Volume Title: Higher Education and Earnings: College as an Investment and Screening Device

Volume Author/Editor: Paul J. Taubman, Terence Wales

Volume Publisher: NBER

Volume ISBN: 0-07-010121-3

Volume URL: http://www.nber.org/books/taub74-1

Publication Date: 1974

Chapter Title: Within-Occupation Regressions

Chapter Author: Paul J. Taubman, Terence Wales

Chapter URL: http://www.nber.org/chapters/c3654

Chapter pages in book: (p. 137 - 152)

8. Within-Occupation Regressions

All but the most primitive economies are characterized by a division of labor into various occupations that differ in terms of such characteristics as the tasks performed, status, and average wage levels. In this sample, as in others, the more highly educated tend to be concentrated in the higher-paying occupations. A question that naturally arises is whether this concentration is due to the affective and cognitive skills produced by, or associated with, education or whether it is due to the use of education as an entry card. In Chapter 9 we attempt to answer this question using information from earnings functions within various occupational groups that are estimated here.

Such occupational earnings equations are of interest in themselves. They indicate both the extent to which success in different occupations depends on ability and education, once entry into an occupation has been achieved, and the extent to which education, ability, and prior work experience impart specific skills. The equations can also be used to examine several other important problems involving, for example, age-income profiles by education level in various occupations, or the degree of riskiness in education-occupation groups. These within-occupation regressions, however, are not appropriate for determining the returns to education. Such equations do not take into account the increases in earnings attributable to entering higher-paying occupations.

SUMMARY Using the NBER-TH data, we have analyzed separately three broad occupational categories: professional, technical, and sales; managerial and business owner; and white-collar, blue-

collar, and service.[1] We make use of the estimated equations, which are presented and discussed in detail later, in several different ways. First, we calculate the average earnings and their variance after standardizing for differences in such characteristics as mental ability, family background, and age. Second, we indicate which variables determine earnings within an occupation.

In Table 8-1, we present mean earnings for 1955 and 1969 and the percentage change in earnings over this period by education and occupation level for people with the same measured characteristics.[2] In 1955, this "standard" high school graduate would have earned a low of $400 per month as a white-collar employee and a high of $628 in managerial work. His professional and sales salaries would be close to his managerial salary, and his technical, blue-collar, and service earnings would be intermediate. In 1969, the rankings over occupations of the high school graduate's earnings are about the same, except that owners and managers do substantially better than professionals and salesmen. As might be expected, the growth rate in earnings is lowest in the service and blue- and white-collar occupations, and is highest for technicians, owners, and managers.[3]

In 1955, incomes earned in the various occupations were about the same at all education levels, but by 1969 incomes were higher for those with more education. Thus, the percentage growth in income is substantially greater at the undergraduate-degree and Ph.D. levels than at the high school or some-college levels for professional, technical, sales, and owner-manager groups. When calculated for people in the top ability fifth, the profiles are steeper.

[1]These categories were chosen in order to obtain a sufficient number of observations while maintaining homogeneity with respect to average income levels. (See the tables in Chapter 4.) Moreover, as will be shown below, the variance of the unexplained residual is approximately constant for the suboccupations in a group, but the variances differ between the occupations.

[2]A separate profile can be constructed for each ability and background characteristic. The discussion that follows is for a person of the average age, in the third fifth in ability and biography, whose father attended high school but not college, who is married, and who is in excellent health.

[3]Miller (1960) finds a similar pattern.

TABLE 8-1 ***Average monthly earnings, by occupation and education, 1955 and 1969 (in dollars)****

