

Cost-Benefit Analysis of College Education in the United States

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Abstract

Advances in research on human capital formation provide a theoretical background with which estimate the cost and benefit of college education. Economics literature mainly use direct costs that incurred due to education per se, excluding room and board, as the cost, and earnings differential between college and high school graduates that is due to college education as the benefit. This benefit is already net off forgone earnings because the earnings of high school graduates when students are enrolled in college represent forgone earnings of college education. We survey net present value (NPV) and internal rate of return (IRR) methods from past studies, including their outcomes. Positive net present values (\$23,000 for male and \$7,000 for female) suggest that the investment in college education is worthwhile. And favorable IRR (10-15 percent for private rate and 11 to 13 percent for social rate) in comparison to those of financial and physical capital also justify an investment in a college education. Note that the IRRs have accounted for the self-selection bias (i.e. better students go to college) and the economic conditions (i.e. recession period represents lower foregone earnings which stimulate the demand for college). Both methods have their strengths and weaknesses. NPV is sensitive to choices of discount rate and productivity rate, whereas IRR often lead to erroneous results when ranking investments under budgetary constraint. In addition, they exclude the fringe benefits as part of total earnings, the non-market effects in the earnings data, and do not consider the quality of the schooling. In spite of these methodological shortcomings, the results still represent the best available estimates of return to college education in the United States. They rationalize government programs in higher education, such as state and federal aid to colleges, and personal investments in college education.

I. Introduction

Governments policy makers are confronted with the following questions: “Should we increase or decrease our investment in education? Would we be better off allocating more resources at the primary school rather than on higher education?” Whereas individual decision makers have to decide: “Should we invest in college education or enter the job market after graduating from high school?” These educational decision-makings involve the use of cost-benefit analysis that, in principle, maximizes the excess of prospective benefits over anticipated costs of college education.

In this paper, we discuss both *economic* and *non-market effects* of college education by examining the costs, the benefits, the methods, and the results, using United States data, from various studies. The next section reviews literature of cost-benefit analysis as applied to education. Section three catalogues direct and indirect costs of college education. In section four, we observe different types of benefits of college education. Section five surveys net present value (NPV) and internal rate of return (IRR) methods of analyzing the costs and benefits from past studies, and their outcomes. The last section summarizes the implications of the cost-benefit analysis to decision makers.

II. Theoretical Background

The modern theoretical basis for estimating the value of education can be traced to the presidential address given by Schultz (1961) to the American Economic Association, in which he emphasized the importance of *human capital*. Becker (1964) and Mincer (1958, 1962) advanced the human capital concept by developing a framework that spurred research in human capital formation, notably the influential works by Hansen (1963) and Mincer (1974).

When manpower are viewed as a form of capital, resource allocation to human capital formation, such as formal education, inevitably follows the same evaluation of investment in physical capital, such as industrial machinery. Investment in education is evaluated on its ability to generate future earnings in terms of additional lifetime income and higher personal utility. The investment is economically efficient if return from investing in a given education equals or exceeds the return from other investments in real estates, stocks, bonds, or savings, for example.

What drives the return from the investment in education is that the education attainment will lead to higher work productivity, which in turn will increase future earnings. This notion follows the theory of *marginal productivity of input*, where wages are determined by the worker's marginal contribution to the revenues of the firm. Thus a more productive worker will get a higher wage, *ceteris paribus*.

III. Costs of College Education

We begin our cost-benefit analysis by identifying the relevant costs of enrolling in college. College students endure the following costs: tuition fees, books and supplies, room and board, etc. Tuition fees and books and supplies are direct costs of education, but room and board expenses are indirect costs. They are merely costs that are incurred to sustain a subsistence level, not due to education per se. Table 1 shows annual direct costs of college education in the U.S. per full-time equivalent (FTE) student.

Table 1: Annual Direct Costs of U.S. College per Student

Year	1969	1974	1978	1982	1985
Direct Cost	\$3,110	\$4,674	\$4,579	\$5,445	\$7,514

Source: Digest of Education Statistics (Cohn and Hughes, 1994)

One of the most important costs that have not been mentioned is earnings that students forgo (opportunity cost) while in school. Although it belongs to an indirect cost, it accounts for

about 40 percent of the total education costs (Cohn and Geske, 1986). We incorporate the forgone earnings when we calculate earnings differential between college and high school graduates in the next section. Because the earnings of high school graduates when students are enrolled in college represent forgone earnings of college education.

In addition to the private costs that the students bear, we have social costs that are assumed by society and non-market costs that are associated with college education. The Social costs can be due to government and philanthropies subsidies, for example. The non-market costs that are commonly related to higher education are “marital instability, job-related stress, destructive social protests, alienation, and feelings of anomie” (Haveman and Wolfe, 1984).

IV. Benefits of College Education

Benefits of college education can be classified into investment and consumption categories. The higher education has consumption benefits if it gives satisfaction or utility over time, such as an increased ability to appreciate art and literature or to make effective use of leisure time. But studies of higher educational benefits usually focus more on the investment category, which examines the contribution of college education to future streams of income. Specifically, this approach computes earnings differential between college and high school graduates at certain age that is due to college education (Cohn and Hughes, 1994).

