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Over-Education in the Labor Market

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"OVER-EDUCATION" IN THE LABOR MARKET

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I. INTRODUCTION

An interesting and somehow puzzling observation is that a large number of workers report a discrepancy between their own level of schooling and that which is required by their job¹. The objective of this paper is to provide explanations of this phenomenon, and to see to what extent they can be supported empirically. By doing this we hope to get a better insight into the relations among schooling, the pattern of wages, and workers mobility across firms and occupations.

The first question asked is whether the discrepancy between the actual and the required years of schooling affect the individual's returns to his schooling. After establishing these relations, we will provide two major explanations for observing differences between required and actual levels of schooling, and examine their empirical implications.

The first is given by taking into account other components of the level

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¹ There are few possibilities to define "required schooling". One option is "the average amount of schooling employers require the average workers who enter the job". By this definition different workers (with different levels of market experience for example) might face different required levels of schooling for similar jobs. Another way is to treat "required" as a minimum necessary condition. A discrepancy might also exist between the required and "needed" amount of schooling. In this work required schooling is measured based on workers' self report. What exactly it measures and to what extent it is subjective depends on the respondent interpretation of the word "required". Rumberger (1987) used an additional measure based on the Dictionary of Occupational Titles, which he refers to as an objective measure.

of human capital such as on-the-job training: Workers might qualify for similar jobs by having different level of schooling but similar levels of total human capital.

Since human capital theory is a life cycle theory, one must also ask whether the discrepancy between required and observed levels of schooling is a long run phenomenon or whether it is observed only at certain stages of the life cycle. Predictions can be made and tested with respect to occupational and firm mobility of workers who are observed having more (less) years of schooling than their job requires.

The paper proceeds as follow: In Section II we describe the data set and report some descriptive statistics. In Section III we focus on the schooling effect on wages and estimate wage regressions by separating the individual level of schooling into that which is required by his job and that which is above or below it. In Section IV we provide the theory and report the empirical results. In Section V a note is made concerning differences in quality among workers. Section VI summarizes the paper.

II. THE DATA SET, DEFINITIONS, AND DESCRIPTIVE STATISTICS.

The data set used for the analysis is the Panel Study of Income Dynamics (PSID), of males age 18-60, over the years 1976-1981. Some of the cross section analysis is based only on the years 1976 and 1978.

In the 1976 and 1978 waves of the PSID, the following question was asked "How much formal education is required to get a job like yours?" The answers were bracketed into 8 classes: 0-5, 6-8, 9-11, 12, 13-15, 16, 17 ².

²We translated the answer "College, no degree necessary; associate degree" to 13-15, "College Degree, BA or BS" to 16, and "College, advance or professional degree" to 17.

Individuals are defined as over/under educated if their reported years of schooling lie outside the reported bracket of their required schooling³. When defining the number of over/under years of schooling, two alternatives were used. The first was to take the difference between actual schooling and the years of schooling in which most of those within the bracket reported as their actual schooling (4, 8, 10, and 14). The second alternative was to take the difference between the actual years of schooling and the "boundaries" of the brackets. Both alternatives were tried at each step of the analysis, and only when the differences were significant both results were reported. In most of the analysis we use the first alternative because under this specification the sum of required schooling and over schooling equals actual schooling⁴.

In Table 1 the sample is separated into three groups: Those with over schooling, those with under schooling and those with required schooling. It can be seen that around 40 percent of the workers in the sample report themselves as over educated and 16 percent report themselves as under educated⁵.

³No qualitative statement should be inferred by the use of such terms. Whether the terms "over" or "under" educated are meaningful is a central issue in this paper.

⁴But when constructing a dummy variable, workers were considered as over/under educated if their reported schooling was not within the interval of required schooling.

⁵If "required" means a necessary condition, it is reasonable to argue that it is impossible to observe workers with less schooling than required. Therefore it must be that another interpretation was used. One possibility is that workers understood it as the "average required" level of schooling. Another possibility is that workers referred to the required level of schooling at the time of the survey, which might differ from that at the time they entered the job. Both explanation are consistent with our findings.

TABLE 1
 SAMPLE MEANS OF SELECTED VARIABLES
 PSID (1976, 1978), Males, Age 18-60

SAMPLE:	With Over Schooling	With Under Schooling	With required Schooling
	(A)	(B)	(C)
Years of over/under schooling	4.15/4.73	2.49/2.72*	
Reported Training	1.42	2.18	1.64
Wage growth	0.0376	0.0234	0.0276
Experience	14.0408	22.0191	15.0857
Tenure	5.9697	11.1425	7.6912
Schooling	12.5870	10.2707	12.3979
Union	0.3191	0.3582	0.3232
Race (1=Blacks)	0.3352	0.2985	0.2758
City	0.2951	0.3283	0.3291
Married	0.8420	0.8912	0.8801
Disabled	0.0585	0.0852	0.0599
Changed firm	0.1595	0.0938	0.1094
Changed occupation	0.3408	0.2814	0.2707
# of observations	2110	830	2230
(percentage)	(.408)	(.160)	(.431)

* Both alternative measures.

