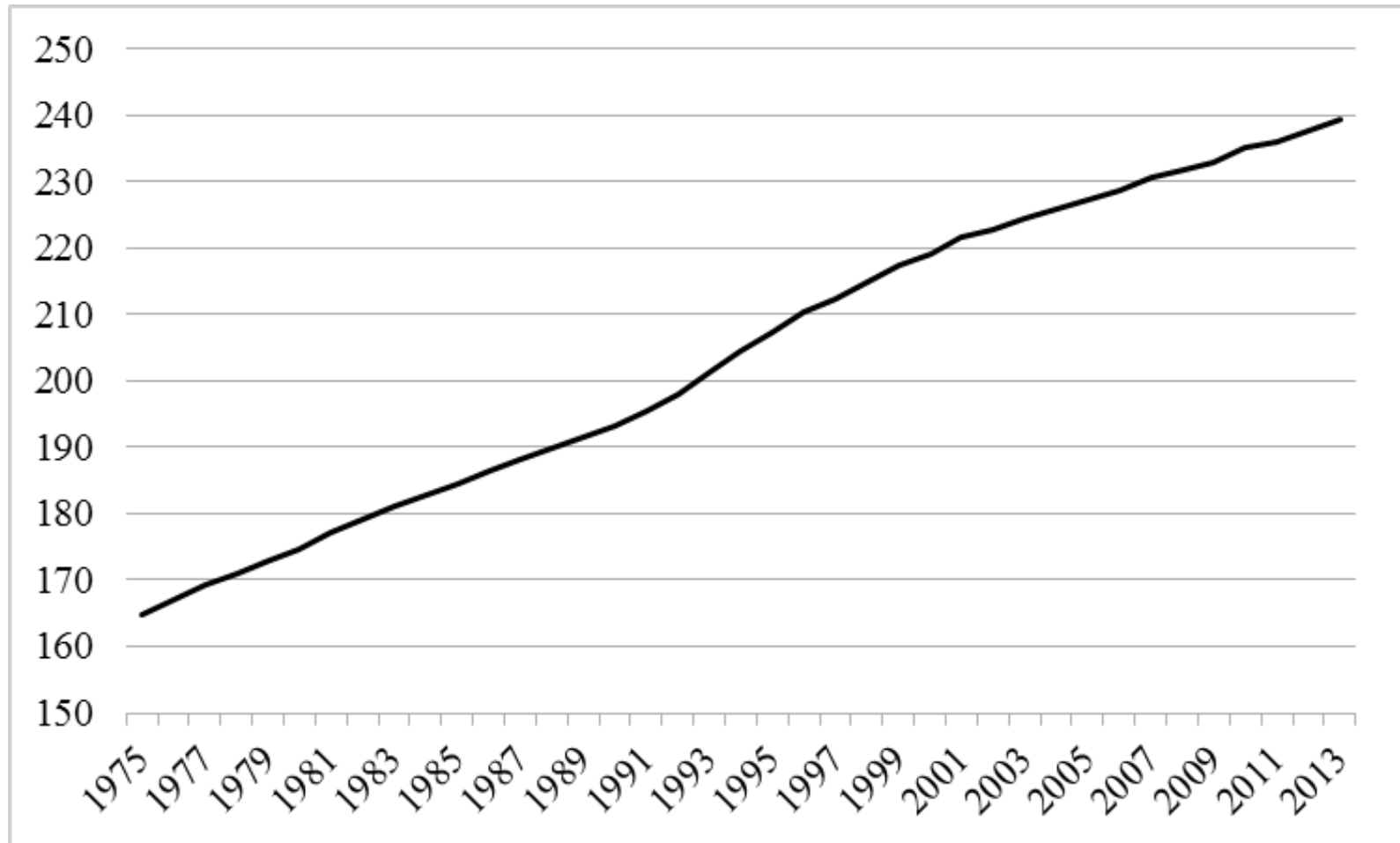
Jorgenson-Fraumeni income-based approach

