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ABSTRACT

This monograph is a survey of recent literature on the economic returns on investment in education. The first section introduces the reader to the concept of human capital and to some ways it can be measured. In the second and third sections, data are presented on the relationship between education and income and the benefits accruing both to individuals and to the nation as a whole from investment in education. Section four deals with estimates of education's contribution to economic growth. Section five summarizes the generalizations concerning education as an investment. These studies reinforce the conclusion presented by other studies that the social returns on educational investment are very profitable, as are private returns on individual investment. A 32-item bibliography is included. (TC)

THE ECONOMIC RETURNS TO EDUCATION

A Survey of the Findings

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INTRODUCTION

During the past few years economists have done highly significant research on the economic benefits accruing to the individual and to society from investment in education. This research has found, as many people would expect, that an investment in high school or college education is quite profitable for the student. Less known, and perhaps more surprising, is the conclusion of researchers that investment in education contributes to the public welfare, or to the economic well-being of the nation as a whole.

Perhaps this finding surprises many of us because we are unaccustomed to thinking of education as an "income producer"; rather, most of us think of schools and colleges as "tax eaters." The fact of the matter is, however, that economists have found a high "public" return on investment in education. They have also concluded that education makes an important contribution to the economic growth of our nation.

This monograph is a survey of recent and useful literature on the economic returns to education. We have attempted to summarize basic findings. Readers who wish more detailed information are, of course, invited to consult our sources, which are listed in the bibliography at the end of this monograph.

While our presentation deals solely with the economic returns to education, we are well aware that education may confer numerous other benefits upon the individual and may have many other kinds of consequences for the country than economic ones alone. We also recognize that a number of matters other than education affect the earnings of the individual. Renshaw (20) has listed the following factors as being positively correlated with formal education. Each undoubtedly contributes to a person's earning power.

(1) People with high IQ's generally obtain more education.

(2) People with more education work longer hours.

(3) Other kinds of education are closely related to the amount of formal education one obtains.

a. Self education
b. Experience
c. Education obtained in the home
d. Training in the armed forces
e. On-the-job training

(4) Some fields that require a high degree of specialization have restrictions on entry.

These and other factors point to the limitations of our approach. If we attribute the entire increase in earning power to formal education, we are no doubt overstating our case.

The reader should also note that much of the analysis that follows uses the rate-of-return approach. As stated by Hunt (16), there are essentially four assumptions which have been made, either implicity or explicitly, by those who have estimated rates of return to education. Each of these could obviously introduce biases. These assumptions are:

(1) Private product is a satisfactory representation of social product.

(2) Rates of return on physical and educational capital are conceptually similar.

(3) Analysis of cross section data provides useful estimates for projecting trends into the future.

(4) The associated increase in money income is a satisfactory measure of the private returns to education.

To the extent that any or all of these are unjustified, then clearly any policy implications drawn from the results are also unjustified.

The organization of the monograph is as follows. The first section introduces the reader to the concept of "human capi-

tal" and to some ways it can be measured. In the second and third sections, data are presented on the relationship between education and income and on the "public" and "private" rates of return on investment in education. Section four deals with estimates of education's contribution to economic growth, and section five summarizes the generalizations drawn in the monograph.

CONTENTS

I

The Concept and Measurement of Human Capital

Education As An Investment in Human Capital

The essential characteristic of education which precludes our thinking of it solely as a consumption item is that the benefits which accrue from education do so over a long period of time. While it is no doubt true that there are substantial immediate benefits of education which give it the appearance of being a consumption item, study of Table 1 indicates that the long-term benefits represented by the income stream are considerable.

What Table 1 tells us is that, on the average, the annual income of males in a given age bracket increases as education increases. Thus, even at age 65, over 40 years after his formal education ceased, the average college graduate earned $2,266 more in 1949 than his counterpart whose formal education ended after four years of high school. While it would be wrong to attribute the entire amount of the differences shown in Table 1 solely to differences in levels of education, it would be equally wrong to contend that they result entirely from differences in ability, motivation, family position or other such factors which have a bearing on the amount of an individual's income. The fact that the differentials have persisted in spite of the increasing number of people now pursuing higher education does indicate, moreover, that education itself is a dominant factor (see Miller, 17).

By treating education as an investment in human capital, we are saying that the process of education enhances the productivity of an individual, and that this increase in productivity is reflected in the income streams as shown in Table 1. We are by no means suggesting that monetary gain is the

Table 1

AVERAGE INCOME BY AGE AND YEARS OF SCHOOL COMPLETED
MALES, UNITED STATES, 1949

	Years of School Completed							
		Elementary School			High School		College	
Age	0	1-4	5-7	8	1-3	4	1-3	4+
14-15	$ 610	$ 350	$ 365	$ 406				
16-17	526	472	514	534	$ 429			
18-19	684	713	885	1,069	941	$ 955		
20-21	944	1,009	1,216	1,535	1,652	1,744	$1,066	
22-24	1,093	1,227	1,562	1,931	2,191	2,363	1,784	$1,926
25-34	1,337	1,603	2,027	2,540	2,837	3,246	3,444	4,122
35-44	1,605	1,842	2,457	3,029	3,449	4,055	5,014	7,085
45-54	1,812	2,073	2,650	3,247	3,725	4,689	5,639	8,116
55-64	2,000	2,045	2,478	3,010	3,496	4,548	5,162	7,655
65 or more	1,140	1,189	1,560	1,898	2,379	3,155	3,435	5,421

Source: Hansen (14), Table 1, 130.

only motivation of those who seek higher education; it obviously is not. What we are suggesting is that an individual who is considering an expenditure now which will yield future income ought to consider education as one of the alternatives.

Thus far, we have been considering human capital from the individual's point of view. It is also important to consider it from society's point of view. Thus, we might ask the question: What would be the economic effect of increased public expenditure on education? While the answer to such a question would depend on the amount and distribution of such expenditure, there is reason to believe that education has been an important determinant of the rate of growth of output in this country. According to the figures in Table 2, between 1919 and 1957 output increased at an average annual rate of 3.1 per cent, while inputs of labor and physical capital increased by only 1.0 per cent per year. Assuming no significant economies of scale, this leaves about two-thirds of the growth in output unaccounted for by changes in inputs. The hypothesis which immediately suggests itself is that at least some of this growth is a result of investment in human capital.

Table 2

INCREASES IN OUTPUT AND INPUTS OF THE PRIVATE DOMESTIC SECTOR OF THE UNITED STATES ECONOMY, 1919 TO 1957

	1919	1957	Increases in Per Cent Per Annum
	(Indexes 1929=100)		
Output	69.7	225.2	3.1
Input			
Labor Input	86.7	116.9	0.8
Capital Input	80.3	158.2	1.8
Total (weighted by relative shares)	84.9	125.5	1.0

Source: Schultz (22), Table 1, 50.

THE MEASUREMENT OF HUMAN CAPITAL

Because the amount of education possessed by an individual is generally measured in terms of years, it is quite natural to

suggest such a unit of measurement for the total stock of human capital represented by the aggregate education of the labor force. Thus, it is tempting to say that if the average member of the labor force has had 11 years of school and the total labor force is 70 million persons, the total stock of human capital is equivalent to 770 million "school years of education." The problem with such a measure is that it fails to take into account such things as differences in the extent to which various years of school contribute to productivity, differences in types of education (*e.g.*, general versus technical), changes in the number of days of school attendance, and long-run changes in the quality of education.