As can be seen in Table 1 (before a control for other variables is made), over educated workers are relatively young (low mean of market experience), while under educated workers are much older. The differences in the mean levels of tenure suggest that the over educated are more likely to change firms, while the under educated stay much longer in the same firm⁶. Black workers are much more likely to be found in jobs which required

⁶The reduction in the incidence of overeducation with tenure can also be the result of intra-firm mobility into positions which require the actual level of schooling. This possibility will be analyzed in detail later on.

lower levels of schooling than they have⁷. Over educated workers report higher rates of firm and occupational mobility than the other two groups, while under educated workers have lower rates of firm mobility but their rates of occupational mobility are higher than those with required schooling⁸. All these observations will be analyzed in detail later on with a control for other observed variables.

III. THE RETURNS TO OVER/UNDER SCHOOLING.

In this section we test the hypothesis that the return to years of schooling which deviate from those required by the job differ from the return to required years of schooling. For that purpose two equations are estimated. The first is given in (1) and is similar to the approach taken by other authors who attempted to investigate the effects of "surplus"/"over" schooling on wages⁹.

Consider the following wage regression:

$$\ln(W_{it}) = X_{it}\beta + \alpha E^r_{it} + \tau E^o_{it} + \delta E^u_{it} + \epsilon_{it} \quad (1)$$

where total schooling (E) is decomposed to that required by the job (E^r) and

⁷Duncan and Hoffman (1981) report that 48.5 percent of black men have completed levels of schooling which exceed that which is required, as opposed to 41.7 among white men (using the 1976 wave of the PSID). Rumberger (1981) also reports higher incidence of overeducation among blacks. His analysis shows that over the period 1960-76 the gap has narrowed as a result of a reduction (increase) in the rate of overeducation among blacks (whites).

⁸Mean levels of tenure are more informative than (yearly) rates of firm separation in reflecting the long run rate of firm mobility. Unfortunately the PSID does not report tenure in occupation.

⁹See Duncan and Hoffman (1981), Rumberger (1987), and Hartog (1986).

that which exceeds/falls below the required schooling (E^o and E^u).

$$E = E^r + E^o - E^u \quad (2)$$

Under this specification, one should be careful in interpreting the coefficients correctly:

τ = The return to an additional year of schooling which exceeds the job requirement, relative to co-workers (workers with the same required schooling who have the required level of schooling).

$\tau - \alpha$ = The return to an additional year of schooling which exceeds the job requirement, relative to workers with the same level of schooling who have the required schooling on the job.

δ = The loss of wage due to a year of under schooling, relative to co-workers (with the same required schooling).

$\alpha + \delta$ = The wage difference between workers who work in jobs which require an additional year of schooling (than they have) and workers who have the same level of schooling but work in jobs which require that level of schooling.

In column (b) of Tables 2 and 3 the estimation results of equation 1 are reported and the following observations can be made:

The returns to years of schooling which are above what is needed for the job are lower, although positive. This means that workers who are working in occupations which demand less schooling than they actually have (over-educated), get higher wages than their co-workers (holding other characteristics constant), but lower than workers with similar levels of schooling, working in jobs where their schooling equals that which is required.

Workers who work in jobs which require more schooling than they have

(under-educated), receive lower wages than their co-workers, but get more than workers with the same level of schooling, working in jobs which require their level of schooling¹⁰.

If one is interested in comparing the over/under educated workers to those who are similar in all other observed characteristics (including schooling), but work in jobs that require the level of schooling they actually have, the following equation provides a more appropriate and direct comparison:

$$\ln(W_{it}) = X_{it}\beta' + \alpha'(OVER)_{it} + \tau'(UNDER)_{it} + \epsilon'_{it} \quad (3)$$

where:

$$OVER \begin{cases} =-1 \text{ if over educated.} \\ =0 \text{ if has the required or under schooling.} \end{cases}$$

$$UNDER \begin{cases} =-1 \text{ if under educated.} \\ =0 \text{ if has the required or over schooling.} \end{cases}$$

In Table 4 the estimation results of equation (3) are reported. The results show that on average, the wage of workers who report higher levels of schooling than required by their job is around 5 percent lower. Workers with less schooling than required have a wage rate which exceeds by 9 percent that of similar workers, with the same level of schooling, who work in jobs which require the level of schooling they actually have.

All other studies that we are aware of, which came up with similar findings¹¹, did not provide satisfactory or testable explanations of the

¹⁰ -.017 and (.048-.017) in Table 2 columns (b).

¹¹where the emphasis in most of the cases was on "over education" only.

findings. Some authors argue that the findings can be explained by differences in quality among different workers. This might be true, but hard to verify empirically. Another argument is that such findings support the hypothesis that the increase in educational attainment in the United States created a pool of "over-educated" and "under-utilized" workers¹². A third type of arguments found in the literature is that such findings challenge the validity of human capital theory in explaining the relations between wages and education¹³.

In the next section we provide some testable theories which explain why we are likely to observe workers at different stages in their working career, working in jobs that require levels of schooling that are below or above theirs.

