THE OCCUPATIONAL DISTRIBUTION OF THE RETURNS TO EDUCATION AND EXPERIENCE FOR WHITES AND NEGROES[1]

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Individuals earn income by employing their skills and knowledge -- their human capital. To earn larger incomes they must increase either the quantity or the price of their human capital. Education and on-the-job training provide the principle means for increasing the quantity of human capital. Migration, improvements in information, and the elimination of other market imperfections, such as discrimination, provide the principle means for raising the price of existing capital.

Although price and quantity effects are theoretically distinguishable, in practice the distinction is blurred by using observed income flows to measure indirectly the value of human capital. Price and quantity effects are lumped together as changes in value. In most cases this is not a serious problem since both the individual and society are interested in raising the value of human capital. Real investment is usually necessary to alter either price or quantity. The basic problem is finding that investment which will earn the greatest return. It may be an investment which will increase the quantity of human capital or it may be an investment which will raise the price of human capital.

When observed income flows are used to measure the value of human capital, efforts to measure the specific effects of any one factor must make explicit allowance for the impacts of all other factors. For example, since innate ability (whatever it is and however it is measured) and education levels are probably linked together, the observed income flows that are associated with higher levels of education are caused partially by education and partially by innate ability. If some correction is not made for ability, observed income flows will overstate the actual returns to education.

A similar problem is presented by on-the-job training. Since training and education are associated together,[2] the returns to more education will be overstated if the effects of training are not considered. Since training programs have costs as well as benefits, the error is compounded in calculations of net returns to education. Training benefits are included in the returns to education, but training costs have not been added to the costs of education. Ability did not have any associated costs which needed to be considered. Strenuous efforts have been made to isolate the returns to education from those caused by ability.[3] Less effort has been made to solve the problems presented by on-the-job training.[4] This

is not surprising. Practically no direct information is available on either its amount or its costs. The informal aspects of much of the training mean that there is no practical method to obtain direct information. Much of the training is acquired in the course of work and does not result from deliberate training programs. Costs are involved, but they are difficult to estimate.

The problem presented by on-the-job training goes beyond that presented by ability in another way. Since innate ability cannot be altered by definition, society and individuals want to know the returns to increasing education (a variable which can be altered). On-the-job training, however, is not innate. It can be altered. Society and the individual want to know what <u>combination</u> of education and training yields the greatest net return.

The standard technique for isolating the returns to any one factor, such as education, has been to hold all other explanatory factors constant and then note the remaining differences in observed income flows. Either regression techniques or detailed data are used to hold the other explanatory factors constant. Both adjustment techniques assume that the effects of each of the explanatory factors is independent of all other explanatory factors and that their separate effects are additive. Thus, the amount of training is assumed to have no influence on the returns to education and the returns to increasing both education and training are assumed to be equal to the sum of the separate returns to increasing each variable independently.

In fact, many of the explanatory variables which affect income flows are not independent but complimentary. Returns are not additive but multiplicative. This is clearly seen in on-the-job training and education. The returns from training partially depend on the level of formal education possessed by the trainee. Low education levels make some types of training impossible and other types expensive. As education levels rise, training costs fall and the variety of training which can be given expands. Complimentarities also work in the opposite direction. Without training, education is of little value. Most jobs require some knowledge which is peculiar to the job and which is not or cannot be acquired in school. Without this training, education is of little value. With complimentarities the benefits from both education and training will be larger than the sum of the benefits from education and training separately.[5]

Corresponding to the earlier distinction between price and quantity effects on the value of human capital, there are two main sources of complimentarities. Technological complimentarities occur when the skills and knowledge acquired in school are complimentary with the skills and knowledge acquired in training. Price complimentarities occur when market imperfections are reduced in the process of acquiring education and training. Thus, a Negro might receive price complimentarities if higher levels of education and training allowed him to move into occupations with less discrimination.

The degree of complimentarity obviously differs for different jobs. In some jobs there are few complimentarities; in others education and training are linked rigidly together. A priori reasoning leads to the conclusion that complimentarities are important and the data presented below confirm this conclusion.

Ignoring complimentarities leads to biased estimates of the returns to increasing education. Holding training levels constant while observing the returns to education may provide a valid estimate of the returns to education within each training level, but it provides a distorted view of the general returns to education. Part of the returns to education arise from shifting training levels as well as moving up the income ladder within each training level. To estimate the returns to education while holding the level of training constant is to seriously underestimate the actual returns to education.[6]

The existence of complimentarities means that a precise functional relationship must be specified between the value of human capital and its explanatory factors. This function will be called the human capital function. All of the explanatory factors which are linked together by complimentarities must be considered together and their interactions specified explicitly. With complimentarities the impact of education cannot be estimated by itself. The returns to education must be estimated together with the returns to other factors.

This paper begins the task of specifying a human capital function by considering the joint impact of formal education and on-the-job training. These two factors were chosen since they are the major instruments for altering the quantity of human capital. In addition, the impact of training has typically been ignored in calculations of the returns to education. Price effects are investigated by studying the different returns to education and training across race, occupation, and region.

The empirical work presented below is not definitive since all of the relevant explanatory factors have not been considered.[7] The empirical work does, however, confirm the need for a human capital function and its precise specification. The empirical complimentarities between education and training are large and should not be ignored in evaluating programs to alter the distribution of income by changing the distributions of training or education. For males in the American economy the returns to both education and training are approximately nine times as large as the returns to education and training separately. The observed price differences across race, occupation, and region are equally large. For Negroes these price differences severely reduce the complimentarities between education and training as well as their absolute returns.