	High school	*Some college*	*Under-graduate degree*	*Some graduate work*	*Master's*	*Ph.D.*
Professional						
1955	$ 606	$ 628	$ 599	$ 607	$ 601	$ 589
1969	1,238	1,324	1,483	1,315	1,366	1,684
Percentage change	(104)	(111)	(148)	(117)	(127)	(186)
Technical						
1955	497	519	490	498	†	†
1969	1,320	1,406	1,565	1,397	†	†
Percentage change	(166)	(171)	(219)	(181)		
Sales						
1955	623	645	616	624	†	†
1969	1,309	1,395	1,554	1,386	†	†
Percentage change	(110)	(116)	(152)	(122)		
Blue-collar						
1955	463	485	496	488	†	†
1969	897	929	992	1,056	†	†
Percentage change	(95)	(92)	(100)	(116)		
Service						
1955	454	475	486	478	†	†
1969	851	883	946	1,010	†	†
Percentage change	(87)	(86)	(95)	(111)		
White-collar						
1955	400	422	433	415	†	†
1969	794	826	843	907	†	†
Percentage change	(99)	(96)	(95)	(119)		
Owner-manager						
1955	628	644	638	697	618	643
1969	1,613	1,708	1,816	1,793	1,873	1,961
Percentage change	(157)	(165)	(184)	(157)	(203)	(205)

*Calculated for people of average age, Q_3 in ability and biography, father attended high school, married, in excellent health, not an M.D. or a teacher.

†No observations.

SOURCE: Derived from Table 8-3.

It is often of interest to know the riskiness attached to earnings within education and occupation groups.[4] Since some of the variability arises from measurable characteristics in each education group, we have calculated a conditional variance defined as $\sigma^2 = [1/(N-k)]\ \Sigma(Y_i - Z_i b_i)^2$. Z_i represents independent variables, and $N-k$ and b_i are the degrees of freedom and the coefficient estimates, respectively, from regressions described in this chapter.[5] It should be noted that

[4] The variance is a complete measure of riskiness only if the distribution of errors is normal or if the utility function is quadratic.

[5] These regressions include the personality variable q and hence differ from those in Table 8-3.

TABLE 8-2
"Conditional" standard errors in monthly earnings, by occupation and education, 1969 and 1955 (in dollars)

	1969					
	High school	*Some college*	*Undergraduate degree*	*Some graduate work*	*Master's*	*Three-year graduate degree*
Professional	$274	$500	$674	$ 461	$302	$ 293
	(11)	(49)	(257)	(75)	(195)	(197)
Technical	577	579	458	*	*	*
	(85)	(82)	(29)	(3)	(4)	(1)
Sales	548	614	865	*	*	*
	(56)	(80)	(90)	(6)	(3)	(2)
Blue-collar	165	182	244	*	*	*
	(211)	(87)	(18)	(1)	(0)	(0)
Service	177	228	244	*	*	*
	(50)	(32)	(11)	(1)	(0)	(1)
White-collar	127	194	212	*	*	*
	(24)	(21)	(11)	(3)	(0)	(0)
Owner-manager	907	884	911	1,158	960	1,261
	(299)	(501)	(610)	(112)	(136)	(36)

*Too few observations to calculate the standard error.

NOTE: The number of observations is given in parentheses beneath the standard error. For the factors that were held constant, see first footnote to Table 8-1.

these variances overstate the riskiness of the various occupations, because some of the residual reflects individual characteristics that we have not measured.

In Table 8-2, we present estimates of the corresponding standard errors (σ) for various education and occupation groups in which we have at least 10 people. Since we would expect individuals to have sorted themselves out by 1969, the results for that year are more interesting. We consider first the ranking of occupations by variability. For this purpose we exclude the graduate levels of education for which we have estimates of the variance in only two occupations. Using 1 for the lowest σ and 7 for the highest, the average ranks over the three educational levels are white-collar, $1^1/_3$; blue-collar, 2; service,

1955					
High school	*Some college*	*Undergraduate degree*	*Some graduate work*	*Master's*	*Three-year graduate degree*
$203	$172	$171	$180	$145	$ 28
(77)	(156)	(488)	(98)	(220)	(16)
114	134	124	*	*	*
(24)	(45)	(20)	(1)	(2)	(0)
191	434	219	249	*	*
(72)	(124)	(139)	(28)	(9)	(7)
102	146	113	*	*	*
(293)	(135)	(44)	(3)	(1)	(1)
103	167	118	*	*	*
(28)	(18)	(14)	(2)	(2)	(4)
83	74	85	*	*	*
(91)	(61)	(45)	(7)	(3)	(1)
282	279	280	320	197	178
(195)	(334)	(362)	(45)	(27)	(14)

$2\,^{2}/_{3}$; professional, $4\,^{1}/_{3}$; technical, 5; sales, $5\,^{2}/_{3}$; and owner-manager, 7. Except for the switch in position between service and blue-collar, these rankings correspond to those of average earnings in 1969; that is, occupations paying lowest (highest) also have the lowest (highest) variability in earnings. Examination of the variability by education within each occupation indicates that in 1969, but not in 1955, σ increases with education, although in 1969 the managerial and technical occupations are exceptions to this rule.[6] Finally, we note that there are much greater differences in the variances between occupations (given education) than between education levels (given occupation).

