DOES MORE SCHOOLING CAUSE BETTER HEALTH?

MEMORIAL LECTURE IN HONOR OF TADASHI YAMADA

2011 MEETING OF JAPAN HEALTH ECONOMICS ASSOCIATION

MICHAEL GROSSMAN CITY UNIVERSITY OF NEW YORK GRADUATE CENTER AND NATIONAL BUREAU OF ECONOMIC RESEARCH

INTRODUCTION

- "The one social factor that researchers agree is consistently linked to longer lives in every country where it has been studied is education. It is more important than race; it obliterates any effects of income." Gina Kolata, "A Surprising Secret to Long Life: Stay in School," New York Times, January 3, 2007
- "With the exception of black males, all recent gains in life expectancy at age twenty-five have occurred among better educated groups, raising educational differentials in life expectancy by 30 percent." Meara, Richards, and Cutler, *Health Affairs*, March/April 2008
- Link does not necessarily imply causality from more schooling to better health
- Health may cause schooling or omitted "third variables" may cause health and schooling to vary in same direction
- Aim: deal with large theoretical and empirical literature on this issue developed in past four decades

TADASHI AND MIKE: STUDENT AND TEACHER

- Met in September 1976 when he enrolled in my course in microeconomics in the Ph.D. Program in Economics at the City University of New York Graduate Center
- Tadashi also took my courses in labor economics and the economics of human resources
- Health economics was still a fairly new area; not enough demand to offer a course in it
- I "snuck" some health economics into the labor and human resources courses to stimulate students to write dissertations in health
- Tadashi became the 23rd out of what is now 102 students to complete a dissertation under my supervision when he received his Ph.D. in 1981

TADASHI AND MIKE: COLLEAGUES AND FRIENDS

- Tadashi taught at Brooklyn College from September 1981 through June 1988, first as an assistant professor and then as a tenured associate professor
- During much of that time he was affiliated with the National Bureau of Economic Research, first as a faculty research fellow and then as a research associate
- My professional and personal relationship with Tadashi was so successful that his older brother Tetsuji entered the CUNY Ph.D. Program in Economics in 1978 and completed his dissertation under my supervision in 1987
- Tadashi and Tetsuji became the first of two sets of brothers to do so





RELATIONSHIP BETWEEN TADASHI'S RESEARCH AND MY PAPER

- Both deal with causal nature of fundamental relationship in health economics
- In Tadashi's case: relationship between fertility and infant mortality
- In his1981 Ph.D. dissertation and publications based on it in the Southern Economic Journal (1985) and Population Review (1986) Tadashi uses Sims-Granger causality techniques to investigate the causal nature of relationship at issue in longtime series data for a number of developing and developed countries

RELATIONSHIP BETWEEN TADASHI'S RESEARCH AND MY PAPER-CONTINUED

- Causal mechanism from health to schooling: reductions in infant mortality increase life expectancy and the number of periods over which returns from investments in formal schooling can be collected
- Third variable that may cause both health and schooling: reductions in fertility stimulate parents to make investments that increase the health and schooling of their children
- More on the effects of health on schooling: Yamada, Kendix, and Yamada, Health Economics (1996)

Frequent use of substances with negative health outcomes (marijuana and alcohol) have negative effects on high school graduation rates

RELATIONSHIP BETWEEN TADASHI'S RESEARCH AND MY PAPER-CONCLUDED

- Empirical relevance for notions that health is an output of household production and that the demand for medical care can be treated as derived from interaction between the health demand and production functions
- Yamada, Yamada, and Chaloupka, *Journal of Human Resources* (1989)

Infant survival production functions in Japan fit by two-stage least squares; rich set of inputs including nutrient intakes, medical care, cigarette smoking, alcohol use, and environmental quality

 Yamada and Yamada in *Firm Benefit Policies in Japan and the United States* (2003), NBER conference volume, University of Chicago Press