THE MODEL

Individuals receive formal and informal training while they are at work. One year of work experience will have different effects on the value of an individual's human capital depending on the amount of training received or the impact of work experience on the price of existing human capital. Everyone has one year of experience after one year of work, but the returns from that experience -- the income flows produced by it -- may be very different. If observed income flows are higher, the value of human capital has increased. This may be caused by either increases in the quantity of human capital or its price.

If price effects do not occur, income flows depend on the amount of training received. Thus, the returns to a year of work experience can be used as a surrogate variable to measure the returns to investment in on-the-job training. If labor training markets are in equilibrium, the rates of return on training will be equal for all training projects. In this case different returns to experience would reflect different amounts of investment in on-the-job training. Equal investments would earn equal returns. If labor training markets are not in equilibrium this conclusion cannot be drawn, but the returns to experience still indicate the pattern of gross benefits from training. If work experience affects the price of human capital and labor training markets are not in equilibrium, the function simply measures the gross returns to a year of work experience.

A function analogous to the production function can be used to measure the returns to experience and education and the complimentarities between them. This function is the human capital function (see equation 1). Just as the real variables and parameters on the right-hand side of a production function determine the annual flow of goods and services, so do the real variables and parameters on

the right-hand side of the human capital function determine the annual flow of income which will be produced by the stock of human capital. According to the human capital function, income flows depend on the years of education and experience (Ed and Ex) the income elasticities with respect to education and experience (b and c), and a shift coefficient (A_j). Making the assumptions which were outlined above, the amount of on-the-job training is represented by the years of experience and the income elasticity with respect to experience. The shift coefficient represents the impact of different capital-labor ratios, the level of technical progress, discrimination, unionization, market imperfections, and any other relevant factors except education and experience. The shift coefficient differs among different groups and over time, but for any one group and at any point in time it can be regarded as a constant.

(1) $\quad I_{jik} = A_j \, Ed_i^{b_j} \, Ex_k^{c_j}$

where I_{jik} = income in occupation j for an individual with i years of education and k years of experience,

A_j = shift coefficient for occupation j,

Ed_k = i years of education,

Ex_k = k years of experience,

b_j and c_j = income elasticities for occupation j.

The impacts of education and experience on incomes can be found by taking the partial derivatives of the human capital function (see equations 2 and 3). As these derivatives indicate, the marginal product of education depends on the shift coefficient, the years of experience, and the years of education already completed. In the same manner the marginal product of experience depends on the shift coefficient, the years of education, and the years of experience already completed. As both of these functions indicate, the returns to either education or experience depend on the level of the other.

(2) $\quad \dfrac{\partial I_{jik}}{\partial Ed_j} = A_j b_j Ed_j^{\,b_j-1} \, Ex_k^{c_j}$

(3) $\quad \dfrac{\partial I_{jik}}{\partial Ex_j} = A_j Ed_j^{\,b_j} \, c_j Ex_k^{c_j-1}$

Since the income elasticities (b and c) are not constrained, there may be increasing or decreasing returns to increases in education and experience. If the sum of the two elasticities is greater than one there are increasing returns and if the sum of the two elasticities is less than one there are decreasing returns.

There is also no reason why the elasticities should be constant over all ranges of education and experience. College may produce higher returns than high school. To test for such differences, the function can be disaggregated into different ranges of education and experience (see equation 4).

(4) $\quad I_{jik} = A_j \displaystyle\prod_{g=1}^{n} Ed_i^{\,b_{jg}} \prod_{i=1}^{m} Ex_k^{\,c_{j1}}$

where n = education classes

m = experience classes

If the human capital function is fit to actual income data, the function can be judged by the standard statistical tests. The usual calculations of the returns to education cannot do this. Observed income differences are adjusted for what is believed to be other relevant factors and then education is assumed responsible for the residual. No statistical tests are possible on this latter assumption.[•] The human capital function, however, has the advantage of providing statistical tests of its own validity as well as providing estimates of the empirical size of the relationships.

THE DATA

The human capital function was fitted to 1960 mean income data for males 18 to 64 years of age.[9] Functions were estimated for whites and Negroes,[10] for ten occupations, and for the North and South. Years of experience were calculated by assuming that each individual begins work at 18 if he has finished school by this age. If not, work begins at the school-leaving age. Thus, a college graduate is assumed to begin work at 22. Eighteen was selected as the starting age for those with 12 or fewer years of education since child labor laws and workmen's compensation laws prevent earlier entry into many jobs. A worker's years of experience were found by subtracting his starting age from his current age. To test the hypothesis that different ranges of education and experience have different elasticities, the education variable was divided into three variables (0-8 years, 9-12 years, and more than 12 years) and experience was divided into four variables (0-5 years, 6-15 years, 16-35 years, and more than 35 years). In a cross sectional analysis of male incomes the human capital function worked very well. In most classifications over ninety-five percent of the variation in incomes was explained (see Appendix A).

THE RESULTS: WHITE VERSUS NEGRO

Income elasticities with respect to education and experience were not constant for all levels of education and experience. For white males the income elasticity was 0.23 for elementary education, 0.61 for high school education, and 2.10 for college

education[11] (see Table 1). For Negro males the education elasticities were 0.32, 0.32, and 1.49, respectively. The elasticities for Negroes were slightly larger for elementary education, but much smaller for high school and college education.