Since average earnings in 1955 do not differ much by education (after standardization) in any occupation, it is not surprising that very few education coefficients are significant in the 1955 equations. On the other hand, the larger educational earnings differences in 1969 (Table 8-1) result in more of the 1969 education coefficients being significant. These coefficients differ by occupations, with service and white- and blue-collar groups displaying smaller effects of education. Both the average level of earnings and the coefficients suggest that around the age of 47, education has imparted skills that are more important in occupations that require leadership and judgment.[7] The ability-measure coefficients tend to corroborate this conclusion. Only the mathematical measure is significant, but it is not important in the service, white-collar, and blue-collar occupations.

A more detailed summary of these findings by occupation may be of some interest to the reader. For the professional group in 1955, we find the top two mathematical-ability fifths and the top three biography fifths significant but all the education coefficients except M.D. insignificant and small. In 1969, the B.A., M.D., and LL.B variables are significant, as are the top two ability fifths and the highest biography fifth. For managers and business owners, all the education coefficients are small and insignificant in 1955. In 1969, the B.A., M.A., and LL.B. coefficients, the top ability fifth, and the top two biography fifths

[6]The increase of σ with education and the higher concentration of the more educated in the higher-variance occupations help to explain the heteroscedasticity discussed in Appendix I.

[7]However, the differences could be explainable by differences in investment in on-the-job training or by small sample sizes in some cells.

are significant. When owners and managers are analyzed separately for 1969, we find that for managers the B.A., M.A., and LL.B. coefficients as well as the top ability and biography variables are significant; for owners, only the B.A. and LL.B. variables are significant. This result for managers is consistent with the results of our study of top corporate managers, presented in Appendix L. For the white-collar, blue-collar, and service group, we find the B.A., some-college, and top biography coefficients significant in 1955, while in 1969 only the B.A. variable is significant.[8]

Thus in 1955 mathematical ability, the information contained in the biography variables, and to a minor extent education affect income within occupations. The result for education is not surprising, since for the sample as a whole its effects are not large, and education coefficients are nearly always smaller within occupations.[9] In 1969, on the other hand, the effects of education are more pronounced, while the ability factors are still important.

Tables 4-3 and 4-4 (pages 66, 67) indicate that many people switched occupations between 1955 and 1969. We can use the 1955 occupation as an indicator of the time spent in a particular occupation or, alternatively, of the type of training received in the past within each occupation. We find that those in the service, white-collar, and blue-collar group in 1955 earn substantially less in 1969 (regardless of occupation in 1969) than those who were in other occupations in 1955. In both the managerial and professional categories, 1969 income is highest for those who were in the same occupation as they were in 1955. Those who switched from professional to managerial, or vice versa, received about $2,000 a year less in 1969 than those who remained in their 1955 occupation. This strongly suggests that there is some specific training in the managerial and professional categories. However, the fact that those with training in

[8]We excluded M.A.'s and Ph.D.'s because there was only one person in each category.

[9]These results on ability and education are similar to those found in the Wolfle-Smith data. In Thorndike and Hagen's study, however, there were only very few more finely defined occupations in which ability was significant. Thus, some of the importance of mathematical ability may be due to differences in ability requirements among suboccupations. In addition, the ability requirements for suboccupations in the professional category may be correlated with nonpecuniary returns.

law do exceptionally well as owners or managers suggests that some skills produced by education are fairly general.

Although the results are not presented here, we have estimated the 1969 equations after including the 1955 residual, with the latter calculated from the individual's 1955 occupation. This variable is highly significant in all occupations with a coefficient of about 1.5 and a t value in excess of 15, and its inclusion increases the $\bar{R}^2$ values by about .2. In these equations this "residual" variable is not orthogonal to the other independent variables because of changes in occupations between 1955 and 1969. Nevertheless, it is clear that it explains more of the variance in earnings than the education or ability variables, even within occupations. The above results are based on a detailed regression analysis of earnings by occupation, to which we now turn.