Demand for preventive health checkups in Japan emanates from more fundamental demand for health ⁹

Table 1

Infant Mortality Rate, Age-Adjusted Mortality Rate, and Educational Attainment, United States, Selected Years, 1910-2000

Year	Infant Mortality Rate (Deaths per 1,000 live births)	Age-Adjusted Mortality Rate (Deaths per 100,000 population based on year 2000 standard population)	College Graduates (Percentage of persons aged 25 and older who completed four years of college or more)
1910	131.8	2,317.2	2.7
1920	92.2	2,147.1	3.3
1930	69.0	1,943.8	3.9
1940	54.9	1,785.0	4.6
1950	33.0	1,446.0	6.2
1960	27.0	1,339.2	7.7
1970	21.4	1,222.6	11.0
1980	12.9	1,039.1	17.0
1990	9.7	938.7	20.3
2000	7.4	869.0	25.6

Table 2

Infant and Age-Adjusted Mortality Regressions^a

	Infant Mortality Rate	Age-Adjusted Mortality Rate
Percentage with four years of college or more	-1.617 (-5.06)	-28.950 (-3.96)
R ²	0.996	0.990
F-statistic	2,814.71	1,078.82

^aEach regression contains an intercept and a cubic time trend. t-statistics are given in parentheses.

CAUSALITY FROM HEALTH TO SCHOOLING

- Students in poor health miss more days of school due to illness and learn less while in school
- Result: Negative effect on school achievement and years of formal schooling completed
- Long-lasting effect if past health an input into current health
- Reduction in mortality increases number of periods over which returns from investments in knowledge can be collected

CAUSALITY FROM HEALTH TO SCHOOLING: EMPIRICAL EVIDENCE

- Edwards and Grossman (1979): negative effects of low birthweight on school achievement of children ages 6-11
- Case and colleagues (2005): similar finding at a later stage in the life cycle

Negative effect on completed schooling by age 23 in British panel

Suggests a permanent or long-term effect

 Behrman and Rosenzweig (2004) and Black and colleagues (2007): Control for genetic traits that may influence both birthweight and schooling by employing data on identical twins

CAUSALITY FROM SCHOOLING TO HEALTH: PRODUCTIVE EFFICIENCY

- Grossman (1972a, 1972b): More educated obtain more health output from given amounts of medical care and other inputs
- Predictions

Positive schooling coefficient in demand function for health

Negative schooling coefficient in demand function for medical care if price elasticity of demand for health less than 1 in absolute value

PRODUCTIVE EFFICIENCY: EMPIRICAL EVIDENCE

• **Grossman (1972b)**

Positive effects of schooling on several measures of health

Schooling coefficient positive but not significant in demand function for medical care

• Wagstaff (1986) and Erbsland and colleagues (1996)

Positive and significant effects of schooling on good health

Negative and significant effects of schooling on number of physician visits

CAUSALITY FROM SCHOOLING TO HEALTH: ALLOCATIVE EFFICIENCY

- More educated pick a different input mix to produce a certain commodity than less educated
- Mix gives them more output of that commodity than the mix selected by the less educated
- Rosenzweig and Schultz (1982), Kenkel (2000), Glied and Lleras-Muney (2003), de Walque (2007, 2010)

ALLOCATIVE EFFICIENCY: EMPIRICAL EVIDENCE

 de Walque (2007): Significant change in the HIV/education gradient following a decade of prevention campaigns in Uganda

No relationship in 1990

By 2000 education lowers risk of being HIV positive among young individuals

Positive relationship between education and condom use during recent period

 Glied and Lleras-Muney (2008): Negative effects of schooling on mortality are largest for diseases and cancer sites in which medical progress has been the most rapid

OMITTED THIRD VARIABLES

• Fuchs (1982) time preference hypothesis

Persons who are more future oriented attend school for longer periods of time and make larger investments in their own health and in their children's health