White male income elasticities with respect to experience were 0.44 for both the first five years and the next ten years of experience, 0.13 for the 16th to 35th years and -0.28 for anything over 35 years of experience. For Negro males the income elasticities of experience were 0.13 in the first five years, 0.56 in the next ten years, and -0.08 for anything over 15 years of experience. Negroes receive less benefit from experience early in their careers and their human capital begins to depreciate sooner than that for whites.[12]

TABLE 1							
Income Elasticities of Education and Experience[13]							
	Education			Experience				Shift Coefficient
	0-8	9-12	12 & up	0-5	6-15	16-35	35 & up	
Professional								
Northern White	.05	.43	1.54	.43	.43	.20	-.24	$1619
Southern White	.21	.73	1.57	.32	.60	.16		971
Nonwhite	.94	.94	.94	.14	.59			216
Managerial								
Northern White	.16	.58	1.95	.48	.36	.36		1389
Southern White	.11	.80	1.79	.19	.51	.25		1813
Nonwhite	.30	.66	.66	.42	.42			739
Clerical								
Northern White	.09	.24	.83	.25	.48			1695
Southern White	.19	.19	1.30	.52	.19	.19		1005
Northern Nonwhite	.05	.38	.54	.33	.33	.04		1465
Southern Nonwhite	.14	.59	.59	.37	.37	.01	-.12	925
Sales								
Northern White	.14	.43	1.59	.24	.69			1417
Southern White	.24	.59	1.83	.23	.65			979
Craftsmen								
Northern White	.08	.23	1.11	.21	.40	-.06		2225
Southern White	.16	.43	1.31	.39	.39	-.07	-.18	1196
Northern Nonwhite	.13	.13	.67	-.06	.58	-.11		2143
Southern Nonwhite	.06	.58	.58	.33	.33	-.03	-.44	1025
Operatives								
Northern White	.08	.23	1.11	.21	.40	-.06		2225
Southern White	.17	.44	.91	.62	.26	-.06	-.24	829
Northern Nonwhite	.06	.16	.41	.30	.30			1661
Southern Nonwhite	.17	.25	.64	-.07	.55			1233
Laborers								
Northern White	.09	.26	.26	.42	.42	-.15		1212
Southern White	.22	.65	1.07	.76	.15	-.06	-.39	360
Northern Nonwhite	.03	.21		.45	.26	-.02	.15	1235
Southern Nonwhite	.16	.16	.94	.36	.36	-.06		720
Services								
Northern White	.20	.20	.71	.37	.62	-.19		887
Southern White	.14	.78		.92	.26	-.09	-.65	469
Northern Nonwhite	-.01	.32	.32	.87	.05	.05		732
Southern Nonwhite	.07	.25	.74	.38	.38	-.06		783
Farmers								
Northern White	.08	.54	1.31	.54	.32	-.16	-.41	948
Southern White	.33	1.17	2.84	.23	.55	-.11	-.11	556
Total								
White	.23	.61	2.10	.44	.44	.13	.28	879
Nonwhite	.32	.32	1.49	.13	.56	-.08		797
Northern White	.15	.56	2.07	.44	.44	.12	-.31	1107
Southern White	.25	.83	2.15	.45	.45	.11	-.32	724
Northern Nonwhite	.07	.25	1.42	.21	.44	-.05		1537
Southern Nonwhite	.27	.27	1.81	.13	.55	-.11	-.11	728

The marginal products of education and experience can be seen in Charts 1 and 2. For the average white male with twenty years of experience, the value of education falls from $2,004 per year for the first year to $152 for the eighth year and then rises to $1468 for the sixteenth year. The returns to the average Negro are much smaller. The value of education falls from $1384 per year for the first year to $110 for the twelfth year, and then rises to $561 for the 16th year.