IV. HUMAN CAPITAL THEORY AND OVER/UNDER SCHOOLING.

A. THE TOTAL LEVEL OF HUMAN CAPITAL

Workers acquire their desired level of human capital through different channels of investment which, to some degree, might serve as substitutes for each other. Therefore, workers who work in jobs that require less schooling than they have, are likely to be less experienced and have invested less in

¹²See for example Freeman (1976). In his book, the definition of over-education is based on changes in the returns to schooling over time ("A society in which reductions in the supply of new graduates restores much of the traditional economic advantage enjoyed by graduates but where moderate increases in supply could not be "absorbed" without substantial declines in relative incomes and job position").

¹³For more details, see the Summary section.

on-the-job training¹⁴. Since schooling is more likely to provide such workers with more general human capital than other forms of investment, such workers might be less attached to the firm or occupation in which they are employed. The result will be higher firm and occupational rates of mobility.

Workers who have lower levels of schooling than required by the job are expected to be more experienced and to have obtained higher levels of training. For the reasons mentioned above, it is predicted that such workers will be less likely to change firm or occupation.

Empirical Results:

As already been shown in Table 1, over educated workers are younger, have lower amounts of training and higher rates of firm and occupational mobility. In Table 5 the partial correlations between over/under schooling and other variables are reported¹⁵. The results suggest that after controlling for different observed characteristics, over educated workers have significantly lesser amounts of training (RQT¹⁶), while under educated workers report significantly greater amounts of on-the-job training. The results also support the prediction that the over educated are the relatively young and inexperienced workers while under educated workers are the older and more experience workers (see Table 5, columns (e)-(h)).

The negative partial correlation between tenure and over-education

¹⁴Rumberger, Levin, and Tsang (1986) report that women are more likely to be "overeducated" than men. This observation is consistent both with their having less job training and the less market oriented content of their education. See Lillard and Tan (1986) and Paglin and Rufolo (1986) respectively for empirical evidence.

¹⁵In columns (a) and (b) the dependent variables are the years of over/under education, while in columns (c) and (d) the dependent variables are dummy variables (whether over/under educated).

¹⁶Years of training needed to qualify them in their present job.

supports the hypothesis that workers with over education are more likely to leave the firm (or to change to a position in which they are not over-educated). This result is also supported by the estimation results of a firm mobility model reported in column (a) of Table 6. Over educated workers have a higher probability of changing firms than other workers. The same results are shown when an occupational mobility model is estimated (column (b)).

Looking at under-educated workers, the firm and occupational mobility models presented in Table 6 indicate that relative to workers with required level of schooling, the under-educated have higher rates of firm and occupational mobility. The coefficients are much lower in magnitude (and level of significance) relative to over-educated workers. When estimating the partial correlation between under-education and tenure with the firm (Table 5), it is shown that after controlling for different variables, including market experience, under-educated workers seem to have similar years of firm tenure to those with required schooling.

B. OVER/UNDER SCHOOLING AND LABOR MOBILITY

1. Matching

A possible reason to observe workers with characteristics which differ from those required by the job is a mismatch between the worker and the job. In such a case it is likely that eventually the worker will change his job, that is his occupation, firm or both¹⁷.

¹⁷In some studies it has been argued that "overeducation" results in dissatisfaction, hence reduces productivity, as well as higher rates of absenteeism, poor health, low energy, and turnover (see, for example Rumberger (1981, Chapter 5), Tsang and Levin (1985)). Although the effects on turnover are consistent with the findings of this work, these studies miss the fact that turnover is more likely to be upward, as will be shown later on. In addition, the cause and effect may be reversed, i.e. those with

Matching theory predicts not only that wages are relatively lower as a result of a bad match, but some information is gained by the worker, which will result in higher wages in the next job. Therefore, wage growth is expected to follow worker mobility.

Empirical Results: The estimation results of the separation models (both firm and occupational mobility) reported in Table 6, confirm the hypothesis that workers with years of schooling which deviate from those required on the job, have higher probabilities of changing both their occupation and the firm.

As far as under educated workers are concerned, it has already been pointed out that their tendency to change firm or occupation is much lower than that of over-educated workers. We have also shown that the partial correlation between tenure and being under-educated is not significantly different from zero. These differences can be understood in light of the observation made earlier, namely, that under-educated have more on-the-job training than other workers, and for that reason are less likely to move.

The estimation results of the wage growth regressions reported in Table 7 show that only over-educated workers, in their first years in the labor force, have on average steeper wage profiles than other workers (holding a set of observed characteristics constant)¹⁸. In Table 8 the results of wage growth regressions, estimated separately for the three groups, are reported. There (see the last two rows) it is shown that over educated workers have higher wage growth if they change occupation (but not if they change firm).

poor health, low energy and satisfaction work at inferior jobs, rather than the other way around (see section V. for a note concerning quality differences).

¹⁸The wage growth is estimated between t and $t-1$. The distinction between over/under educated is made based on the report in t .

