

# Human Capital

E R Eide and M H Showalter, Brigham Young University, Provo, UT, USA

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## Introduction

Human capital refers to the intrinsic productive capabilities of human beings. These capabilities can be increased through investment in things such as education, on-the-job training, and health. Human capital is viewed as an asset that generates a flow of services, most often measured as earnings, although broader measures of output are also used.

Adam Smith in *The Wealth of Nations* (Smith, 1776) set the stage for the study of human capital. Although he does not use the phrase human capital, he identifies the acquired and useful abilities of individuals as a fundamental source of wealth and economic progress of a country. Writing more than a century later, Alfred Marshall notes in his *Principles of Economics* (Marshall, 1920) the long-term nature of investments in human capital and the family's role in undertaking them. Additionally, Marshall expands the notion of returns on human capital to include non-monetary considerations. However, Marshall is also credited with delaying the study of human capital due to his reluctance to put it on the same footing as physical capital.

The modern study of human capital coincides with two developments in economics. The first was a resurgent interest in understanding why economies grow. It was apparent to researchers that national output was growing at a much faster rate than the rates of growth of inputs – land, labor, and physical capital (Denison, 1962). A leading hypothesis to explain the anomaly was that labor was mismeasured: a day of work from a typical worker in the 1950s was substantively different than that of a worker in the 1920s.

The second development dovetailed with the first – the availability of large datasets that allowed exploration of worker productivity and earnings and how they related to characteristics such as the years of education and age. The data revealed that education levels were increasing dramatically and that the higher levels of education might explain rising productivity and wages.

Three authors deserve particular note amid the flurry of theoretical and empirical work in the late 1950s and early 1960s. Jacob Mincer (1958) stimulated a vast literature measuring the returns to education. Using census data, he documented the now-classic result that the years of education has an inverted U-shape on the rate of earnings growth. Theodore Schultz focused on the role of education and general investments in human capital in explaining the increased productivity of labor. His monograph

*The Economic Value of Education* focused attention on education as a subject worthy of concentrated study by economists, thus beginning the field of the economics of education. Gary Becker (1964) organized the emerging threads of empirical and theoretical work into a coherent framework that provided a guidebook for future research.

The study of human capital has proven to be an exceptionally fruitful vein of research with implications for individuals, firms, and nations. The general topic has resulted in an enormous quantity of research. Several comprehensive surveys have been done and are listed under the section titled 'Further reading'. This article will of necessity be very selective in its coverage. The primary focus is on education as an investment in human capital. In what follows, the private returns to education are first addressed. Returns are generally measured in monetary units, but some evidence on nonmonetary returns is also discussed. This is followed by a discussion of the social returns to education. As early as Adam Smith, the potential externalities of education were noted, and this section discusses some of the more prominent findings in the empirical literature. The final section summarizes the conclusions.

## Private Returns to Education

### Theoretical Issues and Modeling

This section begins with a brief overview of the theoretical underpinnings of the study of human capital. The terminology of capital is instructive: human capital and decisions involved with it are the same type as decisions involving physical capital, such as equipment and buildings. A business executive invests in new equipment if the expected benefit derived from the equipment exceeds the cost. Human capital theory uses the same construct: an individual invests in education with an expectation that the investment will provide a benefit in the form of higher earnings.

More generally, human capital theory assumes that individuals take actions that will likely increase their future earnings and overall well-being. Such investments are costly: they might involve direct costs such as tuition and fees for school, and indirect costs such as foregone earnings during the period spent in school. These investments result in some expected future benefits. The benefits might include a higher wage, but can also be anything that the individual values, for example, better working

conditions or a longer life. Human capital theory typically models investment decisions such as those resulting from an optimization process: an individual will invest in such activities in order to maximize well-being over the course of a lifetime. Observed outcomes in the marketplace will be the result of an equilibrium process where the demand for specific skills and abilities is balanced with its supply.

Human capital theory offers numerous useful insights and testable hypotheses about human behavior. One of the first to be explored is that observed differentials in earnings can be explained in part by differences in training costs. Adam Smith noted that professions that require years of training tend to have annual higher earnings than professions with no such restrictions. Using human capital theory, the explanation for this empirical observation is that a rational individual would only be willing to incur the costs of tuition and lost earnings during the training period if that investment has a sufficiently high rate of return in the form of higher earnings post training. This insight also suggests that lifetime earnings is a more appropriate measure when evaluating inequality: two individuals, one who invests in professional training and one who does not, can have identical lifetime earnings, but very different earnings at each point during their lives.