CHART 1

MARGINAL PRODUCT OF EDUCATION FOR MALES WITH TWENTY YEARS OF EXPERIENCE IN 1960
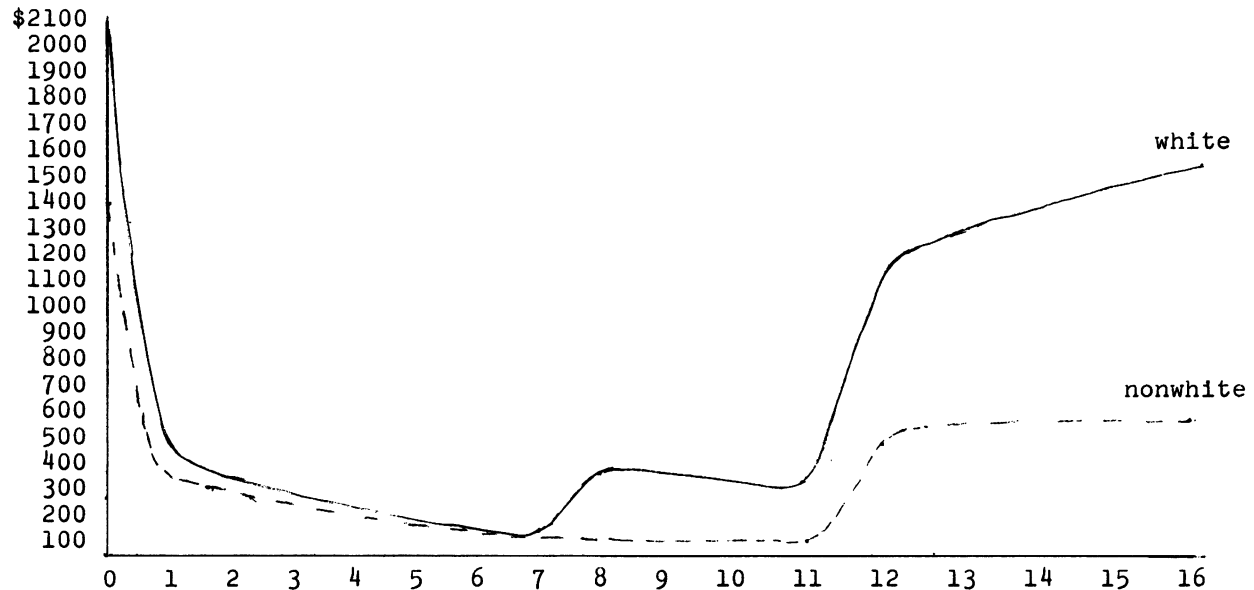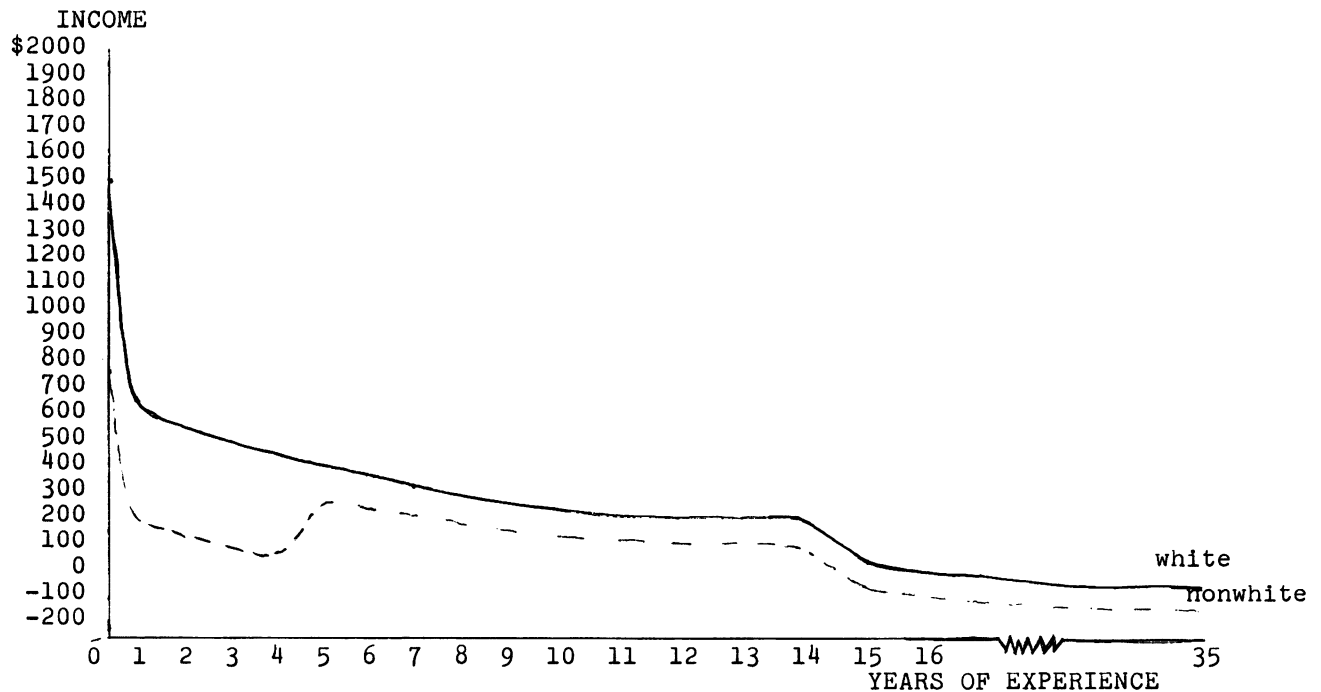

CHART 2

MARGINAL PRODUCT OF EXPERIENCE FOR MALES WITH 10.5 YEARS OF EXPERIENCE IN 1960

As education levels rise, the Negro falls further and further behind. With no education his income is $624 lower than that for a white male with no education (see Table 2). With an eighth grade education he is $1446 behind a comparable white; with a twelfth grade education he is $2356 behind; with a sixteenth grade education

he is $5477 behind. The income gap grows as education rises, and grows at an increasing rate. Discrimination hurts the better educated most.

TABLE 2

THE INCOME GAP

Twenty Years of Experience		10.5 Years of Experience	
Years of Education		Years of Experience	
(Whites minus Nonwhites)			
0	$624	0	-$700
8	$1446	5	$1351
12	$2356	15	$1724
16	$5477	35	$2626
(Northern Whites minus Southern Whites)			
0	$1104	0	$38
8	$875	5	$402
12	$467	15	$596
16	$580	35	$712
(Northern Nonwhites minus Southern Nonwhites)			
0	$2030	0	-$32
8	$1241	5	$999
12	$1350	15	$1273
16	$1479	35	$1384
(Northern White minus Northern Nonwhite)			
0	-$605	0	-$489
8	$1180	5	$906
12	$1854	15	$1479
16	$5109	35	$2284
(Southern White minus Southern Nonwhite)			
0	$321	0	-$559
8	$1546	5	$1503
12	$2599	15	$2156
16	$6008	35	$2956
(Southern White minus Northern Nonwhite)			
0	-$1709	0	-$527
8	$305	5	$504
12	$1598	15	$883
16	$4529	35	$1572