They have a greater gain from occupational mobility than from on the job. Under educated workers, on the other hand, have a greater wage growth when they change firm (but not if they change occupation). They move to firms where their training provides greater payoff¹⁹.

These differences are not fully accounted for by the theoretical predictions made so far. In the next section some further prediction concerning wage growth will be made.

2. Career Mobility

An individual working career might involve, at some stages, changes in the type of tasks performed at work. If the tasks performed at different stages are different enough to fall under different occupational titles, an event of occupational mobility will be observed²⁰. To distinguish this type of mobility from other types of occupational mobility, we define such a mobility as "career mobility"²¹.

Different workers will have different careers, but at some stages of the life cycle it is possible that different careers will intersect. As a result, it will be possible to observe workers with different levels of human capital, working (for a limited period) in the same occupation and

¹⁹See Rosen (1972) for a model which shows how, under certain conditions, the optimal path of investment is such that learning takes place in one firm, while the payoff is provided in another.

²⁰Whether we observe such a mobility or not will depend on the occupational categories and the level of aggregation used. The assumption is that the occupational categories used are such that only when there is an "apparent" change in the tasks performed, an occupational change will be observed. The empirical analysis is based on a 2 digit occupational classification (25 categories).

²¹In order to identify such a mobility empirically, we define "career mobility" as a mobility to a higher level occupation. The vertical ranking used here is developed in Sicherman (1987). See Appendix 2 for a formal definition.

getting similar wages (at least not as different as one might predict from the differences in the levels of human capital). One example will be two careers which have the same "port of entry" (police officer for example). At that stage, workers with different levels of human capital (high school graduate and college graduate) will have similar wage profile. But while the less educated will stay in the occupation, the more educated will be more likely to be promoted (become a sergeant), or leave the organization to another higher level occupation (private detective)²².

It can be easily seen that to observe a worker working in a job where the schooling requirements are lower than his actual level of schooling is consistent and even implied by such a model of career mobility. In the following we list some of the empirical implications and test them using the PSID.

The first implication is that workers who work in jobs which require less schooling than they have are more likely to move to a higher level occupation and a higher wage level.

Empirical Results: In Table 6, the total occupational mobility is decomposed to that which is to a higher level occupation and that which is to a lower level occupation. The results indicate that over educated workers are more likely to move to a higher level occupation than to a lower one.

Another indication for the existence of a career mobility among the over-educated workers is the result discussed earlier, namely, that the channel by which over-educated workers obtain the highest wage growth is through occupational mobility.

²²For a formal presentation of the model described in this section see Sicherman (1987).

Not all career paths involve occupational mobility. Investment in human capital, and a subsequent increase in wages over the life cycle do not necessarily involve an occupational change. Whether we observe an occupational change or not is a function of both the type of career involved and the occupational categories we use. In this analysis we use 25 occupational categories, and our assumption is that using those categories, an occupational change will be observed when there is an apparent change in the tasks performed by the worker. While some occupations provide the better workers with skills which will enable them to move to a higher level occupation, in other careers workers with more human capital will be more productive in the same occupation. The empirical implication is that in those occupations where the schooling effect on wages is lower, the schooling effect on the probability of moving to a higher level occupation is greater.

Empirical Results:

Consider the following fixed effect models:

$$Y_{ijt} = X_{ijt}\beta_1 + \tau_j ED_i + \delta_j + \epsilon_{ijt} \quad (4)$$

where:

$$Y_{ijt} \begin{cases} = 1 & \text{if the worker moved "up" between two surveys.} \\ = 0 & \text{otherwise.} \end{cases}$$

$$\ln(W_{ijt}) = X_{ijt}\beta_2 + \alpha_j ED_i + \mu_j + \epsilon'_{ijt} \quad (5)$$

Equation (4) is the career mobility equation, where the schooling effect (τ_j) is occupation specific (obtained by interacting schooling and

occupational dummies). Equation (5) is a wage equation where the occupational specific schooling effect is given by α_j . In both equations we assume occupational fixed effects, which are estimated by using dummy variables (δ_j and μ_j).

The following is implied by our hypothesis and will be tested empirically:

$$\text{Corr}(\alpha_j, \tau_j) < 0 \quad (3)$$

Estimates of α_j and δ_j are presented in Table 8.

The estimated correlation between the effect of schooling on wage in the occupation and its effect on the probability of moving to a higher level occupation is $-.39$ (with $.95$ level of confidence²³).

V. QUALITY DIFFERENCES, A NOTE.

As was mentioned in the introduction to this paper, the discrepancy between actual and required schooling and the observed wage differentials could also be explained by quality differences among the different groups. Over educated workers have lower quality of schooling and/or general ability, both unobserved in the data. The opposite is true for under educated workers.

Although this argument could be correct, it cannot be tested empirically as long as there is no data available concerning workers' ability and their schooling quality. The results reported in this paper might be consistent with the quality argument as a partial explanation, but reject the hypothesis that such an argument is dominant.

²³The probability that the real correlation is indeed different from zero.

VI. SUMMARY AND CONCLUSIONS

The notion of "over-education" has been discussed in the social science literature both on theoretical grounds and as an empirical observation.