TABLE 8-3 ***Occupational regressions, 1955 and 1969 (in dollars per month)***

	Constant	*Some college*	*Undergraduate degree*	*Some graduate work*	*Master's*	*Ph.D.*	*LL.B.**	*M.D.**	*Teacher*
(1) Y_{55}	$276.3	$21.9	$−7.1	$ 1.1	$−5.5	$−17.5	$40.8	$321.9	$−159.9
	(2.8)	(1.0)	(.3)	(.0)	(.2)	(.5)	(1.1)	(7.5)	(4.0)
(2) Y_{69}	876.8	86.4	244.9	77.1	127.6	445.8	583.7	903.7	−197.8
	(2.0)	(1.1)	(3.0)	(.7)	(1.3)	(4.0)	(5.8)	(7.8)	(2.4)
(3) Y_{55}	397.2	16.4	9.9	69.5	− 9.5	15.3			
	(3.0)	(.5)	(.3)	(1.2)	(1.2)	(.2)			
(4) Y_{69}	1,781.1	94.7	202.9	179.8	259.3	347.4	666.6		
	(3.6)	(1.2)	(2.6)	(1.5)	(2.3)	(1.6)	(2.0)		
(5) Y_{55}	268.5	21.2	32.5	24.8					
	(4.5)	(2.1)	(2.4)	(.7)					
(6) Y_{69}	865.7	31.8	94.0	158.2					
	(4.6)	(1.5)	(2.6)	(1.8)					

*Those with LL.B.'s and M.D.'s are also included in the Ph.D. category.

NOTE: Figures in parentheses are t statistics. Rank 5 is highest. N is sample size.

PROFESSIONAL, TECHNICAL, AND SALES

Consider first the 1,686 individuals in the professional, technical, and sales group in 1955. In equation 1, Table 8-3, we have included the following as determinants of earnings: age; the mathematical factor; the biography variable; the five education variables; background variables; doctor, teacher, and lawyer dummies; and dummies for the sales and technical suboccupations.[10] The most noticeable difference between this equation and the corresponding one using all the data (that is, all occupations combined) is that none of the five basic education variables is significantly different from zero, and all their coefficients are extremely small. On the other hand, the top two

[10] As before, the people who are lawyers and M.D.'s are also included in the Ph.D. category; hence the significance test given in the table is for the difference from the Ph.D. effect and not the difference from high school.

We also examined the effects of the three other ability factors. Since none of these were significant, the results are not presented.

Age	*Ability*				*Technical*	*Sales*	*Service*	*White-collar*	*Health*
	Q_2	Q_3	Q_4	Q_5					
$ 7.6	$ 27.3	$ 38.3	$ 43.2	$ 80.0	$−109.4	$17.0			$−19.8
(2.7)	(1.3)	(1.9)	(2.1)	(4.0)	(4.0)	(1.1)			(2.0)
5.8	103.2	110.0	130.5	291.5	81.7	70.6			−157.4
(.6)	(1.5)	(1.6)	(1.9)	(4.4)	(1.1)	(1.1)			(4.6)
8.2	20.5	15.5	48.0	74.8					−45.0
(2.2)	(.5)	(.4)	(1.3)	(2.1)					(2.4)
−1.7	29.8	22.8	90.4	224.7					−256.7
(.2)	(.3)	(.3)	(1.0)	(2.6)					(5.6)
5.8	2.9	− 3.5	5.4	24.1			$−9.9	$−63.0	−25.0
(3.3)	(.3)	(.3)	(.4)	(1.6)			(.6)	(6.4)	(3.7)
−.3	19.3	5.1	55.5	30.0			−46.0	−103.3	−22.8
(.1)	(.7)	(.2)	(2.0)	(.9)			(1.9)	(3.4)	(1.5)