Returns to experience do not show the same general U-shaped pattern. The value of experience is very high in early years, but falls off as the amount of experience increases. For the average white male with 10.5 years of education, the marginal product of experience falls from $1471 for the first year of experience to $24 for the 35th year. For Negro males, experience is less valuable and shows a slightly different pattern. The first year of experience is only worth $778, but the returns rise in the sixth to fifteenth year to levels almost equal to those for whites. The biggest gap in the returns to experience comes in the early working years. A Negro male with no years of experience and 10.5 years of education begins with an income $700 higher than that of a white in the same position (see Table 2).[15] After five years of experience, white incomes are $1351 ahead of Negro incomes. At fifteen years the gap is $1724 and at thirty-five years, $2626. Most of the income gap caused by experience is built up during the first five years of a worker's career. During these years of high training investments, Negroes are receiving much less training than whites.

NORTH VERSUS SOUTH

The marginal returns to education are higher in the South than in the North. For a white male in the North with twenty years of experience, a high school education increases his annual income by $4576 above what it would have been with no education. For a similar white male in the South, twelve years of education raise his annual income by $5213, For Negroes the comparable figures are $1906 and $2586. Marginal returns to education are lower for Negroes but the same North-South difference exists.

Although the marginal returns to education are higher in the South, average incomes are higher in the North. Higher shift coefficients and greater returns to experience more than offset the differences in marginal returns to education. A white male with twenty years of experience and twelve years of education earns $467 more in the North than he would in the South, and a Negro male earns $1350 more. The incentives for a Negro to move north to benefit from the higher shift coefficients and more extensive or higher priced training are much greater than those for a white.[16]

As educational attainment rises, the income gap between North and South shrinks, but the gap between whites and Negroes widens (see Table 2). As experience increases, the income gaps both between North and South and between white and nonwhite widen. Southern Negro males are particularly handicapped by a lack of training investments. The first five years of experience increase the income gap between northern and southern whites by $364, but they increase the income gap between northern and southern Negroes by $1031. Northern Negroes receive more investment in on-the-job training, or they have a more favorable price structure than southern Negroes, but they receive much less training or they have a more unfavorable price structure than either northern or southern whites. The first five years of experience increase the income gap between northern whites and Negroes by $1395 and between southern whites and northern Negroes by $1031.

The marginal returns to education are large (see Chart 1 and Table 2). The income differences produced by education, however, are not much larger than those produced by experience (see Chart 2 and Table 2). Differences in the returns to experience and in the training investments that produce these returns explain much of the North-South and white-nonwhite income differences. To close the income gaps would require changes in the distribution of on-the-job training as well as education.

Implications of the above results can be seen in the situation facing a high school student with 10.5 years of education who is trying to decide whether to continue school or begin working. If he is white the first year of experience is worth $1523 in the North and $1343 in the South. Another year of education is worth $12 and $15 respectively. If he is Negro, a year of experience would be worth $1179 in the North and $604 in the South. Another year of education would be worth $16 and $19 respectively. By the time the individual has accumulated twenty years of experience however, the relative values of having previously obtained another year of education or experience are reversed regardless of color. The extra year of education is more valuable than the extra year of experience.

For northern whites with twenty years of experience the extra year of education raises incomes by $312 and the extra year of experience raises incomes by $37. A similar reversal exists for the Negro. If time horizons are short and discount rates are high, the individual will drop out of school. With low time horizons and low discount rates the individual will stay in school.

OCCUPATIONAL DIFFERENCES

The same general pattern of returns is visible in almost all occupations. Shift coefficients are higher in the North. Experience is more valuable in the North; education is more valuable in the South. Within each region the returns to both education and experience are lower for Negroes, but the returns to experience for northern Negroes are sometimes higher in specific occupations than the returns to experience for southern whites. Among nonwhites the returns to experience are much higher in the North and the returns to education are slightly higher in the South (see Table 1).

Craftsmen present the principle exception to these rules. The returns to education for northern Negroes are high and the returns to experience are low. Northern Negroes receive little investment in training, but a high level of education allows them to move into higher paying jobs within the crafts. In the South, experience has a much larger return for Negroes, but education a smaller one. More training is done, but formal education is not a route into higher paying jobs.

Although the general pattern of returns across occupations is similar, the magnitudes of the effects differ widely (see Table 3). This is true both across occupations and within occupations. The large differences can be seen within the professional occupations. For the northern white professional worker, 35 years of experience and no education results in an annual income $4685 higher than that achievable with no education and no experience. The same 35 years of experience is worth $1255 to a southern white but only $5 to a Negro.[17] The gains from education are reversed. The increase in income resulting from sixteen years of education is $283 for the northern white, $652 for the southern white, and $1542 for all Negroes.

Incomes rise as education or experience rises. More important is what happens when education and experience increase simultaneously. The impact is much greater than the sum of the two separate impacts. Northern white managers provide a good example (see Table 3). If the effects of having thirty-five years of experience and sixteen years of education were no greater than the sum of the two separate effects, thirty-five years of

TABLE 3.