Several theories challenged the validity of Human Capital theory (Becker 1964; Mincer 1974) in explaining the relations between wages and education. Occasionally, the observed discrepancy between workers' level of schooling and (a measure of) that which is required by the job, was brought as a support to such a challenge.

One implication of the "Screening Hypothesis" (Spence [1973]) is that a discrepancy occurs between the worker's level of schooling and that which is needed on the job ("needed" and not necessarily "required"). To what extent such a discrepancy represents an "over-education" is subject to empirical investigation and will depend on the efficiency of schooling as a screening device, as well as the private and social returns to schooling.

The "Job Competition" model (Thurow [1975]) suggests that individuals are allocated to available jobs based on their education, as well as other characteristics. These characteristics allow employers to estimate the costs of providing the workers with the skills needed on the job. Since allocation is based on available supplies of both workers and jobs, a discrepancy between workers' schooling and that which is required by the job might result.

A similar approach is taken by the "Assignment" literature (Tinbergen [1956]). There the problem is presented as an allocation problem, where workers differing in ability are allocated to jobs with different levels of difficulty or complexity.

The increase in college attainment in the United States (of the "baby

boom" generation), and the resulting reduction in the returns to schooling, revived the notion of over-education²⁴. There the question is how fast can the market (both demand and supply) adjust to such a situation and what are the policy implications in order to restore equilibrium.

The objective of this paper was to provide an explanation for the discrepancy between workers' level of schooling and that which is required by their job, and to see to what extent it can be supported empirically.

Using standard human capital theory, we provide two basic explanations for this discrepancy: First, a trade off might exist between schooling and other forms of human capital. Therefore, workers might qualify for similar jobs by having different levels of schooling but similar levels of total human capital. Second, such a discrepancy might be the result of a mismatch between the worker and the job, or a temporary stage of his career where skills acquired in a lower level job will be useful later on in a different job.

Based on these explanations, some empirical implications are made and tested. The major findings of the paper are:

1. Workers who are working in occupations which demand less schooling than they actually have (over-educated) get higher wages than their co-workers (holding other characteristics constant), but lower than workers with similar levels of schooling who are working in jobs where their schooling equals that which is required.

Workers who work in jobs which require more schooling than they have (under-educated), receive lower wages than their co-workers, but get more than workers with the same level of schooling, working in jobs which require

²⁴See, for example, Freeman (1976).

their level of schooling.

2. Over educated workers are younger and report lower amounts of training.

Under educated workers report significantly higher amounts of on-the-job training and are older. These results support the prediction that the over educated are the relatively young and inexperienced workers while under educated workers are the older and more experience workers.

3. (a) Over educated workers have higher rates of firm and occupational mobility than other workers with similar characteristics.

(b) They are more likely to move to a higher level occupation.

4. Over-educated workers experience a greater wage growth when changing occupation. Under-educated workers are observed having steeper wage profiles than other workers in the first ten years in the labor market. They have steeper wage profiles when they change firm (but not when they change occupation).

These observations support the hypothesis that a discrepancy between workers' schooling and the level of schooling required on the job are the result of a mismatch and movement along a career path. The quality hypothesis is rejected as a dominant explanation for the discrepancy.