Schultz has developed a more sophisticated approach which, while still containing many of the same deficiencies mentioned above, is superior to the "aggregate education" measurement. This procedure involves measuring the stock of education in terms of "equivalent 1940 school years," a measurement which takes into account the effects of changes in school attendance. His results, given in Table 3, show that the stock of human capital increased three and one-half fold between 1900 and 1957 when measured in terms of school years, but increased six and one-third fold when measured in "equivalent school years."

Table 3

TOTAL SCHOOL YEARS COMPLETED OF THE LABOR FORCE OF THE UNITED STATES, 1900 TO 1957

Year	Labor Force (millions)	School Years Completed Per Person	Total School Years Completed (millions)	Equiv. 1940 School Years Completed Per Person	Total Equiv. 1940 School Years Completed (millions)
1900	28.1	7.70	216	4.14	116
1910	35.8	7.91	283	4.65	167
1920	41.4	8.12	336	5.25	217
1930	48.7	8.41	410	6.01	293
1940	52.8	9.02	476	7.24	382
1950	60.1	10.10	607	8.65	520
1957	70.8	10.96	776	10.45	740

Source: Schultz (22), Table D, 87.

II

Education and Earnings

As suggested earlier, the extent to which productivity is related to education can be seen by assuming that earnings are an accurate reflection of productivity and comparing the earnings streams of individuals with various amounts of education. In this section we shall make three types of comparisons:

(1) Annual incomes of persons in the same age bracket with different amounts of education.

(2) Lifetime incomes of individuals with different amounts of education.

(3) Discounted lifetime incomes of individuals with different amounts of education.

Education and Annual Income

Table 4, taken from Miller (17), shows variations in average annual income over the past generation for males with different amounts of education. Women are excluded from the analysis because the relationship between their income and education may be distorted by the fact that a large proportion of them either do not enter the labor force or are employed only on a part-time basis.

The data in Table 4 clearly show that at all age levels additional schooling is associated with higher average incomes for males. This association has persisted despite the fact that the educational attainment of the population has increased considerably in the past generation. In fact, as shown in Table 5, the differential between high school graduates and elementary school graduates has widened, while that between college graduates and high school graduates has shown little

Table 4

MEAN INCOME (OR EARNINGS) FOR MALES 25 YEARS OF AGE AND OVER BY YEARS OF SCHOOL COMPLETED AND AGE: 1939, 1946, 1949, 1956, AND 1958

Years of School Completed and Age		1939[a]	1946[b]	1949[c]	1956[c]	1958[c]
Total: 25 Years Old and Over						
Elementary:	Total[f]	$1,036	$2,041	$2,394	$3,107	$3,096
	Less than 8 years[d]	(e)	1,738	2,062	2,613	2,551
	8 years	(e)	2,327	2,829	3,732	3,769
High School:	1 to 3 years	1,379	2,449	3,226	4,480	4,618
	4 years	1,661	2,939	3,784	5,439	5,567
College:	1 to 3 years	1,951	3,654	4,423	6,363	6,966
	4 years or more	2,607	4,527	6,179	8,490	9,206
25 to 34 Years:						
Elementary:	Total	837	1,729	2,185	3,061	3,143
	Less than 8 years[d]	(e)	1,394	1,880	2,662	2,670
	8 years	(e)	2,011	2,540	3,685	3,663
High School:	1 to 3 years	1,150	2,062	2,837	4,407	4,341
	4 years	1,335	2,335	3,246	4,813	4,909
College:	1 to 3 years	1,566	2,875	3,444	5,437	5,774
	4 years or more	1,956	3,237	4,122	6,307	7,152

Table 4—Continued

Years of School Completed and Age		1939[a]	1946[b]	1949[c]	1956[c]	1958[c]
35 to 44 Years:						
Elementary:	Total	1,110	2,095	2,610	3,694	3,686
	Less than 8 years[d]	(e)	1,730	2,244	3,169	3,023
	8 years	(e)	2,425	3,029	4,256	4,403
High School:	1 to 3 years	1,574	2,607	3,449	4,799	5,035
	4 years	1,979	3,463	4,055	5,992	6,007
College:	1 to 3 years	2,270	4,069	5,014	7,131	8,015
	4 years or more	3,141	5,054	7,085	9,790	10,106
45 to 54 Years:						
Elementary:	Total	1,199	2,349	2,797	3,672	3,660
	Less than 8 years[d]	(e)	2,027	2,418	3,078	3,008
	8 years	(e)	2,629	3,247	4,289	4,337
High School:	1 to 3 years	1,732	2,959	3,725	4,876	4,864
	4 years	2,256	3,744	4,689	6,104	6,295
College:	1 to 3 years	2,428	4,671	5,639	7,426	8,682
	4 years or more	3,575	5,242	8,116	11,702	12,269
55 to 64 Years:						
Elementary:	Total	1,057	2,082	2,577	3,462	3,436
	Less than 8 years[d]	(e)	1,814	2,278	2,922	2,956
	8 years	(e)	2,365	3,010	3,932	3,960

High School:	1 to 3 years	1,551	2,648	3,496	4,398	5,034
	4 years	2,104	3,179	4,548	5,920	6,510
College:	1 to 3 years	2,065	3,888	5,162	6,677	6,992
	4 years or more	3,247	5,461	7,655	9,595	10,966
65 Years Old and Over:						
Elementary:	Total	(e)	1,541	1,560	1,875	1,903
	Less than 8 years[d]	(e)	1,434	1,366	1,686	1,672
	8 years	(e)	1,670	1,898	2,247	2,337
High School:	1 to 3 years	(e)	1,894	2,379	2,560	2,661
	4 years	(e)	2,601	3,115	3,314	3,036
College:	1 to 3 years	(e)	2,720	3,435	4,269[f]	4,180
	4 years or more	(e)	3,902	5,421	5,835	6,091

[a] Restricted to persons reporting $1 or more of wage or salary income and less than $50 of other income for native white and Negro males 25 to 64 years old only.
[b] Total money earnings.
[c] Total money income.
[d] Includes persons reporting no years of school completed, not shown separately.
[e] Not available.
[f] Base is less than 100 sample cases.
Source: Miller (17), Table 1, 966.

change. This latter differential did, however, increase considerably during the recession years of 1949 and 1958, suggesting the possibility that persons with college educations are not as subject to unemployment as are the less educated.

Table 4 also shows that, in terms of income received, college-trained individuals seem to benefit the most from years of experience on the job. Table 6 gives further information on this matter. In 1958, college-trained individuals in the 45 to 54 age bracket (peak earning power years) had mean incomes which were 72 per cent higher than the mean incomes of college-trained individuals who were, on the average, 20 years younger. The comparable percentages for high school and elementary school graduates were 28 and 18, respectively. Thus, the college graduate of any given age not only earns more than persons of the same age with less education, but the earnings of the college graduate exceed those of other persons to a greater extent as he grows older. In other words, the college graduate is increasingly advantaged with respect to earnings as he grows older.