Human capital theory undergirds most of modern labor economics. It offers explanations and insights on topics as diverse as discrimination, inequality, unemployment, fertility, marriage markets, immigration, and productivity. This brief survey focuses on the relatively narrow slice of empirical work that touches on topics in education.

### Empirical Estimates and Methodology

Although human capital theory suggests that individuals invest in education in anticipation of a wide range of benefits, most empirical work has focused on the monetary rewards of increased earnings. Such data have tended to show rates of return of about 10% for an additional year of education, with some variation by gender and race/ethnicity (Psacharopoulos and Patrinos 2004). These return measures ignore nonmonetary and consumption benefits of education, and they also ignore any externalities associated with education. There has been substantial work done on these latter topics which are discussed later in this article.

Several methodological issues arise in estimating the returns to education. The goal of most empirical work is to establish a causal link between education and measures of return, which tends to be much more difficult than simply measuring a correlation. Early work compared lifetime earnings profiles for groups with different levels of educational attainment. More advanced analysis based on multiple regression analysis has attempted to account for a host of technical estimation problems such as omitted variables,

nonrandom samples, incorrectly measured variables, and jointly determined outcomes. These issues are discussed briefly in what follows.

A key omitted variable in much empirical work is innate ability (e.g., natural intelligence, work ethic) which can also include unobserved effort. The fundamental difficulty is that high-ability individuals are likely to obtain more years of schooling than low-ability individuals, but high-ability individuals would also tend to earn more for any given amount of schooling than low-ability individuals. This makes it difficult to disentangle the effect of schooling versus innate ability.

A large literature is devoted to investigating and overcoming this particular problem. Ideally, a researcher would like to observe otherwise identical individuals who differ only in their level of education. Although this approach is impossible in practice, clever research strategies using advanced econometrics have been employed with varying degrees of success.

Nonrandom sampling is often a problem with estimating returns to education for individuals with weak attachment to the labor market. For example, in contrast to most college-educated males, a substantial fraction of women who graduate from college will exit the workforce for extended periods of time. This implies that estimating returns to college will rely on a subset of the available data (women who work) that might not be representative of the full population of women. As with accounting for unobserved ability, a large literature has developed to account for this type of problem, again, with varying degrees of success.

Measurement error can afflict several variables of interest in empirical models. One example is earnings: earnings can be misstated in surveys because of carelessness by either the responder or the person (or machine) coding the information; or, responder wariness toward the survey instrument might lead to inaccurate data. Another example is in the measurement of school quality: a year of schooling from an Ivy League college might be very different than a year of schooling from the local junior college. Such problems cloud the measurement of the causal relationship between schooling and earnings, and the relationship between human capital accumulation and outcomes more generally. Several approaches have been used to account for this problem, the simplest of which is the development of better data sources.

The problem of jointly determined variables, also known as endogeneity, arises in situations where multiple outcomes are simultaneously decided upon. For example, household fertility decisions are likely to be made jointly with decisions about the level and type of education to obtain. This makes it difficult to measure a causal impact of one endogenous variable on another, although such causal links are theoretically possible. For example, it seems likely that having additional children makes it

more costly and therefore less probable that a person will pursue additional years of education. But measuring the independent effect is confounded by the joint-decision process. The typical strategy to deal with endogeneity is to use an econometric technique known as instrumental variables estimation. Alternative complex estimation techniques have also been used in the empirical literature.

### Topics in Empirical Estimation

Research on the development of human capital tends to have a three-pronged focus: (1) childhood and adolescence, with a heavy emphasis on kindergarten through high school completion; (2) young adulthood, emphasizing formal post-secondary education; and (3) adults, highlighting on-the-job training and general experience. Each is discussed in turn.

#### Primary and secondary education

Economic research on the effects of K-12 education is usually organized around the notion of an education production function. This approach posits that inputs such as teacher quality, class size, school policies, family demographics, and general aptitude of students determine observable outcomes such as test scores and high school completion.

A large empirical literature attempts to quantify the empirical relationship between inputs and outputs. One of the earliest and most influential studies was directed by James S. Coleman (Coleman *et al.*, 1966). This government-sponsored study documented a significant Black-White achievement gap in test scores, and it came to the controversial conclusion that family background characteristics were much more important in explaining outcomes than school-controlled inputs such as class size and teacher quality. Subsequent research critiqued both the methodology and the data of the Coleman report, but an acknowledgment of the weak association between school inputs and student outcomes has been the dominant view among economists since the 1980s (Hanushek, 1986; Burtless, 1996).