TABLE 2
WAGE REGRESSIONS

SAMPLE:	All workers		with "required"	with "over"	with "under"
	(a)	(b)	(c)	(d)	(e)
INTERCEPT	0.688849 (13.724)	0.541488 (10.022)	0.559048 (7.3686)	0.603484 (6.6261)	0.596113 (5.3399)
EXPERIENCE	0.015999 (6.9195)	0.016546 (7.2221)	0.012535 (3.6759)	0.015195 (3.6909)	0.030885 (5.9518)
EXPERIENCE ²	-0.000280 (4.9168)	-0.000306 (5.4104)	-0.000145 (1.6852)	-0.000339 (3.2187)	-0.000581 (5.0659)
TENURE	0.018668 (7.4345)	0.018505 (7.4323)	0.022175 (6.1407)	0.022187 (4.8610)	0.007963 (1.5038)
TENURE ²	-0.000395 (4.5730)	-0.000403 (4.7079)	-0.000558 (4.4874)	-0.000584 (3.4055)	-0.000039 (0.2338)
SCHOOLING	0.038398 (14.092)		0.050924 (11.888)	0.038274 (7.8638)	0.045738 (7.0401)
REQUIRED SCHOOLING		0.048462 (16.115)			
"OVER" SCHOOLING		0.039013 (11.184)			
"UNDER" SCHOOLING		-0.016835 (3.3797)			
UNION	0.179433 (13.802)	0.174886 (13.572)	0.150639 (8.1129)	0.225814 (10.058)	0.139222 (4.7995)
RACE (1=BLACK)	-0.132545 (9.6171)	-0.130288 (9.5443)	-0.120256 (5.9579)	-0.145440 (6.3453)	-0.134007 (4.2565)
SMSA	0.129569 (10.254)	0.123942 (9.8898)	0.114548 (6.3687)	0.140579 (6.4872)	0.113773 (3.9509)
MARRIED	0.015133 (0.9089)	0.010088 (0.6115)	0.000515 (0.0211)	0.028268 (1.0881)	-0.047107 (1.0174)
DISABLED	-0.044676 (1.9286)	-0.047867 (2.0872)	-0.051303 (1.4893)	-0.049414 (1.1911)	-0.033027 (0.7537)
RQT	0.002798 (11.262)	0.002613 (10.567)	0.002753 (7.2989)	0.003434 (7.2691)	0.001844 (4.1083)
OCCUPATIONAL DUMMY: MANAGERS, NOT S.E.	0.021369 (0.9072)	0.042585 (1.8143)	0.014105 (0.4447)	0.054273 (1.2421)	0.058813 (1.1012)
SELF-EMPL. BUSINESSMEN	-0.186020 (3.2818)	-0.144956 (2.5702)	-0.162056 (1.8244)	-0.324997 (3.3947)	0.141526 (1.2902)
CLERICAL AND SALES	-0.165714 (6.8619)	-0.134337 (5.5455)	-0.170416 (4.9197)	-0.122617 (2.8919)	-0.064741 (1.1749)
CRAFTSMEN/FOREMEN	-0.120164 (5.5883)	-0.072672 (3.2918)	-0.103535 (3.3856)	-0.094471 (2.3571)	-0.028369 (0.6159)
OPERATIVES	-0.208469 (9.0202)	-0.153104 (6.4084)	-0.204942 (6.1857)	-0.143436 (3.4243)	-0.111854 (2.1228)
LABORERS & SERVICE	-0.338118 (12.952)	-0.272346 (10.046)	-0.294149 (7.4143)	-0.289798 (6.3846)	-0.223952 (3.6228)
FARMERS & FARM MANAGERS	-0.579586 (5.1442)	-0.531547 (4.7580)	-0.583798 (3.3784)	-0.572094 (3.3445)	-0.364521 (1.2538)
ARMY	-0.298139 (6.5829)	-0.256178 (5.6766)	-0.256638 (4.1026)	-0.284119 (3.7807)	-0.208401 (1.5260)
R ²	.4797	.4905	.5228	.4514	.5050
# of obs	3133	3133	1369	1253	511

TABLE 3
WAGE REGRESSIONS
(No control for tenure)

SAMPLE:	All workers		with "required"	with "over"	with "under"
	(a)	(b)	(c)	(d)	(e)
INTERCEPT	0.711154 (13.998)	0.562206 (10.287)	0.584366 (7.6449)	0.618161 (6.7153)	0.627218 (5.5756)
EXPERIENCE	0.022922 (10.758)	0.023386 (11.067)	0.022062 (7.2418)	0.023398 (6.0736)	0.033113 (6.7370)
EXPERIENCE ²	-0.000350 (6.5863)	-0.000379 (7.1620)	-0.000287 (3.7027)	-0.000470 (4.6375)	-0.000542 (4.9212)
SCHOOLING	0.037994 (13.761)		0.050508 (11.708)	0.038107 (7.7437)	0.044972 (6.8522)
REQUIRED SCHOOLING		0.048246 (15.847)			
"OVER" SCHOOLING		0.037713 (10.688)			
"UNDER" SCHOOLING		-0.016965 (3.3644)			
UNION	0.197918 (15.203)	0.192369 (14.910)	0.169504 (9.1183)	0.246196 (10.997)	0.153482 (5.2838)
RACE (1=BLACK)	-0.129439 (9.2820)	-0.126855 (9.1900)	-0.119270 (5.8258)	-0.130307 (5.6659)	-0.147362 (4.6591)
SMSA	0.126255 (9.8641)	0.120320 (9.4844)	0.114046 (6.2461)	0.135085 (6.1716)	0.109837 (3.7770)
MARRIED	0.016846 (0.9985)	0.011394 (0.6818)	-0.005346 (0.2160)	0.035215 (1.3422)	-0.052471 (1.1227)
DISABLED	-0.053676 (2.2892)	-0.056864 (2.4510)	-0.056661 (1.6202)	-0.065174 (1.5580)	-0.031345 (0.7098)
RQT*	0.002881 (11.446)	0.002690 (10.747)	0.002823 (7.3711)	0.003463 (7.2528)	0.001859 (4.1214)
OCCUPATIONAL DUMMY: MANAGERS, NOT S.E.	0.004332 (0.1820)	0.027087 (1.1425)	-0.005992 (0.1871)	0.043816 (0.9928)	0.031231 (0.5844)
SELF-EMPL. BUSINESSMEN	-0.224025 (3.9101)	-0.179166 (3.1435)	-0.210161 (2.3376)	-0.337186 (3.4875)	0.112376 (1.0209)
CLERICAL AND SALES	-0.178574 (7.3097)	-0.145430 (5.9362)	-0.189618 (5.4182)	-0.138118 (3.2302)	-0.063623 (1.1419)
CRAFTSMEN/FOREMEN	-0.142648 (6.5877)	-0.092482 (4.1564)	-0.126588 (4.1147)	-0.116767 (2.9022)	-0.049383 (1.0683)
OPERATIVES	-0.230509 (9.8941)	-0.171960 (7.1340)	-0.227041 (6.7934)	-0.168013 (3.9936)	-0.121854 (2.2894)
LABORERS & SERVICE	-0.374253 (14.307)	-0.304100 (11.168)	-0.325331 (8.1382)	-0.328785 (7.2694)	-0.263033 (4.2794)
FARMERS & FARM MANAGERS	-0.571480 (5.0055)	-0.520332 (4.5990)	-0.542200 (3.0926)	-0.559844 (3.2372)	-0.389915 (1.3269)
ARMY	-0.276943 (6.0419)	-0.233829 (5.1232)	-0.227080 (3.5851)	-0.270478 (3.5656)	-0.158474 (1.1532)
R ²					
# of obs	3133	3133	1369	1253	511