EDUCATION AND LIFETIME INCOME

In attempting to measure lifetime income it would, of course, be ideal to have life-cycle data on a group of individuals. In the absence of such data, Miller has constructed some estimates based on the data shown in Table 4, adjusted for mortality rates. These figures, which are shown in Table 7, are computed by summing the earnings at each age multiplied by the probability that an individual will live to that age. Using the figures for 1949, we find support for the frequently heard remark that a college education is "worth" $100,000. That is, the difference in lifetime income of a college graduate and a high school graduate was expected to be, in 1949, about $100,000 (more accurately, it was over $111,000). By 1958, this difference in lifetime income had increased to approximately $178,000.

As Miller has indicated, the more highly educated groups

Table 5

MEAN INCOME (OR EARNINGS) BY LEVEL OF SCHOOL COMPLETED, FOR MALES 25 YEARS OLD AND OVER, FOR THE UNITED STATES: 1939, 1946, 1949, 1956, AND 1958

Year	Elementary-High School Differential Average Income			High School-College Differential Average Income		
	Elementary School Graduate	High School Graduate	Per Cent Difference	High School Graduate	College Graduate	Per Cent Difference
1939	(a)	$1,661	(a)	$1,661	$2,607	57
1946	$2,327	2,939	26	2,939	4,527	54
1949	2,829	3,784	34	3,784	6,179	63
1956	3,732	5,439	46	5,439	8,490	56
1958	3,769	5,567	48	5,567	9,206	65

(a) Not available.

Source: Miller (17), Table 3, 969.

Table 6

MEAN INCOME (OR EARNINGS) FOR MALES 25 TO 34 YEARS AND 45 TO 54 YEARS OF AGE, BY LEVEL OF SCHOOL COMPLETED, FOR THE UNITED STATES: 1939, 1946, 1949, 1956, and 1958

Age and Level of School Completed	1939	1946	1949	1956	1958
Elementary School Graduate					
25 to 34 years	(a)	$2,011	$2,540	$3,685	$3,663
45 to 54 years	(a)	2,629	3,247	4,289	4,337
Per Cent Increase	(a)	31	28	16	18
High School Graduate					
25 to 34 years	$1,335	2,335	3,246	4,813	4,909
45 to 54 years	2,256	3,744	4,689	6,104	6,295
Per Cent Increase	69	60	44	27	28
College Graduate					
25 to 34 years	1,956	3,237	4,122	6,307	7,152
45 to 54 years	3,575	5,242	8,116	11,702	12,269
Per Cent Increase	83	62	97	86	72

(a) Not available.

Source: Miller (17), Table 6, 974.

Table 7

LIFETIME INCOME (EARNINGS) BASED ON ARITHMETIC MEANS FOR MALES IN SELECTED AGE GROUPS, BY YEARS OF SCHOOL COMPLETED, FOR THE UNITED STATES: 1939, 1946, 1949, 1956, AND 1958

Years of School Completed and Age	1939[a]	1946[b]	1949[c]	1956[d]	1958[c]
Income from Age 18 to Death:					
Elementary: Total	(e)	(e)	$113,330	$154,593	$154,114
Less than 8 years[d]	(e)	(e)	98,222	132,736	129,764
8 years	(e)	(e)	132,683	180,857	181,695
High School: 1 to 3 years	(e)	(e)	152,068	205,277	211,193
4 years	(e)	(e)	185,279	253,631	257,557
College: 1 to 3 years	(e)	(e)	209,282	291,581	315,504
4 years or more	(e)	(e)	296,377	405,698	435,242
Income from Age 25 to Death:					
Elementary: Total	(e)	$ 87,004	104,998	143,712	143,808
Less than 8 years[d]	(e)	74,369	91,095	123,295	120,965
8 years	(e)	98,702	122,787	168,004	169,976
High School: 1 to 3 years	(e)	107,940	141,870	192,254	198,881
4 years	(e)	135,852	174,740	237,776	241,844
College: 1 to 3 years	(e)	161,699	201,938	281,553	305,395
4 years or more	(e)	201,731	286,833	391,992	419,871

[a] Restricted to persons reporting $1 or more of wage or salary income and less than $50 of other income for native whites and Negroes.

[b] Total money earnings.

[c] Total money income.

[d] Includes persons reporting no years of school completed, not shown separately.

[e] Not available.

Source: Miller (17), Table 11, 981.

have made the greatest relative gains in lifetime income in the years since 1939. For example, in 1946 high school graduates could expect to earn 35 per cent more than elementary school graduates; by 1958, however, they could expect to earn 44 per cent more. The income of high school graduates has thus been rising more rapidly than that of persons with less education. The same pattern, but in pronounced form, exists between the earnings of high school and college graduates. For instance, the differential in favor of college graduates was 48 per cent in 1946. By 1958, it had risen to 70 per cent (Miller, 17, 983).

EDUCATION AND DISCOUNTED LIFETIME INCOME

It is probably safe to assume that a rational individual, when confronted with the problem of measuring his lifetime income, would be concerned not only with its amount but also with its distribution throughout his future. In fact, he would tend to value a given amount of income more highly if it were to be received in the relatively near future as opposed to the distant future, and he would value it most highly if he were to receive it as current income. This being the case, he should have some method of reducing a given amount of future income to its equivalent in current income. The discounting procedure, to be examined here, does just that.

By way of example let us assume that an individual is expecting to earn $5,300 in the year following the current year. Let us further assume that he could invest his money, if he so desired, and earn interest at the rate of 6 per cent per year. The "present value" of the $5,300 is therefore, the amount which he would have to invest now so that in one year's time it would appreciate to $5,300. Let us call this amount C_1. Clearly, then, it must be the case that

$$C_1 (1.06) = \$5,300$$

therefore

$$C_1 = \frac{\$5,300}{1.06} = \$5,000$$

That is, the present value of the $5,300, to be received one year hence, is $5,000. Likewise, if our hypothetical income earner is expecting to earn $6,000 in the second year, the "present value" of this amount, call it C_2, can be found from the expression:

$$C_2 (1.06)^2 = \$6,000$$

or,

$$C_2 = \frac{\$6,000}{(1.06)^2} = \$5,340.86$$

In general, then, if we designate income expected t years hence as E_t, we may calculate the present value of E_t, call it C_t, by the formula

$$C_t = \frac{E_t}{(1 + r)^t}$$

where r is the assumed rate of interest.

The present value of the entire stream of lifetime earnings is thus the sum of all the individual C_t's. In effect this procedure provides an answer to the question of how much an individual would have to invest currently, at a given interest rate, in order to receive the same stream of future receipts which he now expects as earnings.

Houthakker (15), using the same basic data as Miller, has computed mean incomes in 1949 by age and years of schooling both before and after taxes. He then weighted these figures to reflect mortality rates, thus providing estimates of expected lifetime incomes for persons with various levels of education. Using the techniques described above he has then discounted these lifetime incomes back to age 14 using discount rates of 0, 3, 6 and 8 per cent. The results of this procedure are shown in Table 8.