TABLE 8-3 ***(continued)***

Single	*Father attended high school*	*Father attended college*	*Biography* Q_2	Q_3	Q_4	Q_5	*Occupation*	$\bar{R}^2/N$
$-108.9	$16.1	$ 6.2	$ 20.8	$ 44.7	$ 55.6	$ 66.7		.12
(2.7)	(1.2)	(.4)	(1.1)	(2.3)	(2.9)	(3.4)	Professional, technical, and sales	238
−259.2	87.6	−83.5	105.4	48.4	39.7	145.0		.21
(2.1)	(1.9)	(1.5)	(1.6)	(.7)	(.6)	(2.2)		728
−144.0	47.2	15.8	− 92.3	−57.7	15.2	16.5		.03
(1.4)	(1.9)	(.5)	(2.4)	(1.5)	(.4)	(.5)	Managers and owners	336
117.6	91.7	157.4	90.6	54.4	203.8	199.7		.05
(.5)	(1.6)	(2.2)	(1.1)	(.6)	(2.4)	(2.3)		1,085
− 74.2	5.6	17.5	8.0	26.5	34.7	43.3		.11
(2.6)	(.6)	(1.2)	(.7)	(2.1)	(2.6)	(3.0)	Blue-collar, white-collar, and service	115
− 98.5	20.5	− 1.8	− 5.8	43.1	30.6	3.0		.04
(1.5)	(.9)	(.1)	(.2)	(1.4)	(1.0)	(.1)		208

mathematical-ability fifths and the top three biography fifths are significant, and their magnitudes do not differ much from those obtained when using all the data. The M.D. and teacher dummies are significant, and their magnitudes are substantial, while the dummy for lawyers is not significantly different from that of Ph.D.'s or high school graduates. This is in line with our earlier profile discussion in which we found that the M.D. profile starts high and is fairly flat, whereas the lawyer profile starts low and climbs faster. These findings suggest that educational differences (including M.D.) have no effect on incomes within the professional occupation, but that differences in mental ability have a substantial effect. (There are enough people at all the education levels to ensure that the result cannot be attributed to small sizes in any of the categories.)

Incomes of technical workers are about $1,200, or 15 percent below incomes of those in the professional or sales occupations. Finally, as far as the background factors are concerned, the single (marital-status) and health variables are significant, while the father's education variables are not. The magnitude of

the single variable is about the same as for the entire sample, but the coefficient of the health variable is only about half as large.

Since census results generally indicate a positive influence of education on earnings within occupations, we must ask whether our results are due to standardizations for ability and background factors, some of which cannot be done with census data. In an equation (not shown) containing only the age, education, and suboccupation dummies as independent variables, none of the five basic education dummies is significant. One possible explanation for the difference between this and census results is that only those in the top half of the IQ scale are considered here, and dummies are included here for M.D.'s and teachers. In addition, census equations usually span a wider age interval.

Equation 2 in Table 8-3 is the corresponding 1969 equation for the professional, technical, and sales occupation, but because of switches in occupation there are now 1,324 people in this group.[11] There are some important qualitative as well as quantitative differences between the 1955 and 1969 results. Perhaps of most interest is the fact that the B.A. and Ph.D. coefficients are highly significant and their magnitudes fairly substantial in 1969. For example, after standardizing for ability and background factors, B.A. holders receive incomes 20 percent above those of the average high school graduate in this occupation, and Ph.D. holders receive earnings about 40 percent higher. In addition, incomes of M.D.'s are well over double, and incomes of LL.B.'s are about double, those of the average high school graduate. The other education coefficients are all positive, but their magnitudes are less than that of B.A. The top two mathematical-ability fifths are again significant, with magnitudes about the same as when all the data are used, but only the top biography fifth is significant. This general pattern of results corresponds to that for the sample as a whole in that educational effects become much more important than ability effects over time. Once again, the sales suboccupation dummy is insignificant, but now the technical suboccupation is also, indicating

[11] We also exclude people with zero income, and this number differs in the two years.

that although technical workers start more slowly their incomes are equal to those of professionals by the age of 47.[12]

Data are available on whether the individual is a self-employed professional in 1969. When a dummy variable for the self-employed is added to equation 2, its coefficient is $630 and it is highly significant, suggesting that the self-employed, other than lawyers and doctors, do substantially better than the non-self-employed.[13] The self-employed lawyers and M.D.'s, in turn, earn higher incomes than other self-employed individuals.[14]