* Years of training needed to be qualified for the job.

TABLE 4
WAGE REGRESSIONS
PSID, Males, 1976, 1978

Obs: 3133

	(a)	(b)	(c)	(d)
INTERCEPT	0.601583 (11.437)	0.603155 (11.670)	0.624781 (11.735)	0.625285 (11.959)
EXPERIENCE	0.017759 (7.6235)	0.016017 (6.9788)	0.025099 (11.714)	0.022926 (10.846)
EXPERIENCE ²	-0.000309 (5.3878)	-0.000285 (5.0385)	-0.000389 (7.2594)	-0.000358 (6.7881)
TENURE	0.019578 (7.7095)	0.018623 (7.4578)		
TENURE ²	-0.000431 (4.9386)	-0.000405 (4.7253)		
SCHOOLING	0.049204 (16.976)	0.045184 (15.725)	0.049130 (16.728)	0.044994 (15.464)
"OVER" SCHOOLING (1=YES. 0=NO)	-0.054448 (4.2591)	-0.053707 (4.2753)	-0.062719 (4.8519)	-0.061618 (4.8538)
"UNDER" SCHOOLING (1=YES. 0=NO)	0.092203 (5.3053)	0.071660 (4.1692)	0.087466 (4.9708)	0.066547 (3.8272)
UNION	0.170101 (12.956)	0.175976 (13.627)	0.188283 (14.310)	0.193615 (14.974)
RACE (1=BLACK)	-0.144454 (10.423)	-0.128992 (9.4177)	-0.141091 (10.058)	-0.125357 (9.0503)
SMSA	0.127217 (9.9518)	0.124072 (9.8744)	0.123655 (9.5479)	0.120579 (9.4787)
MARRIED	0.017462 (1.0384)	0.010689 (0.6463)	0.019162 (1.1243)	0.012084 (0.7214)
DISABLED	-0.048345 (2.0659)	-0.047849 (2.0807)	-0.057690 (2.4349)	-0.056721 (2.4379)
RQT		0.031527 (10.577)		0.032525 (10.779)
OCCUPATIONAL DUMMY: MANAGERS, NOT S.E.	0.036370 (1.5250)	0.032938 (1.4054)	0.019657 (0.8155)	0.016869 (0.7127)
SELF-EMPL. BUSINESSMEN	-0.172129 (3.0006)	-0.161264 (2.8603)	-0.209447 (3.6108)	-0.196605 (3.4508)
CLERICAL AND SALES	-0.183201 (7.5341)	-0.145285 (6.0130)	-0.196276 (7.9786)	-0.156544 (6.4060)
CRAFTSMEN/FOREMEN	-0.095427 (4.3227)	-0.092823 (4.2787)	-0.117049 (5.2599)	-0.113426 (5.1899)
OPERATIVES	-0.215196 (9.1245)	-0.172311 (7.3239)	-0.236976 (9.9629)	-0.191769 (8.0809)
LABORERS & SERVICE	-0.333552 (12.417)	-0.294804 (11.062)	-0.368874 (13.684)	-0.327453 (12.242)
FARMERS & FARM MANAGERS	-0.575672 (5.0550)	-0.542654 (4.8473)	-0.565573 (4.9000)	-0.532088 (4.6926)
ARMY	-0.280632 (6.1130)	-0.270784 (6.0014)	-0.257741 (5.5470)	-0.248597 (5.4473)
R ²	.4694	.4879	.4545	.4741

TABLE 5
WHO REPORTS OVER/UNDER SCHOOLING?