Annual Increase in Incomes Due to Education and Experience

	Experience 35 years of experience and no education.	Education 16 years of education and no experience.	Both 16 years of education and 35 years of experience
Professional			
Northern White	$4685	$ 283	$12642
Southern White	$1255	$ 692	$11777
Nonwhite	$ 5	$1542	$ 6943
Managerial			
Northern White	$2870	$ 399	$18442
Southern White	$2799	$1754	$14832
Nonwhite	$ 539	$ 294	$ 6795
Clerical			
Northern White	$2473	$ 556	$ 6809
Southern White	$1381	$ 175	$ 5411
Northern Nonwhite	$2731	$ 227	$ 7787
Southern Nonwhite	$1239	$ 252	$ 5061
Sales			
Northern White	$2140	$ 918	$10901
Southern White	$ 838	$1098	$10150
Craftsmen			
Northern White	$2599	$ 918	$ 7736
Southern White	$1470	$ 380	$ 7869
Northern Nonwhite	$ 283	$3233	$ 4111
Southern Nonwhite	$1707	$ 207	$ 4006
Operatives			
Northern White	$1625	$1170	$ 5155
Southern White	$1280	$ 83	$ 6233
Northern Nonwhite	$2471	$ 260	$ 4737
Southern Nonwhite	$ 160	$2436	$ 3113
Laborers			
Northern White	$2079	$ 138	$ 4652
Southern White	$ 676	$ 11	$ 5351
Northern Nonwhite	$2812	$ 42	$ 3735
Southern Nonwhite	$ 778	$ 209	$ 3452
Services			
Northern White	$1039	$ 252	$ 5390
Southern White	$1375	$ 8	$ 4665
Northern Nonwhite	$3353	$ 3	$ 4022
Southern Nonwhite	$1443	$ 112	$ 3169
Farmers			
Northern White	$1889	$ 115	$ 6036
Southern White	$ 248	$1375	$ 9487

experience and sixteen years of education would raise incomes by $3269 per year above that of the individual with no education and no experience. In fact, increasing education and experience simultaneously raises incomes to $18,442 above what they would have been with no education and no experience. The combined effect of education and experience is almost six times as great as the sum of the two individual effects. The complimentarities between education and experience are large but they differ widely by occupation, race, and region.

Factors other than education and experience play an important role in income differences. These other factors are measured by the shift coefficients. They include the impact of capital-labor ratios, unionization, technical progress, discrimination, and other market imperfections. The shift coefficients range from $2225 for northern white craftsmen to $360 for southern white service workers. Shift coefficients are higher in the North than in the South, but there is an interesting racial difference. The shift coefficients for whites and nonwhites are approximately equal in the South. In the North the shift coefficients for Negroes is higher than that for whites. Northern Negro males are in occupations where the returns to education are smaller and where the investment in training is less, but they are occupa-

tions and industries, such as durable goods, with high shift coefficients. Soutnern Negroes receive even less training and they are not located in occupations with high coefficients.

IMPLICATIONS

The existence of strong complimentarities means that the returns from programs designed to improve education, on-the-job training, or shift coefficients are heavily dependent on what is happening simultaneously to each of the other variables. Increasing education will have little effect on incomes if the individuals work in areas with low shift coefficients and little training. Conversely, education will have a large impact on incomes if the individuals work in areas with ample training and high shift coefficients. The same complimentarities affect the returns to programs designed to alter either training or shift coefficients. If the other necessary factors are not present, the observed returns to any one program will be very low. Thus, any program designed to affect one of the variables, such as on-the-job training, will appear to fail unless it is coordinated with other programs to alter simultaneously the structure of education and shift coefficients. This means education programs, training programs, and efforts to move individuals into areas with high shift coefficients must be coordinated. The combination of policies which will produce the greatest income changes at the least cost cannot be determined abstractly. The present positions of the individuals to be aided must be determined. Only then can the marginal benefits and costs be determined.

Given the general characteristics of the poor, large returns could be earned by remedial programs designed to raise everyone in the labor force to at least eighth grade standards of literacy. The social benefits from such a program are large, but the benefits are also large from a narrow economic point of view. The marginal income flows from raising education levels in this range are great and the complimentarities with on-the-job training programs are very important. Unless an individual possesses an eighth grade standard of literacy he is under a very severe competitive handicap and as general education levels rise this handicap will grow. Since most individuals with less than an eighth grade standard of literacy are beyond the normal school age, efforts to bring the working population up to this standard must focus on adult education programs. This is precisely the area where the least effort has been made in educational programs for the poor. Concentrating on children might eliminate poverty in the long-run, but the long-run is intolerably long. Something must be done for those who are going to be in the labor force for the next thirty years.

Education plays a vital role in eliminating the differences between the income distributions for whites and Negroes. Negroes receive less education and part of the observed differences in the economic returns to education for Negroes is caused by differences in the quality of the education that is provided. The principle need, however, is for more on-the-job training. More than 80 percent of the difference between white and Negro incomes is explained by differences in the returns to experience. Negroes receive much less training. Unless this defect can be overcome, education programs will have little impact on the incomes of Negro Americans.

APPENDIX A

Equation (1) is estimated in the following form:

$$\ln I = A + b_1 \ln Ed_1 + b_2 \ln Ed_2$$
$$+ b_3 \ln Ed_3 + C_2 \ln Ex_2$$
$$+ C_3 \ln Ex_3 + C_1 \ln Ex_4$$

Where I = mean income level

Ed_1 = years of education possessed by individual up to a maximum of 8

Ed_2 = years of education possessed by individual up to a maximum of 12

Ed_3 = total years of education possessed by individual

Ex_1 = years of experience up to a maximum of 5

Ex_2 = years of experience up to a maximum of 15

Ex_3 = years of experience up to a maximum of 35

Ex_4 = total years of experience.