Table 8
PRESENT VALUE AT AGE 14 OF LIFE-TIME INCOME BY YEARS OF SCHOOL COMPLETED

Discount Rate (Per Cent)	0	3	6	8
		Before Tax		
Years of School Completed				
Elementary:				
0	$ 64,132	$ 26,220	$13,014	$ 8,896
1-4	79,386	33,939	17,492	12,179
5-7	100,430	42,758	21,834	15,098
8	124,105	52,923	27,037	18,700
High School:				
1-3	142,522	59,734	30,008	20,514
4	175,160	72,475	36,328	24,990
College:				
1-3	198,268	78,138	36,547	23,793
4 or more	280,989	106,269	47,546	30,085
		After Tax		
Elementary:				
0	60,785	24,944	12,428	8,515
1-4	75,021	32,189	16,638	11,730
5-7	93,571	40,006	20,537	14,252
8	115,277	49,425	25,380	17,592
High School:				
1-3	130,933	55,260	27,945	19,188
4	157,940	66,055	33,466	23,149
College:				
1-3	175,206	69,651	32,912	22,400
4 or more	238,761	91,335	41,432	26,454

Source: Houthakker (15) Table 3, 28.

For our purposes we are interested in the difference between any two entries in a given column of Table 8. Consider, for example, the individual who is contemplating four years of college after finishing high school. Using a discount rate of 8 per cent, the present value of the *extra earnings*, be-

fore taxes, resulting from a college education is $5,095 (*i.e.*, $30,085-$24,990). In other words, the amount of money which a person would have had to invest at age 14 (in 1949) so that he could receive a stream of receipts precisely equal to the stream of *extra earnings* he would receive because of his choice of a college education is $5,095.

In fact, in all but three cases in Table 8, the present value of the contribution of additional education to the earnings stream is positive. The question now arises as to the extent to which this contribution does or does not exceed the costs of securing the additional education.

It is this question to which we turn our attention in the following section.

III

The Rate of Return on Investment in Education

Thus far, we have been considering only the monetary returns to education without making any mention of the costs. Indeed, if we satisfied ourselves with merely summing up the lifetime income stream as above, then costs would appear trivial and could be neglected. As we have previously noted, as of 1949 a male high school graduate who went on to four years of college could expect to add over $100,000 to his lifetime earnings (not discounted). This amount is surely much greater than the costs of obtaining this education and thus the investment appears worthwhile.

In this section we will relate monetary returns to education, as measured in previous sections of this monograph, with costs of education, not yet measured, by means of a discount procedure. This procedure provides an answer to the question: What rate of discount will equate the stream of extra returns resulting from education with the costs incurred in obtaining that education?

Measuring the Costs of Education

We must consider the cost aspect of our problem from two views, social and private. Following Hansen (14), we will refer to these as "total resource costs" and "private resource costs." The first, total resource costs, has three major components: (1) school costs incurred by society (that is, teachers' salaries, supplies, interest, and depreciation on capital); (2) opportunity costs incurred by individuals (namely, income foregone during school attendance); and (3) incidental school-related costs incurred by individuals (for example, books and travel). Private resource costs include numbers (2) and (3) above, but substitute tuition and fees paid

by individuals for the first item.

Schultz (21) has tabulated total resource costs on an aggregate basis for each of several years between 1900 and 1956. Tables 9 and 10 show a breakdown of the school costs incurred by society for each of these years. Considering the year 1950 (which refers to the school year of 1949-50), we see that the total school costs incurred by society in that year amounted to 6.505 billion dollars (see Table 9) plus 2.128 billion dollars (see Table 10), or a total of 8.633 billion dollars.

Shultz's method of estimating foregone earnings in each of the years under consideration is as follows. He first finds the average gross weekly earnings for all manufacturing industries. He then estimates, on the basis of 1949 data, that high school-age workers, being subject to somewhat low wages, would earn during the school year (40 weeks) an amount equal to 11 times this average weekly wage. College-age workers, according to a similar estimate, would earn 25 times the average gross weekly earnings for all manufacturing industries in 40 weeks. Thus, high school students forego the equivalent of 11 weeks of work at the average manufacturing wage, and college students forego the equivalent of 25 weeks of such a wage. Elementary school students are assumed to have no foregone earnings.

Next Schultz adjusts his estimate for unemployment. He assumes the following rates of unemployment and applies them to both high school and college students:

YEAR	PER CENT UNEMPLOYMENT
1900	8.2
1910	3.9
1920	4.2
1930	12.4
1940	14.7
1950	4.1
1956	3.0

These estimates, both before and after adjustment for unemployment, are shown in Table 11.

Table 9

ANNUAL RESOURCE COSTS OF EDUCATIONAL SERVICES RENDERED BY ELEMENTARY AND SECONDARY SCHOOLS IN THE UNITED STATES, 1900-1956, IN CURRENT PRICES

(Millions of dollars except Column 4 in Billions)

	Public Schools						Private Schools			Public and Private Schools	
Year	Gross Expenditures (1)	Capital Outlay (2)	Net Expenditures (3)	Value of Property (4)	Implicit Interest and Depreciation (5)	Total Public (6)	Gross Expenditures (7)	Total Private (8)	Total (9)	Secondary (10)	Elementary (11)
1900	215	35	180	.55	44	224	27	28	252	19	233
1910	426	70	356	1.1	88	444	54	56	500	50	450
1920	1,036	154	882	2.4	192	1,074	104	108	1,182	215	967
1930	2,317	371	1,946	6.2	496	2,442	233	246	2,688	741	1,947
1940	2,344	258	2,086	7.6	608	2,694	227	261	2,955	1,145	1,810
1950	5,838	1,014	4,824	11.4	912	5,736	783	769	6,505	2,286	4,219
1956	10,955	2,387	8,568	23.9	1,912	10,430	1,468	1,404	11,884	4,031	7,853

Source: Schultz (21), Table 3, 578.

Table 10

ANNUAL RESOURCE COSTS OF EDUCATIONAL SERVICES RENDERED BY COLLEGES AND UNIVERSITIES IN THE UNITED STATES, 1900 TO 1956, IN CURRENT PRICES

(In Millions of Dollars)

Year	Gross Expenditures (1)	Auxilliary Enterprises (2)	Capital Outlay (3)	Net Expenditures (4)	Value of Physical Property (5)	Implicit Interest and Depreciation (6)	Total (7)
1900	46	9	17	20	254	20	40
1910	92	18	30	44	461	37	81
1920	216	43	48	125	741	59	184
1930	632	126	125	381	1,925	154	535
1940	758	152	84	522	2,754	220	742
1950	2,662	539	417	1,706	5,273	422	2,128
1956	4,210	736	686	2,788	8,902	712	3,500

Source: Schultz (21), Table 4, 579.