Since data are available on an individual's occupation in 1955, it is possible to test the proposition that individuals who were in the same occupation in 1955 and 1969 earned higher incomes than those who switched into the professional group after 1955. In an equation (not presented here) that includes dummy variables representing the 1955 occupation of the individual, those who were in the professional and technical, sales, and managerial categories in 1955 received over $4,000, $2,000, and $1,500 a year more, respectively, than those in the white-collar, blue-collar, and service group. Hence, experience gained in other occupations is not as useful as in the professional occupation, although sales experience is more valuable than managerial, which in turn is more valuable than "other" occupational background. (The greater impact of sales may be because the group studied in 1969 is professional, technical, and sales.) While the above results are useful for studying the relative importance of specific and general experience, the equations cannot be used directly to examine the effects of education in 1969 (within the occupation), because occupation in 1955 is partially determined by education. Thus, with the introduction of the 1955 occupations, the coefficients on Ph.D. and B.A. are substantially smaller.

MANAGERS AND BUSINESS OWNERS

The results for the 1,000 managers and business owners in the sample in 1955 are presented in equations 3 and 4 in Table 8-3.

[12]As mentioned in Chapter 4, the 1955 and 1969 definitions of the technical occupation may differ, in which case no significance should be placed on the difference between the 1955 and 1969 results.

[13]Since most M.D.'s and some lawyers are self-employed, the M.D. coefficient drops from $904 to $487, the LL.B. coefficient from $584 to $286, and the Ph.D. coefficient from $445 to $428.

[14]As is the case with owners, the earnings of self-employed professionals may include a return on financial capital.

In equation 3, the only significant variables are age, the top fifth of mathematical ability, health, and the second fifth of biography. Again, education coefficients are insignificant and income levels do not differ much from those of high school graduates.[15]

In the 1969 regressions (involving 1,700 people), both the B.A. and M.A. coefficients are significant, but earnings at these levels exceed a high school graduate's earnings by about 15 percent only. Since in this occupation we would not expect differential nonpecuniary rewards to those with master's and undergraduate degrees and since the income in these two education groups is nearly the same, we can conclude that the low rate of return to a master's degree (discussed in Chapter 6) is not attributable to nonpecuniary returns. The other education coefficients are positive, with t values greater than 1, and the overall education pattern is monotonic. The LL.B. dummy is large and significant, indicating that the average income for managers trained as lawyers is about 66 percent higher than that of the average high school graduate in the group, and 50 percent greater than that of those with a B.A. or M.A. The top ability fifth and the top two biography fifths are significant, and each adds to income about the same amount as does possession of a B.A. degree. The father's college variable is significant, and its coefficient is substantially larger than it is in the sample as a whole, a result that may stem from the relative importance of business connections in this occupation.

When dummy variables are included to reflect the 1955 occupations, the magnitudes of the education coefficients are reduced. Those in 1955 occupations other than white-collar, blue-collar, and service do much better in 1969, with the professional group receiving about $4,500, managers $6,500, and sales personnel $5,500 more than those in the blue-collar, white-collar, and service occupations in 1955. Thus, once again, there appears to be more specific training within the occupation, but with people in sales having training that is more readily transferable than that of other outsiders.

Data are available in 1969 to run the regressions separately for owners and managers. For the managerial group, the significant variables are B.A., M.A., Ph.D., LL.B. (as compared with high school), the top ability and biography variables, health, and the

[15]Although the equation is not presented, this result holds also when only the education variables are included.

father's high school and father's college variables. Within the managerial group, education and high ability, along with some type of social connection, are important determinants of earnings.[16]

We present in Appendix L a separate study based on data made available by Lewellen (1968) of earnings of top corporate executives from 1940 to 1963. We find that those with an undergraduate degree earn slightly more than those with graduate training, with both groups earning about 40 to 50 percent more than high school graduates. Since ability is not held constant in these regressions, we reestimated the NBER-TH sample equations without including ability and found that incomes of undergraduate-degree holders and those with graduate work were 30 and 45 percent, respectively, above incomes of high school graduates.[17]

On the other hand, for owners in 1969, only the B.A. and marital-status variables are significant. This is a particularly surprising result, since one would expect skills depending on both education and mental ability to play a major role in determining the success of those who attempt to earn a living on their own.[18] The difference in results between the managerial and owner groups is also surprising, in that one of the roles of an owner is to manage. However, the owner results may be obscured because the income data are "profits," which consist of earnings and return to financial investment, and because one would generally expect capital to be more rapidly available to the more educated, if only because of family wealth. However, our study includes the father's education and biography variables that are intended to reflect this effect, and as noted earlier, people in our sample had access to Veterans Administration loans.