To calculate the elasticities for different levels of education and experience, the 'b' and 'c' coefficients are added together. Thus, the elasticity for the 0-8 educational range is $b_1+b_2+b_3$, the elasticity for the 9-12 range is b_2+b_3, and the elasticity for the above 12 range is simply b_3. The elasticities of experience are calculated in a similar manner. Since the log of zero is negative infinity, individuals with no education are inserted at the value of 0.01 years of education rather than at their actual value. Variables were dropped from the regressions when they did not exceed their standard errors.

South

	A	b_1	b_2	b_3	c_1	c_2	c_3	c_4	$\bar{R}^2$	S_e
Professional White	6.8783 (.1773)	-.5180 (.2208)	-.8388 (.3392)	1.5712 (.2222)	-.2790 (.2129)	.4396 (.1699)	.1593 (.0689)		.94	.101
Farmers White	6.3208 (.1505)	-.8403 (.1225)	-1.6659 (.2241)	2.8351 (.1619)	-.3205 (.1937)	.6568 (.1115)		-.1111 (.0426)	.99	.061
Managers White	7.5026 (.1215)	-.6933 (.1513)	-.9945 (.2324)	1.7938 (.1523)	-.3231 (.1459)	.2547 (.1164)	.2540 (.0472)		.97	.069
Clerical White	6.9129 (.1136)		-1.1153 (.1187)	1.3032 (.1666)	.3266 (.0836)		.1926 (.0287)		.93	.081
Nonwhite	6.8295 (.0638)	-0.4523 (.0886)		.5936 (.0578)		.3620 (.0356)	.1253 (.1061)	-.1165 (.1138)	.99	.029
Sales White	6.8867 (.1216)	-.3530 (.1520)	-1.2339 (.2442)	1.8282 (.1666)	-.4181 (.1199)	.6476 (.0560)			.97	.076
Crafts White	7.0870 (.0782)	-.2641 (.1064)	-.8830 (.1727)	1.3085 (.1179)		.4586 (.0455)	.1179 (.1117)	-.1829 (.1140)	.97	.053
Nonwhite	6.9329 (.0872)	-.5226 (.1156)		.5819 (.0894)		.3582 (.0600)	.4119 (.1763)	-.4380 (.1681)	.94	.055
Operatives White	6.7201 (.1186)	-.2689 (.0823)	-.4711 (.1533)	.9091 (.1197)	.3618 (.1626)	.3166 (.0912)	.1821 (.1202)	-.2410 (.1076)	.98	.040
Nonwhite	7.1172 (.0849)	-.0746 (.0658)	-.3903 (.1802)	.6379 (.1512)	-.6196 (.1075	.5528 (.0400)			.98	.031
Services White	6.1501 (.2509)	-.6456 (.1639)	.7807 (.1220)		.6635 (.3537)	.3478 (.1947)	.5652 (.2560)	-.6520 (.2354)	.94	.084
Nonwhite	6.6637 (.0835)	-.1844 (.1146)	-.4924 (.2860)	.7420 (.2351)		.4434 (.0526)	-.0625 (.0378)		.95	.056
Labor White	5.8871 (.2323)	-.4290 (.1361)	-.4147 (.4044)	1.0673 (.3727)	.8111 (.3291)	.2144 (.1857)	.3284 (.2436)	-.3915 (.2102)	.96	.064
Nonwhite	6.5797 (.0823)		-.7769 (.3566)	.9400 (.3476)		.4184 (.0633)	-.0627 (.0468)		.93	.064
White	6.5847 (.1150)	-.5755 (.1631)	-1.3252 (.2564)	2.1544 (.1706)		.3359 (.0639)	.4303 (.1703)	-.3164 (.1746)	.97	.081
Nonwhite	6.5898 (.1088)		-1.5479 (.1728)	1.8131 (.1534)	-.4190 (.1418)	.6586 (.1131)		-.1117 (.0511)	.95	.079

FOOTNOTES

1. The research reported herein was performed pursuant to a contract with the Office of Economic Opportunity, Executive Office of the President, Washington, D.C., 20506, and was based in part on data collected by the Equal Employment Opportunity Commission, Washington, D. C., under section 709 (c) of the Civil Rights Act of 1964, in cooperation with the Office of Federal Contract Compliance of the United States Department of Labor.

2. Mincer, Jacob, "On-the-job Training: Costs, Returns, and Some Implications," The Journal of Political Economy. Supplement, October 1962.

According to Mincer, on-the-job training accounted for 55 percent of the total training costs of those with a college education, 46 percent for those with a high school education, and 69 percent for those with an elementary education. See Mincer, op. cit.

3. For the most comprehensive attempt see: Hannoch, Giora, "An Economic Analysis of Earnings and Schooling". Journal of Human Resources, Summer 1967.

4. For the one major article see: Mincer, op. cit.

5. The same kinds of complimentarities would exist between migration and education or training.

6. This is equivalent to holding occupations constant while studying the returns to education. Many of the returns to education occur by moving across occupations rather than within occupations.

7. Most notably innate ability.

8. The additivity assumption can be compared with the human capital function of this paper by testing the equation

$$I = a + b \text{ Ed} + c \text{ Ex.}$$

The form of the function given in equation (1) does a better job of fitting the observed data. The additive model leads to negative incomes for groups with little education and experience.

9. All data come from the 1960 Census volume, "Occupation by Earnings and Education." North refers to North and West in census classifications.

10. Negroes and nonwhites will be used interchangeably since 92 percent of nonwhites are Negroes. All data refers to the census category nonwhite.