However, a small but growing set of research is reexamining the production function relationship using data generated by experimental and quasi-experimental designs. A notable example is the Tennessee student teacher achievement ratio (STAR) project that performed an experiment to measure the impact of class size on student outcomes (Word *et al.*, 1994; Krueger, 1999; Krueger and Whitmore, 2001). The results suggest a significant effect of class size on test scores and on the likelihood of taking a college-entrance exam.

An important set of related research employs quasi-experiments. A quasi-experiment refers to data generated without an explicit experiment such as the STAR project, but includes institutional details that allow researchers to treat the data as if it were. An interesting example of this

approach is a paper by Angrist and Lavy (1999) that uses the institutional rule of a 40-child maximum class size in Israeli public schools to examine the effects of class size on test scores. They find that smaller class size leads to higher test scores in some situations.

A variety of policy experiments designed to improve and evaluate student-learning outcomes are currently underway throughout the United States, and past policy innovations are currently being studied to determine their effects, if any. Examples include the following: (1) High-stakes testing where administrators and teachers can be punished if aggregate test scores are too low, or where individual students can be retained in a grade or be subject to remedial education if their test scores are not sufficiently high. (2) Vouchers where individuals receive government funding to be spent on the school of their choice, including private schooling. (3) Charter schools that are fully government funded, but have less-direct oversight than typical government schools. (4) The effects of peers on student outcomes. Peer effects are fundamental in evaluating policies like tracking where students are segregated by ability measures such as test scores, or combining children of different grades in the same classroom. (5) The role of teacher quality on student outcomes. Quality can refer to experience, education level, and type, or measures of teacher performance. (6) Direct incentives to students for performance on standardized tests, such as monetary payments for high test scores.

Many of these topics and research agendas are discussed in greater detail elsewhere in the encyclopedia.

#### Post-secondary education

A substantial amount of work has been done over the past two decades focusing on postsecondary formal education. In the early 1990s, researchers documented a substantial rise in the return to completing college relative to completing high school. A number of explanations have been given. The rising demand for skilled labor due to the forces of international trade and specialization has received some empirical and theoretical support. (Acemoglu, 2002)

Another area of research has focused on variations in quality of education. Noting that there are large discrepancies in college tuition across institutions, a natural question arises whether higher tuition results in correspondingly higher earnings. An interesting strand of research compares outcomes from individuals attending elite private institutions (e.g., Ivy League Schools) with less-prestigious universities. The empirical results are mixed. A widely cited work by Brewer *et al.* (1999) suggests earnings tend to be as much as 40% higher for students from elite institutions compared with their peers at less-selective universities. But using different data and different methodology, Dale and Krueger (2002) find a much smaller effect on earnings from attending an elite university.

A related literature examines the returns to attending a community (junior) college. This literature notes that a majority of first-year college students enrol in a community college. The empirical evidence to date suggests that the returns to a year of community college are similar to the returns to a year of college at a 4-year institution (Kane and Rouse, 1995).

Returns to particular college majors has also been an active area of research. The literature documents substantial differences in the returns to various majors, with math-oriented and technical majors earning approximately 30% more than nontechnical majors. Large differences remain even after accounting for the ability bias that leads innately more capable individuals into technical majors.

#### ***On-the-job training and work experience***

Becker's (1964) seminal book notes a difference between firm-specific and general human capital. In his model, firms would not invest in general human capital – general literacy, for example – because workers might leave the firm after they receive the training. But recent work suggests that there might be conditions under which firms do invest in general training (Acemoglu and Pischke, 1999). A growing body of empirical evidence supports this work. For example, Autor (2001) documents the workings of temporary help firms providing training in general skills.

A final area of inquiry deals with the depreciation of human capital. While formal education and work experience can build human capital, detachment from the labor force and general inactivity can deteriorate it. This is one of the major economic concerns arising from extended spells of unemployment. Work by Mincer and Ofek (1982) examines the implications of interruptions of labor-force participation by married women. They find that the longer the period of interruption, the lower the wages upon reentry into the labor force. However, they also find rapid growth in wages after these women return to work.

#### **Nonmonetary Returns to Education**

As noted by Marshall, human capital investments might have payoffs beyond increases in earnings. There is an expanding research agenda attempting to measure such returns. For example, recent work by Lleras-Muney (2005) examines the causal impact of education on longevity. Using variation in education level induced by compulsory education laws, she estimates that a year of schooling leads to an increased life expectancy at age 35 of 1.7 years.

A second example is the interaction of human capital investment and family interactions. Higher marketplace

returns reduce the demand for children and lead to relatively higher labor-force participation by married women. Divorce rates, wage inequality, and occupational segregation by gender exemplify topics where human capital theory has extended its reach. It is often difficult to conclusively show causal relationships between educational attainment and these nonmonetary outcomes due to data constraints; but research continues to explore these topics and circumstantial evidence continues to mount.