Table 11

ANNUAL EARNINGS FOREGONE BY STUDENTS, ADJUSTED AND NOT ADJUSTED FOR UNEMPLOYMENT, 1900-1956, IN CURRENT PRICES

Year	Average Weekly Earnings, All Manufacturing (Dollars) (1)	Annual Earnings Foregone Per Student While Attending High School: Unadjusted (Dollars) (2)	Annual Earnings Foregone Per Student While Attending High School: Adjusted for Unemployment (Dollars) (3)	Annual Earnings Foregone Per Student While Attending College or University: Unadjusted (Dollars) (4)	Annual Earnings Foregone Per Student While Attending College or University: Adjusted for Unemployment (Dollars) (5)
1900	8.37	92	84	209	192
1910	10.74	118	113	269	259
1920	26.12	287	275	653	626
1930	23.25	256	224	581	509
1940	25.20	277	236	630	537
1950	59.33	653	626	1,483	1,422
1956	80.13	881	855	2,003	1,943

Source: Schultz (21), Table 2, 575.

Table 12

TOTAL RESOURCE COSTS PER STUDENT PER YEAR OF HIGH SCHOOL AND COLLEGE, 1900–1956

	High School				College			
Year	School Costs (1)	Earnings Foregone (2)	Incidental Costs (3)	Total (4)	School Costs (5)	Earnings Foregone (6)	Incidental Costs (7)	Total (8)
1900	27	84	4	115	170	192	19	381
1910	45	113	6	164	228	259	26	513
1920	86	275	14	375	308	626	63	997
1930	154	224	11	389	486	509	51	1,046
1940	161	236	12	409	498	537	54	1,089
1950	357	626	31	1,014	801	1,422	142	2,365
1956	524	855	43	1,422	1,168	1,943	194	3,305

Sources: Col. 1: Schultz (21) Table 5, Col. (4) divided by Col. (1).
Col. 2: Table 11 above, Col. (3).
Col. 3: Col (2) times .05.
Col. 5: Schultz (21) Table 6, Col. (4) divided by Col. (1).
Col. 6: Table 11 above, Col. (5).
Col. 7: Col. (6) times .10.

As for the third component, school-related costs incurred by individuals, Schultz makes the assumption that these are 5 per cent of foregone earnings for high school students and 10 per cent of foregone earnings for college students.

By converting the school costs incurred by society to a per capita basis, we can compute the total resource costs of one year of high school and one year of college by summing the three component costs. These are shown separately and totalled in Table 12.

Schultz does not give us private resource costs, nor does he compute a rate of return. Hansen (14), however, fills this gap, at least for the 1950 (school year 1949-50) data. He lists average tuition and fee charges as $245 per student in that year.

While Hansen is content to use Schultz's estimates of school costs and incidental school-related costs, he computes his own estimates of foregone earnings. Using the same basic data as Miller (17) and Houthakker (15), Hansen also computes "age-income profiles" for each level of education. (These "profiles" are shown in Table 1; relevant portions are reproduced here as Table 13.) Hansen states that "opportunity costs were taken directly from the age-income profiles of the alternative level of schooling being used in the calculations. For example, at age eighteen the opportunity costs for the person undertaking four years of college is the income that the high school graduate would obtain from ages eight-

Table 13

AVERAGE INCOME BY AGE AND YEARS OF SCHOOL COMPLETED, MALES, UNITED STATES, 1949

Age	Years of School Completed	
	8	12
14-15	$ 406	----
16-17	534	----
18-19	1,069	$ 955
20-21	1,535	1,744

Source: Table 1.

een to twenty-one." (14, p. 130). Thus, the total opportunity cost of four years of college, as figures in Table 13 show, would be $5,398 (two years at $955 and two at $1,744), or an average annual cost of $1,349. Similarly, four years of high school would involve opportunity costs of $1,880 (two years at $406 and two at $534), or $470 per year.

We can now combine the estimates thus far derived to show total and private resource costs per student for 1949. This is done in Table 14. The figures shown here are slightly less than those shown for 1950 in Table 12.

The Rate of Return

Using the cost data shown in Table 14 and the income data shown in Table 1, which he adjusts for mortality rates, Hansen computes average and marginal rates of return on total and private resource costs. For the latter he computes the rates of return both before and after federal income tax. His results are shown in Tables 15, 16, and 17.

The diagonal elements in Tables 15-17 represent marginal returns, while the off-diagonal elements are average returns. Hence we see that the profitability of investment in education depends upon one's time horizon. Consider Table 16, for example. If an individual has just completed grade one and is considering going on through two years of college (grade 14), his average rate of return, before tax, would be 18.1 per cent. If, however, he has just completed one year of college and is considering a second, he can expect a marginal rate of return of only 6.2 per cent. The latter rate of return is conceivably less than could be received by investing in alternative assets; the former is most likely higher. The time horizon is also important when considering the returns on total resource costs. Hence we see that public policy decisions based on this type of analysis will differ, depending on whether average or marginal rates are deemed to be relevant.

As was to be expected, the private rates, before tax, are greater than the rates on total resource costs in all cases. This

Table 14

TOTAL AND PRIVATE RESOURCE COSTS PER STUDENT BY SCHOOL LEVEL, 1949 (DOLLARS)

School Level	Total Resource Costs: School Costs (1)	Earnings Foregone (2)	Incidental Costs (3)	Total (4)	Private Resource Costs: Tuition and Fees (5)	Earnings Foregone (6)	Incidental Costs (7)	Total (8)
Elementary	201	——	——	201	——	——	——	——
High School	357	470	31	858	——	470	31	501
College	801	1,349	142	2,292	245	1,349	142	1,736

Source: Col. 1: Schultz (21), Table 5, Col. 4 divided by Col. 1.
Col. 2: Data computed from Table 13.
Col. 3: Data computed from Table 12, Incidental costs, 1950.
Col. 5: Hansen (14).
Col. 6: Data computed from Table 13.
Col. 7: Data computed from Table 12, Incidental costs, 1950.

Table 15

INTERNAL RATES OF RETURN TO TOTAL RESOURCE INVESTMENT IN SCHOOLING, UNITED STATES, MALES, 1949*

To:	From: Age	Grade	(1) 6 1	(2) 8 3	(3) 12 7	(4) 14 9	(5) 16 11	(6) 18 13	(7) 20 15
(1)	7	2	8.9	—	—	—	—	—	—
(2)	11	6	12.0	14.5	—	—	—	—	—
(3)	13	8	15.0	18.5	29.2	—	—	—	—
(4)	15	10	13.7	15.9	16.3	9.5	—	—	—
(5)	17	12	13.6	15.4	15.3	11.4	13.7	—	—
(6)	19	14	11.3	12.1	11.1	8.2	8.2	5.4	—
(7)	21	16	12.1	12.7	12.1	10.5	10.9	10.2	15.6

* All rate-of-return figures are subject to some error, since the estimation to one decimal place had to be made by interpolation between whole percentage figures.

Source: Hansen (14), Table 3, 134.

Table 16

INTERNAL RATES OF RETURN TO PRIVATE RESOURCE INVESTMENT IN SCHOOLING BEFORE TAX, UNITED STATES, MALES, 1949*

To:	From: Age	Grade	(1) 6	(2) 8	(3) 12	(4) 14	(5) 16	(6) 18	(7) 20
			1	3	7	9	11	13	15
(1)	7	2	+	—	—	—	—	—	—
(2)	11	6	+	+	—	—	—	—	—
(3)	13	8	+	+	+	—	—	—	—
(4)	15	10	28.3	34.6	25.9	12.7	—	—	—
(5)	17	12	25.6	29.4	23.3	15.3	18.6	—	—
(6)	19	14	18.1	18.7	14.8	10.4	9.5	6.2	—
(7)	21	16	18.2	18.7	16.2	12.9	13.0	11.6	18.7

* All rate-of-return figures are subject to some error, since the estimation to one decimal place had to be made by interpolation between whole percentage figures.