- Stock of human capital is lifetime earnings in present discounted value of all persons in a population
- Measure lifetime earnings in PDV by age, sex, and education
 - Future earnings equal current earnings multiplied by income growth rate
 - Assume current survival, school enrollment rates persist into future
- Sum lifetime earnings across all persons to measure stock
- Investment: births, education, immigration
- Depreciation: deaths, aging, emigration
- Magnitude of investment/depreciation is effect on stock

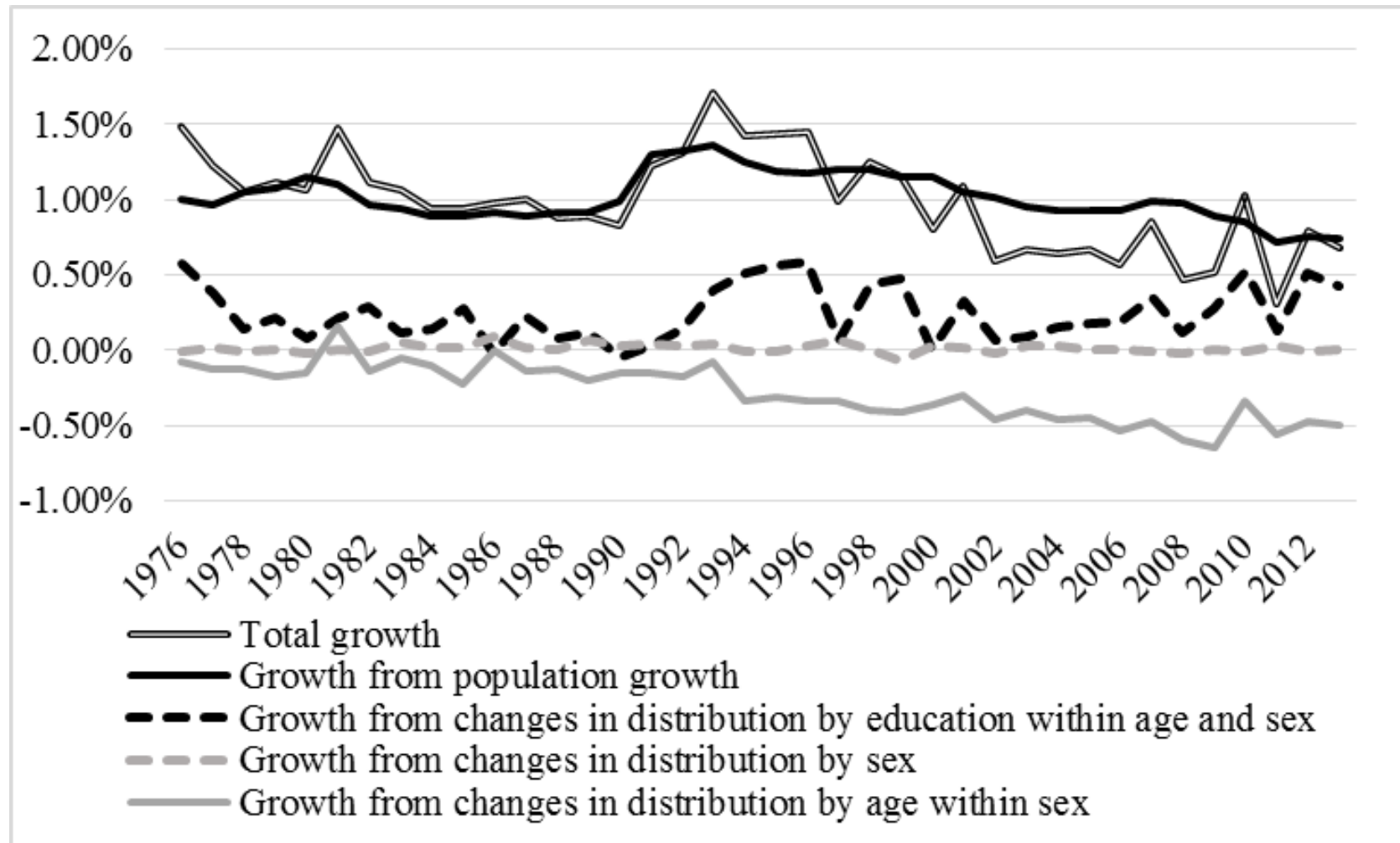
Measures for the U.S., 1975-2013

- Jorgenson-Fraumeni income-based approach
 - Include all ages, but will also look specifically at ages 15-64
 - Include market and non-market components, but will focus on market
- Uses March, October Current Population Survey as main data set
 - Adjusted to match population, school enrollment aggregates
 - Births and deaths from Centers for Disease Control
- Income growth rate of 2%, discount rate of 4%
- Reals measured using a chained Fisher index
 - Volume is population, weight is lifetime income

Real stock, all ages (\$tr, 2013)



Decomposition of yearly growth of stock



Net investment in human capital

- Investment from births
- Investment from education of persons net of aging of enrolled
 - More robust measure than gross education measures
 - Follows lifetime income as people move along the typical age-education track (high school through 18, college through age 22)
- Depreciation from aging of non-enrolled persons
- Depreciation from deaths
- Residual net investment
 - Migration and measurement error