11. The income elasticities with respect to education are greater than those for any occupation since a large part of the gain is explained by shifts across occupations rather than within occupations. Since those with high education levels are concentrated in occupations with high shift coefficients and high income elasticities with respect to experience, the mean rise in income from low to high education levels is greater for the total population than it is for any individual occupations.

12. Age can cause skills to depreciate and skills can become obsolete. Earlier depreciation for Negroes may be due to lower health standards or less permanent skills.

13. In several occupations there were not enough Negroes to estimate the human capital function.

14. The function is fit in such a way as to provide step discontinuities in the value of the function at eight years of education and twelve years of education. Given market imperfections, completing high school may be much more valuable than dropping out one day before graduation. An alternative hypothesis would be that there are kinks in the marginal product curves at these points but not step discontinuities. This possibility is currently under study.

15. This is caused by an income elasticity with respect to education which is higher for Negroes for the first eight years than for whites. At higher education levels whites would have higher incomes.

16. To gain the benefit of higher returns to experience a Negro would have to move north to get the better training. Experience probably does not become more valuable by simply moving north, but this could happen if discrimination were lowering wages more in the South than in the North.

17. Most of the nonwhite male professionally are in the South.

18. For some numerical examples see: Thurow, Lester C., The Economics of Poverty and Discrimination, The Brookings Institution, 1968.

19. For estimates of shift coefficients by income classes see: Ibid.

	A	b_1	b_2	b_3	c_1	c_2	c_3	c_4	$\bar{R}^2$	S_e
Total White	6.7783 (.1161)	-.3796 (.1646)	-1.4847 (.2588)	2.0986 (.1721)		.3132 (.0645)	.4086 (.1718)	-.2778 (.1762)	.97	.081
Nonwhite	6.6807 (.0838)		-1.1696 (.1319)	1.4910 (.1177)	-.4292 (.1130)	.6384 (.0898)	-.0760 (.0396)		.97	.060
Professional Nonwhite	5.3753 (.4437)			.9377 (.1595)	-.4535 (.1664)	.5910 (.0900)			.94	.082

North and West

	A	b_1	b_2	b_3	c_1	c_2	c_3	c_4	$\bar{R}^2$	S_e
Professional White	7.3896 (.1341)	-.3824 (.1794)	1.1089 (.2650)	1.5436 (.1731)		.2366 (.0655)	.4359 (.1729)	-.2393 (.1772)	.95	.082
Farmers White	6.8539 (.1508)	-.4601 (.1130)	-.7650 (.1810)	1.3069 (.1237)	.2193 (.2136)	.4774 (.1170)	.2552 (.1427)	-.4102 (.1325)	.97	.055
Managers White	7.2361 (.1312)	-.4268 (.1668)	-1.3716 (.2506)	1.3540 (.1624)	.1163 (.0731)		.3604 (.0267)		.97	.077
Nonwhite	7.2895 (.0689)	-.3355 (.0918)	-.1535 (.1514)	.5384 (.1058)		.2878 (.0355)	.0448 (.0244)		.97	.038
Clerical White	7.4355 (.0802)	-.1496 (.1011)	-.5919 (.1609)	.3301 (.1071)	-.2349 (.0790)	.4804 (.0369)			.97	.050
Nonwhite	7.2895 (.0689)	-.3355 (.0918)	-.1535 (.1514)	.5384 (.1058)		.2878 (.0355)	.0448 (.0244)		.97	.038
Sales White	7.2564 (.1364)	-.2894 (.1704)	-1.1652 (.2739)	1.5907 (.1823)	-.4345 (.1345)	.6947 (.0628)			.96	.085
Crafts White	7.7073 (.0966)	-.1421 (.1186)	-.8818 (.1913)	1.1069 (.1289)	-.1861 (.1118)	.4605 (.1899)	-.0599 (.0393)		.95	.059
Nonwhite	7.6699 (.3725)		-.5345 (.2445)	.6671 (.2339)	-.6415 (.4949)	.6903 (.2234)	-.1094 (.0567)		.93	.052
Operatives White	7.3526 (.0662)	-.0977 (.0933)	-.1746 (.1481)	.3777 (.0974)		.4420 (.0351)	-.0749 (.0258)		.97	.047
Nonwhite	7.4149 (.0528)	0.0995 (.0733)	-.2512 (.1825)	.4121 (.1494)		.2062 (.0108)			.97	.036
Services White	6.7878 (.1361)		-.5176 (.2143)	.7142 (.1911)	-.2475 (.1835)	.8165 (.1458)	-.1942 (.1644)		.93	.097
Nonwhite	6.5962 (.1179)	-.3309 (.0932)		.3244 (.0634)	.8269 (.0973)		.0463 (.0256)		.95	.059
Laborers White	7.1000 (.0847)	-.1724 (.0865)		.2613 (.0555)		.5659 (.0484)	-.1486 (.0357)		.96	.061
Nonwhite	7.1189 (.1171)	-.1771 (.0821)	.2054 (.0640)	.1912 (.1675)	.2808 (.0965)	-.1670 (.1256)	.1478 (.1147)		.97	.038
White	7.0092 (.1241)	-.4056 (.1760)	-1.5140 (.2767)	2.0699 (.1841)		.3161 (.0690)	.4333 (.1837)	-.3094 (.1884)	.96	.087
Nonwhite	7.3378 (.1077)	-.1772 (.1322)	-1.1721 (.2133)	1.4192 (.1437)	-.2271 (.1247)	.4833 (.0991)	-.0456 (.0438)		.95	.066