+ This indicates an infinite rate-of-return, given the assumption that education is costless to the individual to the completion of eighth grade.

Source: Hansen (14), Table 4, 136.

Table 17

INTERNAL RATES OF RETURN TO PRIVATE RESOURCE INVESTMENT IN SCHOOLING AFTER TAX, UNITED STATES, MALES, 1949*

To:	From: Age	Grade	(1) 6	(2) 8	(3) 12	(4) 14	(5) 16	(6) 18	(7) 20
			1	3	7	9	11	13	15
(1)	7	2	+	—	—	—	—	—	—
(2)	11	6	+	+	—	—	—	—	—
(3)	13	8	+	+	+	—	—	—	—
(4)	15	10	27.9	33.0	24.8	12.3	—	—	—
(5)	17	12	25.2	28.2	22.2	14.5	17.5	—	—
(6)	19	14	17.2	17.5	13.7	9.4	8.5	5.1	—
(7)	21	16	17.2	17.3	14.4	11.5	11.4	10.1	16.7

* All rate-of-return figures are subject to some error, since the estimation to one decimal place had to be made by interpolation between whole percentage figures.

+ This indicates an infinite rate-of-return, given the assumption that education is costless to the individual to the completion of eighth grade.

Source: Hansen (14), Table 5, 136.

follows from the fact that total resource costs exceed private resource costs. When comparing private rates, after tax, with total rates, however, we find two exceptions to this general rule. After the completion of one year of college, both the marginal rate of return on a second year and the average rate of return on three more years are less for the individual than they are for society. This suggests, according to Hansen, "that the student pays more than his own way in securing schooling at the college level. This might indicate the need for a re-study of the assesssment of the costs of college against the individual, unless the possible underinvestment in college training that would be produced is regarded as acceptable in some broader sense." (p. 137)

By way of conclusion, Hansen compares the "rate-of-return" approach with the "additional life-time income" approach, both of which were examined above, in order to see how an individual would rank various levels of schooling considered as investments. For simplicity, he assumes the decision maker to have just completed eight years of elementary school and to be making one, presumably irrevocable, decision. As can be seen by looking at Table 18, the "additional life-time income" approach suggests that any and all amounts of schooling are worthwhile; likewise, discounting at 3 and 6 per cent gives the same impression. When discounting at 8 or 10 per cent, however, two years of college are less profitable than merely finishing high school, and the after tax return to two years of college, when discounted at 10 per cent, is even less than the return to two years of high school. With regard to the rate of return method, four years of high school appear to offer the highest average rate of return when one discounts back to age 14. Of course, it is the marginal rate of return rather than the average rate of return upon which a person bases his decision to continue his education.

"UNDERINVESTMENT IN COLLEGE EDUCATION?"

The evidence which has been cited clearly indicates that the rate of return on a college education is in excess of 10 per

Table 18

ALTERNATIVE METHODS OF COMPARING VALUE OF PRIVATE ECONOMIC RETURNS TO INVESTMENT IN SCHOOLINGS, AS VIEWED AT AGE FOURTEEN, UNITED STATES, MALES, 1949

Schooling from Completion of Grade 8 to completion of	Additional Lifetime Income (1)	Present Value of Additional Income at 3 Per cent (2)	6 Per cent (3)	8 Per cent (4)	10 Per cent (5)	Internal Rate of Return (Per cent) (6)
			Before Tax			
2 years high school	$ 16,802	$ 7,756	$ 2,301	$1,190	$ 545	12.7
4 years high school	46,083	18,156	6,488	3,601	1,949	15.3
2 years college	66,763	23,800	7,352	3,215	996	10.4
4 years college	141,468	49,429	17,252	8,722	4,135	12.9
			After Tax			
2 years high school	$ 14,143	$ 5,081	$ 1,956	$ 996	$ 436	12.3
4 years high school	38,287	13,580	5,362	2,929	1,547	14.5
2 years college	52,485	17,000	5,364	2,084	336	9.4
4 years college	109,993	36,575	12,824	6,170	2,611	11.5

Source: Hansen (14), Table 6, 138.

cent. Furthermore, if we assume that the rate of return on alternative investments is approximately 5 per cent, then these figures clearly imply that there is underinvestment in college education. Becker (2) questions these percentages, however, stating: "Even 9 per cent is probably too high an estimate of the return to all college graduates since it refers only to urban male whites. The rate of return to non-whites seems to be about two percentage points lower than this."

Becker further discusses the average rate of return to business capital as dependent on the rates of return to ". . . the corporate and unincorporated sectors and on the relative importance of each sector." Using these measurements he concludes ". . . the average return to all business capital would be 8 per cent." Becker's figures, then, would give us a far different picture of the rate of return on a college education.

IV

The Contribution of Education to Economic Growth

Another method of assessing the economic value of education, one which carries with it the implication of some rate of return, is that of measuring the contribution which education has made to economic growth. In this section we will consider the estimates of this contribution made by Denison (9) and Schultz (21).

Denison's Estimates

Using mean income data found in the work of Houthakker (15), Denison presents income differentials by level of education for males of the same age (see Table 19). Denison next makes the assumption that three-fifths of each of the differentials shown in column 1 of Table 19 are due to differences in education. He then derives new differentials which reflect only this difference. These are shown in column 2 of Table 19 (col. 2 = 3/5 [col. 1 − 100] + 100).

Denison's assumption made it possible for him to calculate the effects of increased education on past growth. For each year for which he could derive a distribution of individuals by number of years of school completed, he calculated what the average earnings of males over 25 would have been if the earnings at each educational level were a constant fraction (column 2, Table 19) of actual 1949 earnings of eighth grade graduates. "The differences from period to period of earnings so computed can be used to isolate the effect of changes in the length of schooling, measured in years, on average income. An adjustment is then possible to take account of changes in the number of days of school attendance during the year." (p. 70)

Table 19

MEAN INCOME DIFFERENTIALS BY LEVEL OF SCHOOLING COMPLETED

Years of School Completed	(1) Mean Income as % of Mean Income of Eighth Grade Graduates	(2) Mean Income Differential Used to Represent Effect of Education (% of Income of Eighth Grade Graduates)
None	50	70
Elementary School		
1 to 4 years	65	79
5 to 7 years	80	88
8 years	100	100
High School		
1 to 3 years	115	109
4 years	140	124
College		
1 to 3 years	165	139
4 years or more	235	181

Source: Denison (9), Table 8, 68.