Net investment, 1977 and 2013 (\$tril.)

	1977		2013	77-13
	Nominal	Real (2013\$)	Nominal	Annual % change
Human capital stock	\$41.1	\$169.2	\$239.4	+1.0%
Net investment	\$0.4	\$1.8	\$1.7	-0.1%
Births	\$0.7	\$2.9	\$3.5	+0.5%
Education net of aging	\$0.6	\$3.0	\$4.2	+1.0%
Aging of non-enrolled	\$0.8	\$3.5	\$6.2	+1.6%
Deaths	\$0.1	\$0.4	\$0.5	+0.3%
Residual	\$0.0	-\$0.2	\$0.8	

Comparison with Jorgenson-Fraumeni

- Model modified to match original J-F papers
 - Investment in education measures on a gross basis
 - Includes market and non-market components

All results in trillions of current dollars	J-F	New series
Jorgenson-Fraumeni (1989) [$g = 2\%$, $\rho = 4\%$]		
Stock, 1982	\$167.0	\$187.9
Investment in education, 1982	\$2.4	\$3.6
Jorgenson-Fraumeni (1992) [$g = 1.32\%$, $\rho = 4.58\%$]		
Stock, 1982	\$199.0	\$147.1
Investment in education, 1982	\$2.8	\$2.3

Alternative: measure investment using cost

- Define activities or production as investment in human capital
- Value it at cost (Kendrick, 1976)
- In some cases, easy as re-classifying existing aggregates from consumption to investment
 - Example: re-classify private and government consumption expenditures for education as investment
- In others, there's more work to do
 - Example 1: include foregone student earnings in cost of education
 - Example 2: take research and public service functions of higher ed out

Income and cost measures of education

Year	Cost-based education investment				Income-based measure	Ratio of income to cost
	PCE	Govt. CE	Student time	Total cost		
1977	17.7	95.4	73.2	186.3	629.5	3.38
2013	267.8	739.9	412.6	1,420.3	4,193.8	2.95