[16] Indeed, those with an M.A. earn about $1,600 a year more than those with a B.A.

[17] These results are surprisingly close in view of the following differences in the data. First, since the Lewellen sample consists only of successful managers, we would expect the effects of education to be underestimated. Second, in Appendix L income is defined as the present discounted value of after-tax compensation, whereas in the NBER-TH sample it is defined as before-tax earnings. From information in Lewellen, it appears that earnings in this occupation understate the return to education for the most successful. Finally, both the time period and average age in the two samples differ, and the results in the Lewellen sample change over time.

[18] Clearly, other types of abilities may be important in determining income, although the other ability factors we tried were not significant.

WHITE-COLLAR, BLUE-COLLAR, AND SERVICE

We have combined the blue-collar, white-collar, and service occupations and have included intercept dummies for the latter two.[19] The Ph.D. and M.A. education dummies are excluded, since only one Ph.D. holder and one M.A. holder are in this broad occupational group. The results for 1955, presented in equation 5, Table 8-3, indicate that the significant ability and education coefficients are the B.A., some-college, and top biography variables, with the magnitude of the education coefficients indicating incomes about 10 percent above the income of the average high school graduate. White-collar workers earn about 25 percent less than blue-collar workers; those in the service trades earn about the same amount. Once again, the health and single variables are significant.

By 1969, there was a substantial drop in the number of people in this broad occupation—from 756 to 497.[20] In the equation for 1969, when all the ability and background factors are included, only the B.A. variable is significant, with a coefficient about 10 percent greater than high school earnings. This coefficient is about one-third as large as it is when all the data are analyzed, indicating that much of the income difference attributable to educational attainment arises from entering other occupations. Neither the mathematical-ability nor biography variables follow the expected monotonic pattern, with the only significant variable being the fourth fifth of the mathematical factor. In general, it appears that mental ability plays no role within this occupational group, and the effect of education is not very large. Further, the variables reflecting the other abilities are not significant determinants of earnings in this group.

In 1969, both the white-collar and service occupations pay significantly less than the blue-collar occupations, with average earnings being about 12 and 5 percent lower, respectively, than that of the average blue-collar worker. We have included dummy variables representing the individual's 1955 occupation. The results, not recorded in Table 8-3, indicate that the 1955 professional occupational experience contributes the most to white-collar earnings in 1969. Those who were professionals in 1955 receive about $800 more per year than those who were

[19]Farm workers were excluded from our study.

[20]However, since the 1969 occupation was that reported by the individual, the response may be affected by status considerations. In 1955 these occupations were assigned on the basis of job descriptions.

white-collar employees. This result differs from the other case studies in that being in a different occupation in 1955 adds more to 1969 income than being in the same one.

COMPARISON WITH THE WOLFLE-SMITH DATA

It is interesting to compare the 1955 results with those obtained using the Wolfle-Smith data, because the two samples are very similar in terms of age and calendar time. In the Wolfle-Smith study, the same occupational groups were used, except that the professional, technical, and sales group was combined with the managerial category. Within this broad occupation, there was no noticeable effect of education on income, but mental ability played an important role. This result is remarkably similar to the one we obtain for our professional, technical, and sales group, in which no education variable is significant but the top two mathematical fifths and the top three biography fifths are significant. Again, in our 1955 managerial equation, no education variables are significant, but in this case only the top mathematical-ability fifth is significant. In the other broad occupation group in the Wolfle-Smith study, neither the education nor the ability variables are related to income.

In summary, the results for the two sets of data are very similar qualitatively, thus lending support to our earlier conclusions. It is important to recall, however, that these results are valid only for individuals about 33 years of age. Analysis of NBER-TH data suggests that even within occupations the effects of education are much more important for individuals aged 45 to 50.