His results are shown in Table 20. (It should be noted that this adjustment is based on the assumption that a doubling of the number of days of school attended per year while hold-

Table 20

LABOR OUTPUT PER MAN BASED ON TOTAL DAYS OF EDUCATION

Period	Per Cent Change	Annual Rate of Change (Per Cent)
1910 to 1920	4.9	0.48
1920 to 1930	6.9	0.67
1930 to 1940	8.8	0.85
1940 to 1950	10.4	1.00
1950 to 1960	10.3	0.99
1910 to 1930	12.1	0.57
1930 to 1960	32.6	0.94
1910 to 1960	48.6	0.79

Source: Denison (9) Table 9, p. 72, Cols. 5 and 6.

ing the number of years constant would have the same effect on output as a doubling of the number of years of school while holding the number of days per year constant.)

The meaning of the results can be seen by considering the period 1950 to 1960. The first column of Table 20 tells us that "if the labor force in 1950 had been as well educated as that of 1960, it would have contributed 10.3 per cent more to production than it actually did. Since labor represented about 75 per cent of the national income at that time, the national income would have been larger by 7.7 per cent." (9, p. 72)

The second column of Table 20 shows the average annual rates of change which are implied by the total period changes in the first column. Thus, if we consider the period 1930 to 1960, we see that output per laborer due to education increased at an average annual rate of .94 per cent. National income in this period was increasing at approximately 3 per cent per year (see 9 and 21). Hence, again assuming labor's share to be 75 per cent we find that increased education contributed $.75 \times .94 = .705$ points to the growth rate of output. In other words, 23.5 per cent of the growth experienced from 1930 to 1960 was due to increased education of the labor force.

In his analysis Denison focuses attention on the period from 1929 to 1957. He concludes that the contribution of education to economic growth during these years was 23 per cent. "When related to the growth of national product per person employed, the contribution of additional education appears still more impressive. My final estimate is that education contributed 42 per cent of the 1.60 percentage point growth rate in product per person employed." (p. 73)

The importance of Denison's assumption that three-fifths of the income differential was due to differences in education cannot be stressed too strongly. The effect of alternative assumptions can be approximated by multiplying the results in Table 20 by the ratio of the alternative percentage to 60 per cent. Thus, if we assumed that 75 per cent of the differential was due to differences in education, we would credit

29.3 per cent of the growth in output to education. Similarly, substitution of 50 per cent would credit 19.6 per cent of total growth to education.

SCHULTZ'S ESTIMATES

According to Schultz (21) the stock of education carried by the labor force was equal to 180 billion dollars in 1929 and 535 billion dollars in 1957, both measured in 1956 prices. This represents an increase of 355 billion dollars. Meanwhile, the real income of the United States rose from 150 to 302 billion dollars in 1956 prices during this period. If we again assume labor's share to be 75 per cent, then its contribution to output increased from 112.5 to 226.5 billion dollars over the period. If earnings per person had been held constant, labor would have earned only 155.5 billion dollars in 1957. Hence, they earned 71 billion dollars more than they would have if earnings per laborer had been held constant at the 1929 level. Schultz now asks the question: "How much of this 71 billion dollars is attributable to more education?"

Because the labor force increased by 38 per cent between 1929 and 1957, Schultz adds 69 billion dollars to the 1929 stock of education (38 per cent of 180 billion dollars) in order to keep the per laborer stock of education constant in these two years. Hence, the 355 billion dollars increase in the stock of education carried by the labor force consists of two parts. The first part, 69 billion dollars, is due to growth in the labor force. The second part, 286 billion dollars, is due to an increase in the stock of education per laborer.

The extent to which these two increases contributed to the growth in national income clearly depends upon the rate of return earned by this investment. Schultz uses three estimates, as shown in Table 21. The 9 per cent rate he takes from Becker (2). The 11 per cent is his own estimate of the return to college education in 1958, and the 17.3 per cent is a weighted average of his estimates for the returns to elementary, high school, and college education (35, 10, and 11 per cent, respectively). His results are summarized in Table 21.

Table 21

ESTIMATES OF THE CONTRIBUTION IN THE LABOR FORCE TO EARNINGS AND TO NATIONAL INCOME, BETWEEN 1929 AND 1956, IN THE UNITED STATES

Rate of Return	Stock of education added (in billions of dollars)		Income attributable to this additional education (in billions of dollars)			Proportion of the 71 Billion Dollars increase in earnings of labor col. 5 x 100 / 71
	Part One	Part Two	Part One	Part Two	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
9	69	286	6.2	25.7	31.9	36
11	69	286	7.6	31.5	39.1	44
17.3	69	286	11.9	49.5	61.4	70

Source: Schultz (21), Table 18, 81.

Thus, the increase in education per member of the labor force "explains" between 36 and 70 per cent of the otherwise unexplained increase in earnings per laborer.

Comparing these results with Denison's, we first note that the 71 billion dollars increase in labor's earnings represents roughly 46 per cent of the growth of national income. Applying the 36 and 70 per cent figures to this, we see that the increase in education per laborer accounted for between 16.6 and 32.2 per cent of the growth in income from 1929 to 1957.

V

Summary

This monograph deals with the findings of economists concerning education as an investment. Data are presented on the benefits accruing both to individuals and to the nation as a whole from investment in education. In summarizing our findings, we shall state generalizations pertaining to (1) the effects of education on earnings, (2) the rate of return on investment in education, and (3) the contribution of education to economic growth.

Education and Earnings

1. Data on annual income for males show that at all age levels income increases as years of schooling increase. For example, in the category from 25 to 34 years, average annual income in 1958 was $3,663 for elementary school graduates, $4,909 for high school graduates, and $7,152 for college graduates. Income for persons in the years of peak earning power, the 45 to 54 age bracket, ranged from $4,337 for elementary school graduates to $6,295 for high school graduates and $12,269 for college graduates.

2. The relationship between income and educational attainment has persisted through the years, even though the amount of school attained by the population has increased. Indeed, income differentials between elementary school graduates and high school graduates, and between high school and college graduates have increased in recent years. In 1949, the average high school graduate had an income 34 per cent greater than the elementary school graduate, while the college graduate's income exceeded that of the high school graduate by 63 per cent. By 1958, the high school graduate's advantage over the elementary school graduate had increased to 48 per

cent, and that of the college graduate over the high school graduate to 65 per cent.

3. In terms of income received, persons with the most education benefit to the greatest extent from years of job experience. The college graduate benefits most in this respect; his earnings increase proportionately more than do those of elementary and high school graduates as he gets older. For example, in 1958 college-trained individuals in the 45 to 54 age bracket had average incomes that were 72 per cent higher than those of persons in the 25 to 34 age category. Comparable differences for elementary school and high school graduates were 18 per cent and 28 per cent, respectively. Thus the college graduate, who earns more than persons with less education at any age level, is increasingly advantaged as he grows older.

4. Total lifetime income increases as education increases. As of 1958, the average male graduate of elementary school could be expected to earn $169,976 during his lifetime, as compared with $241,844 for the high school graduate and $419,871 for the college graduate.

5. As in the case of annual income, the greatest gains in lifetime income in recent years have accrued to persons with the most education. For example, in 1946 high school graduates could expect to earn 35 per cent more than elementary school graduates; by 1958, they could expect to earn 44 per cent more. The same pattern, but in far more pronounced form, exists between high school and college graduates. The differential in favor of college graduates was 48 per cent in 1946, but it had increased to 70 per cent by 1958.