 Becker and Mulligan (1997) endogenous time preference hypothesis

Present value of lifetime utility is *higher* the smaller is the rate of time preference for the present

More educated more efficient in making investments that lower rate of time preference; causality from increase in schooling to reduction in rate of time preference for the present

OMITTED THIRD VARIABLES: EMPIRICAL EVIDENCE

 Farrell and Fuchs (1982): Reject hypothesis that schooling causes cigarette smoking because completed schooling at age 24 has same effect on smoking participation at age 17 as it does at age 24

Sample of persons, all of whom were at least high school graduates and were high school seniors at age 17

- de Walque (20010): Examines effects of college completion on participation by same person at ages 17 and 45; latter age is much older than that considered by Fuchs
- Schooling effect at age 45 exceeds effect at age 17 by 40 percent
- Cowan (forthcoming) also casts doubts on interpretation of findings by Farrell and Fuchs
 Lower college tuition costs raise teenagers' college expectations and reduce their engagement in risky behaviors including smoking

OMITTED THIRD VARIABLES: INSTRUMENTAL VARIABLES APPROACH

• Lleras-Muney (2005)

Instrument: compulsory education laws, Outcome: adult mortality

OLS estimate: additional year of schooling lowers probability of dying in next 10 years by 1.3 percentage points

IV estimate much larger: 3.6 percentage points

• Currie and Moretti (2003)

Instrument: new college openings, Outcomes: low birthweight and maternal smoking during pregnancy

IV estimates bigger, Increase in maternal schooling between 1950s and 1980s accounts for 12 percent of 6 percentage point decline in low birthweight

INSTRUMENTAL VARIABLES APPROACH-CONTINUED

- Chou, Liu, Grossman, and Joyce (20010)
- Instrument: increase compulsory education from 6 to 9 years in Taiwan in 1968 combined with 80 percent increase in number of new junior high school openings between that year and 1973, at a differential rate among regions
- Form treatment and control groups of women and men who were between the ages of 12 and under on the one hand and between 13 and 20 on the other hand in 1968
- Outcomes: Incidence of low birthweight and mortality of infants born to the treatment and control groups in the years 1978-1999
- Mother's schooling causes favorable infant health outcomes, with IV estimates similar in magnitude to OLS estimates
- Increase in schooling associated with 1968 legislation saved almost 1 infant death in 1,000 live births, resulting in decline in infant mortality of approximately 11 percent

CONCLUSIONS: SUGGESTIONS FOR FUTURE RESEARCH

 Investigation of long term association between parents' attributes and children's attributes including health

Case and colleagues (2005): poor health in utero and in childhood associated with lower health at age 42

Health at that age positively related to parents' schooling, unless own schooling held constant

Schooling part of the story but uncoupling causal links associated with genetic and behavioral factors difficult

SUGGESTIONS FOR FUTURE RESEARCH-CONTINUED

- Preliminary example: Research on impacts of compulsory school reform in Taiwan
- Tsai, Liu, Chou, and Grossman (2011): Use same instrument for parents' schooling as one employed by Chou, Liu, Grossman, and Joyce (2010)
- One-year increase in either mother's schooling or father's schooling raises probability that child is admitted to one of the 6 best colleges in Taiwan by approximately 10 percent and effect is causal
- Two Taiwan studies underscore causal role played by parental schooling in the acquisition of two most important sources of human capital: health capital and knowledge capital

SUGGESTIONS FOR FUTURE RESEARCH: CONCLUDED

- Specification and estimation of model in which time preference can be identified as potential mechanism via which schooling affects health
- Public policy context: suppose most of effect of schooling on health operates through time preference
- Implication: School-based programs to promote health knowledge may have smaller payoffs than programs that encourage investments in time preference made by more educated
- In an ever-changing world in which new information constantly becomes available, general interventions that encourage futureoriented behavior may have much larger rates of return in the long run than specific interventions designed, for example, to discourage cigarette smoking, alcohol abuse, or the use of illegal drugs.