#### **Social Returns to Education**

Research evidence suggests there exists substantial private gain to investment in education, but it is also an important question whether gains accrue to individuals other than the person actually investing in human capital: is there some social return to education over and above what any given individual obtains? In economics, such a phenomenon is known as a positive externality and its existence justifies government involvement in the promotion of education. Without such externalities, the rationale for government provision of education becomes much weaker.

Two general approaches have been used to measure the extent of externalities. First, macroeconomists have tried to identify aggregate human capital externalities. A recent focus of this literature has been to determine whether skilled (high human capital/education) workers tend to raise wages for unskilled workers (Ciccone and Peri, 2006). More generally, this aggregate approach attempts to measure whether there are monetary benefits to entire economies that are not fully reflected in wages. There is no consensus on the magnitude of this aggregate effect.

The second approach is a more narrowly focused search to identify specific externalities from education, usually involving nonmonetary outcomes. A few examples include the following:

- *Citizenship.* An educated citizenry is often argued to be necessary for a functioning democracy. Such fundamental tasks as voting and filing taxes require some basic level of cognitive function. Recent work has attempted to measure whether education has a discernable, causal effect on voting behavior. Milligan *et al.* (2004) find that schooling increases civic participation in the United States. They also find that higher levels of education are positively associated with individual awareness of campaign issues and that educated individuals are generally more involved in the political process.
- *Crime.* Criminal activity offers an interesting case study in externalities. Criminal acts almost by definition cause harm to people other than the person committing the crime. Hence the reduction in crime due to higher education levels is *de facto* an externality of education. Human capital explanations for a link between education and crime usually involve opportunity-cost

arguments. Individuals with few marketable skills have a low opportunity cost in the commission of crime and in the possible time cost of incarceration. Such arguments are used to explain the widely noted age profile of criminal activity: property and violent crimes increase through adolescence for males, peaks in the late teens, and declines markedly thereafter. On the other hand, white-collar crime, which tends to require somewhat more sophistication, peaks at a much later age and the declines more slowly. An interesting study by Lochner and Moretti (2004) attempts to measure the causal effect of schooling on criminal activity. They estimate that an extra year of schooling results in a 0.37 percentage point reduction in the probability of incarceration for blacks, and a 0.10 percentage point reduction for whites. They estimate that the social savings per additional high school graduate is between US\$1170 and US\$2100. They also find that nearly a quarter of the difference in the black-white gap in incarceration rates can be accounted for by differences in years of schooling.

- *Health.* The case for externalities in health is theoretically compelling but empirically weak. A key example involves vaccinations. Vaccinating an individual against communicable diseases benefits the individual (a private return), but also lowers the incidence of the disease in the population (a social return). If education has a causal effect that increases vaccination rates, this would imply the existence of an externality. Although a strong positive correlation exists between education and vaccination rates, a definitive causal link has not been established.

Other possible health links include educational effects that lower rates of smoking and drunk driving. Both of these activities have the potential to harm individuals other than the one engaged in the activity. But as with vaccinations, solid empirical support is currently lacking.

Some recent work argues that individuals do not adequately account for the addictive nature of products like cigarettes and alcohol and that the resulting unintended harm to an individual from their own actions ought to be considered as an externality. This work is in its early stages and no definitive empirical work has yet been produced.

Finally, some authors have argued that insurance pooling results in an education externality on health (Manning *et al.*, 1991). The empirical evidence suggests that education leads to healthier lifestyles, but with insurance pooling, healthy individuals are not rewarded with lower health insurance premiums in employment-based insurance pools, despite the reduction in medical expenses resulting from better health. In not being rewarded, healthy individuals confer a positive externality on the less-healthy individuals in the pool. The empirical magnitude of the potential effect is uncertain.

## Conclusion

Human capital theory forms the basis for most of the empirical work in the economics of education. It has proved to be a powerful tool for conceptualizing how individuals make educational choices and for guiding how the implications of those choices are measured. Empirical work establishing causal relationships is often difficult, fraught with problems of limited and inadequate data. But exciting new work continues to refresh, refine, and occasionally refute previous theoretical and empirical conclusions.

See *also*: Education and Inequality; Education Production Functions: Concepts; Education Production Functions: Evidence from Developed Countries; Education Production Functions: Evidence from Developing Countries; Race Earnings Differentials; Returns to Education in Developed Countries; Returns to Education in Developing Countries; School Quality and Earnings; The External Benefits of Education.

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