6. Even when lifetime income is discounted—that is, equated to return on current investment—the contribution of additional education to earnings is positive and significant.

THE RATE OF RETURN ON INVESTMENT IN EDUCATION

1. Education yields a high rate of return on investment—

i.e., the monetary returns exceed the costs of education by a considerable margin. This is true from the point of view of society as a whole as well as that of the individual who invests in education for himself. The benefits to society are impressive; for example, in 1949 an investment in education that would have permitted male first graders to complete high school would have produced a 13.6 per cent return, on the average. An investment through four years of college would have returned 12.1 per cent on the total investment. Even more striking are the economic returns to individuals. For example, the male first grader in 1949 could expect a 25.6 per cent return on the private funds required to see him through high school, and a return of 18.2 per cent on the funds required for him to graduate from college.

2. Research on additional lifetime income resulting from private investment in more education shows that the rate of return remains high at all educational levels. For example, for males in 1949 the rate of return to funds used to educate the eighth grader through four years of high school was 15.3 per cent; the return to an investment in four years of college was 12.9 per cent.

3. It is quite possible that society (as well as individuals) is making an "underinvestment" in college education. This contention rests upon the fact that the rate of return on a college education is clearly in excess of 10 per cent, while the rate of return on alternative investments is considerably lower (approximately five per cent).

The Contribution of Education to Economic Growth

1. Studies have concluded that increases in years of schooling completed by the labor force have contributed significantly to the economic growth of the nation. Denison, studying data for the period from 1929 to 1957, found that 23 per cent of the economic growth of the country during these years was attributable to the increased education of the labor force. Schultz, who studied increases in income in the United

States during the same years, concluded that the increase in education per laborer accounted for between 16.6 and 32.2 per cent of the growth in income during this period.

2. These studies reinforce the conclusion reached in previously mentioned research dealing with the rate of return on investment in education—that is, the social returns on educational investment are very profitable, as are private returns on individual investment. Education is, then, not merely an excellent investment for the individual; it also yields heavy returns to the society as a whole.

BIBLIOGRAPHY

1. Abramovitz, Moses; "Economic Growth in the United States," *American Economic Review*, Vol. 52 (Sept., 1962), pp. 762-782.
2. Becker, Gary S.; "Underinvestment in College Education?", *American Economic Review*, Vol. 50 (May, 1960), pp. 346-354.
3. .....; "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy* (Supplement), Vol. 70 (Oct., 1962), pp. 9-49.
4. Benson, Charles S. (ed.); *Perspectives on the Economics of Education*, Boston: Houghton Mifflin Company, 1963.
5. Bowman, Mary Jean; "Human Capital: Concepts and Measures," in *The Economics of Higher Education*, ed. Selma J. Mushkin. Washington: U.S. Department of Health, Education and Welfare, Office of Education, 1962, pp. 69-92.
6. .....; "Social Returns to Education," *International Social Science Journal*, Vol. 14 (Dec., 1962), pp. 647-659.
7. .....; "Converging Concerns of Economists and Educators," *Comparative Education Review*, Vol. 6 (Oct., 1962), pp. 111-119.
8. Debeauvais, M.; "The Concept of Human Capital," *International Social Science Journal*, Vol. 4(Dec., 1962), pp. 660-675.
9. Denison, Edward F.; *The Sources of Economic Growth in the United States and the Alternatives Before Us.*, New York: Committee for Economic Development, 1962.
10. .....; "Education, Economic Growth and Gaps in Information," *Journal of Political Economy* (Supplement), Vol. 70 (Oct., 1962), pp. 124-128.
11. Eckaus, Richard S.; "Education and Economic Growth," in *The Economics of Higher Education*, ed. Selma J.

Mushkin. Washington: U.S. Department of Health, Education and Welfare, Office of Education, 1962, pp. 102-128.

12. .....; "Economic Criteria for Education and Training," *Review of Economics and Statistics*, Vol. 46 (May, 1964), pp. 181-190.
13. Glick, P. C. and H. P. Miller: "Educational Level and Potential Income," *American Sociological Review*, Vol. 21 (June, 1956), pp. 307-312.
14. Hansen, W. Lee; "Total and Private Rates of Return to Investment in Schooling," *Journal of Political Economy*, Vol. 71 (April, 1963), pp. 128-140.
15. Houthakker, H. S.; "Education and Income," *Review of Economics and Statistics*, Vol. 41 (Feb., 1941), pp. 24-28.
16. Hunt, Shane J.; "Income Determinants for College Graduates and the Return to Educational Investment," *Yale Economic Essays*, Vol. 3 (Fall, 1963), pp. 305-357.
17. Miller, H. P.; "Annual and Lifetime Income in Relation to Education: 1939-1959," *American Economic Review*, Vol. 50 (Dec., 1960), pp. 962-986.
18. .....; "Income and Education: Does Education Pay Off?", in *The Economics of Higher Education*, ed. Selma J. Mushkin. Washington: U.S. Department of Health, Education and Welfare, Office of Education, 1962, pp. 129-146.
19. Mincer, Jacob; "On-The-Job Training: Costs, Returns, and Some Implications," *Journal of Political Economy* (Supplement), Vol. 70 (Oct., 1962), pp. 50-79.
20. Renshaw, Edward F.; "Estimating the Returns to Education," *Review of Economics and Statistics*, Vol. 42 (Aug., 1960), pp. 318-324.
21. Schultz, T. W.; "Capital Formation by Education," *Journal of Political Economy*, Vol. 68 (Dec., 1960), pp. 571-583.
22. .....; "Education and Economic Growth," in *Social*

Forces Influencing American Education, ed. Nelson B. Henry. Chicago: University of Chicago Press, 1961, pp. 46-88.

23. .....; "Investment in Human Capital," *American Economic Review*, Vol. 51, (March, 1961), pp. 1-17.
24. .....; "Investment in Human Capital: Reply," *American Economic Review*, Vol. 51, (Dec., 1961), pp. 1035-1039.
25. .....; "Reflections on Investment in Man." *Journal of Political Economy* (Supplement), Vol. 70 (Oct., 1962), pp. 1-8.
26. .....; "Rise in the Stock of Capital Represented by Education in the United States, 1900-57," in *The Economics of Higher Education*, ed. Selma J. Mushkin. Washington: U.S. Department of Health, Education and Welfare, Office of Education, 1962, pp. 93-101.
27. .....; *The Economic Value of Education*, New York: Columbia University Press, 1963.
28. Shaffer, Harry; "Investment in Human Capital: Comment," *American Economic Review*, Vol. 51 (Dec., 1961), pp. 1026-1034.
29. Vaizey, John; *The Economics of Education*, New York: Free Press of Glencoe, Inc., 1962.
30. Walsh, J. R.; "Capital Concept Applied to Man," *Quarterly Journal of Economics*, Vol. 49 (Feb., 1935), pp. 255-285.
31. Weisbrod, Burton A.; "The Valuation of Human Capital," *Journal of Political Economy*, Vol. 69 (Oct., 1961), pp. 425-436.
32. .....; "Education and Investment in Human Capital," *Journal of Political Economy* (Supplement), Vol. 70 (Oct., 1962), pp. 106-123.