Other education benefits are social benefits, option values, and intergenerational effects. Social benefits are benefits that are accrued to society, such as income taxes paid during one's lifetime income stream. Option values refer to optional choices that are available because of schooling (Weisbrod, 1962). Completion of undergraduate program gives students an option to pursue graduate education. Becoming a college professor provides some level of freedom and flexibility in terms of teaching and research. Intergenerational effects are benefits that will be

passed on future generation (Ribich, 1968; Spiegelman, 1968; Swift and Weisbrod, 1965). The premise is that “persons are more likely to complete a given level of education if their parents are (or were) more highly educated” (Cohn and Geske, 1986).

The last benefit category is non-market effect that has both externalities and secondary market impact characteristics. Past evidence shows that schooling tends to increase the ability to achieve a desired family size and to avoid “unwanted children” (Haveman and Wolfe, 1984). The result also associates schooling to lower criminal activity, reduced job and mate search costs, and better health and lower expected mortality in comparison to those of their spouses.

V. Method and Results: NPV and IRR

The next step of the analysis is to determine one of the two cost-benefit criteria for decision-making: net present value (NPV) and internal rate of return (IRR).

A. Net Present Value (NPV)

The proper method to estimate NPV of college education is to compute the *difference* between the present value of lifetime income attributable to a college graduate and the present value of lifetime income attributable to a high school graduate with similar characteristics, net of direct costs of college education (Cohn and Geske, 1986; Cohn and Hughes 1994).

$$NPV = \sum_{t=18}^{66} (E_{ct} - E_{ht} - C_t) / (1+i)^{t-18} \quad \dots (1)$$

$E_{ct} - E_{ht}$ in equation (1) is the earnings differential between college and high school graduates, at age t , that is due to college education. C_t is the direct costs of college education at age t . We assume that a person begins college education at age 18 and earns until age 66.

The positive net present values in Table 2 indicate that investment in college education, on average, is worthwhile. But the result do not consider earnings differential due to ability, good luck, and other personal characteristics. Although this self-selection bias is only about 12 percent (Taubman, 1976) if we include variables employed in the earnings function of Mincer (1974).

Table 2: Net Present Value of College Education, 1979 data (in thousands of 1981 dollars)

		Present Value of Benefits	Present Value of Costs	Net Present Value
College graduates vs. high school graduates	Males	\$60	\$37	\$23
	Females	\$44	\$37	\$7

Source: Cohn and Geske (1986)

Note: Assuming 5% discount rate and 0 rate of productivity increase. Earnings of high school graduates already represent forgone earnings of college graduate

B. Internal Rate of Return (IRR)

Many of IRR studies use the earnings function as the basis to compute the rates of return to education. The IRR is also a preferable method over NPV in many studies because one does not need to predetermine an appropriate discount rate¹. IRR itself is the discount rate that would give zero NPV (Equation 2).

$$\sum_{t=18}^{66} (E_{ct} - E_{ht} - C_t) / (1 + IRR)^{t-18} = 0 \quad \dots (2)$$

Various research in college education investment estimate that the private IRR ranges from 10 to 15 percent, while the social IRR is somewhat less; around 11 to 13 percent (Table 3). Note that the private IRRs have accounted for the self-selection bias (i.e. better students go to college) and the economic conditions (i.e. recession period represents lower foregone earnings which stimulate the demand for college). These rates of return are higher than those of 10-year treasury securities and housing, and less than those of non-housing capital. However, rates of

¹ But NPV is a superior method for ranking education projects under a budgetary constraint.

return to college education are more stable and less risky than those to financial and physical capital.

Moreover, there are two instances where the estimated returns to college education are downwardly biased. First, the use of earnings data rather than total compensation (since fringe benefits as a percentage of total compensation have increased in recent years) biases the IRR results downward by over 20 percent (Kiker and Rhine, 1985). Second, studies that focus on increased earnings and neglect the non-market effects of schooling may have captured only about 50 percent of the total value of an additional year of schooling (Haveman and Wolfe, 1984). Therefore the investment in college education is justifiable based on the IRR method as well.

Table 3: Private and Social IRR of U.S. College Education Vs. Returns from Other Investments

Author(s)	Sample Year	Private IRR	Social IRR	Rate of return Housing	Rate of return Non-Housing	Rate of return 10-year T bill
Hansen (1963)	1950	11.4%	10.9%	2.0% (1969)	22.0% (1969)	6.7% (1969)
Becker (1964)	1958	14.8%		1.0% (1974)	17.0% (1974)	7.6% (1974)
Mincer (1974)	1960	10.0%		6.0% (1978)	19.0% (1978)	8.4% (1978)
Freeman (1977)	1973	7.5-10.0%	8.5-10.5%	7.0% (1982)	14.0% (1982)	13.0% (1982)
McMahon and Wagner (1982)	1976	17.0%	13.0%	6.0% (1985)	18.0% (1985)	10.6% (1985)
Cohn and Hughes (1994)	1985	15.7-18.8%				

Source: For private and social IRR, see Cohn and Geske (1986). For housing and non-housing, see Mills (1989). For T bill, see The Economic Report of the President (1991).

VI. Summary

Although the positive net present value of college education suggests that the investment is worthwhile, the analysis is sensitive to the choice of the discount rate and productivity rate. Higher discount rate and lower productivity rate would decrease earnings differential and net present value.

An IRR method yields a favorable rate of return of college education in comparison to those of financial and physical assets. And the inclusion of fringe benefits and non-market effects into the earnings data would adjust the results upward. Even after these adjustments, the results has their shortcomings for neglecting the quality of schooling.

In spite of the methodological deficiencies, the outcomes represent the best available estimates of return on college education in the United States. They rationalize government programs in higher education, such as state and federal aid to colleges, and personal investments in college education

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