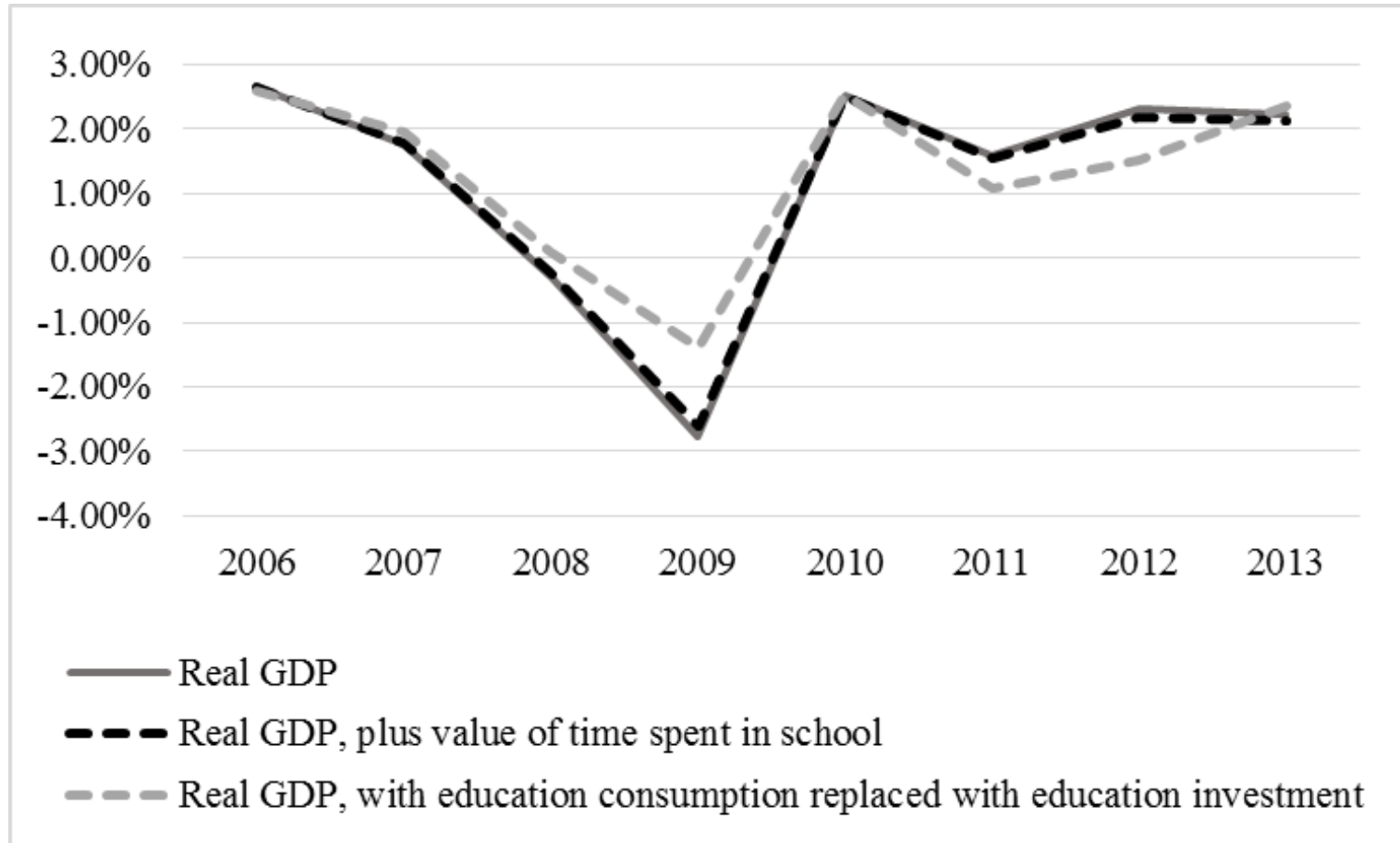
All measures in billions of current dollars

- Abraham (2010) notes that differences between income and cost of education may be understood as profit to household sector
- But also notes size of difference may suggest measurement problems

Education investment in the Great Recession

- College enrollment increased substantively in Great Recession
- Does the recession look different by accounting for education?
 - Official GDP estimates: value education based on cost
 - Cost approach: re-classify education spending from consumption to investment, add on value of student time
 - Income approach: replace personal, government consumption expenditures on education with income-based investment in education net of aging
- Cost approach (adding value of student time) has miniscule impact
- Income approach reduces GDP loss from 2007-09 from -3.1% to -1.3%

Year-to-year growth in GDP, 2006-2013



Conclusions

- Income-based measures of stock increases 1% annually 1979-2013
 - Driven by population growth
 - Little change per capita: higher education and aging population cancel out
- Education investment 3x greater in income method vs. cost method
 - Income method modestly mitigates decline in GDP in Great Recession
- Extensions
 - Series of cost measures alongside income measures
 - Bridging concepts of investment between the two approaches
 - Investigating differences between income and cost approaches
 - Longer/more internationally consistent series