Dep' variable:	years of over educ.	years of under ed.	if over educ.	if under educ.	years of over educ.	years of under ed.	if over educ'	if under educ'
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
INTERCEPT	-0.494017 (0.9061)	4.261890 (21.805)	0.217299 (2.4257)	0.293161 (4.5771)	2.15653 (7.504)	1.57097 (17.647)	0.21610 (4.666)	0.415196 (13.130)
EXPERIENCE	0.002544 (0.4065)	0.010169 (4.5334)	0.000591 (0.5752)	0.004076 (5.5451)	-0.024194 (-5.222)	0.014325 (9.929)	-0.002616 (-3.504)	0.004311 (8.457)
TENURE	-0.098504 (5.2608)	-0.005742 (0.8555)	-0.013710 (4.4565)	-0.000488 (0.2222)				
TENURE ²	0.002238 (3.5572)	0.000523 (2.3201)	0.000282 (2.7320)	0.000063 (0.8529)				
SCHOOLING	0.545580 (6.4782)	-0.552237 (18.292)	0.021367 (1.5442)	-0.006151 (0.6218)	0.065773 (3.569)	-0.123006 (-21.50)	0.027792 (9.359)	-0.030609 (-15.09)
SCHOOLING ²	-0.020220 (5.6909)	0.016585 (13.021)	0.000442 (0.7578)	-0.001226 (2.9371)				
UNION	-0.170660 (1.5672)	0.013818 (0.3540)	-0.007773 (0.4345)	-0.004845 (0.3788)	-0.113186 (-1.109)	-0.018290 (-0.571)	-0.009090 (-0.553)	-0.003612 (-0.322)
RACE (1=BLACK)	0.359513 (3.0573)	-0.079364 (1.8828)	0.074716 (3.8672)	-0.020959 (1.5172)	0.421522 (3.800)	-0.074377 (-2.134)	0.092652 (5.183)	-0.033554 (-2.749)
SMSA	-0.478629 (4.5345)	0.101245 (2.6758)	-0.063367 (3.6539)	0.044023 (3.5504)	-0.423466 (-4.184)	0.078438 (2.462)	-0.062868 (-3.854)	0.038949 (3.587)
MARRIED	-0.454476 (3.2613)	0.064067 (1.2825)	-0.052355 (2.2867)	0.023788 (1.4531)	-0.370807 (-2.853)	-0.011742 (-0.289)	-0.056823 (-2.713)	0.000283 (0.020)
DISABLED	0.159173 (0.8489)	0.031309 (0.4658)	0.021862 (0.7096)	0.032008 (1.4531)	0.367694 (2.028)	0.012396 (0.219)	0.052105 (1.784)	-0.008226 (-0.412)
RQT	-0.084287 (3.7825)	0.050139 (6.2768)	-0.018785 (5.1309)	0.020909 (7.9876)	-0.107565 (-4.966)	0.050286 (7.355)	-0.021559 (-6.176)	0.020089 (8.429)
R ²	.0502	.2628	.0561	.1254	.0319	.1565	.0453	.1057

of obs: 3838

TABLE 6

FIRM AND OCCUPATIONAL MOBILITY OF WORKERS WITH OVER/UNDER SCHOOLING
O.L.S. REGRESSIONS ESTIMATES

Dep' variable	Changed Firm	Changed occupation	Moved* "up"	Moved* "down"
	(a)	(b)	(c)	(d)
INTERCEPT	0.472473 (0.0330)	0.573217 (0.0422)	0.324107 (0.0335)	0.249110 (0.0326)
SCHOOLING	-0.009947 (0.0020)	-0.014396 (0.0025)	-0.007853 (0.0020)	-0.006543 (0.0019)
EXPERIENCE	-0.015440 (0.0017)	-0.011230 (0.0022)	-0.006822 (0.0018)	-0.004407 (0.0017)
EXPERIENCE ²	0.000227 (.00004)	0.000138 (.00005)	0.000084 (.00004)	0.000054 (.00004)
UNION MEMBER (1=YES, 0=NO)	-0.071697 (0.0113)	-0.012195 (0.0145)	0.018513 (0.0115)	-0.030708 (0.0112)
RACE (1=BLACK)	-0.020211 (0.0123)	0.037624 (0.0157)	0.016949 (0.0125)	0.020674 (0.0122)
LARGE CITY	0.028129 (0.0112)	-0.005737 (0.0143)	-0.015530 (0.0113)	0.009793 (0.0110)
MARRIED	-0.056300 (0.0146)	-0.005667 (0.0187)	-0.022205 (0.0148)	0.016538 (0.0144)
DISABLED	0.053835 (0.0200)	-0.025728 (0.0255)	-0.021140 (0.0203)	-0.004588 (0.0198)
"OVER" SCHOOLING (1=YES, 0=NO)	0.054256 (0.0108)	0.046376 (0.0138)	0.031908 (0.0109)	0.014467 (0.0106)
"UNDER" SCHOOLING (1=YES, 0=NO)	0.013788 (0.0156)	0.033691 (0.0200)	0.021193 (0.0159)	0.012497 (0.0154)
R ²	.069	.031	.020	.001
# of observations	4989	5017	5017	5017

Standard Errors in parentheses.

* Moved to a higher/lower level occupation.

TABLE 7

WAGE GROWTH AND OVER/UNDER SCHOOLING

O.L.S. REGRESSIONS ESTIMATES

Dep' variable: $\ln(W_t) - \ln(W_{t-1})$

SAMPLE:	ALL WORKERS	"YOUNG"	"OLD"*
	(a)	(b)	(c)
INTERCEPT	0.113487 (0.0243)	0.117340 (0.0451)	0.065991 (0.0452)
SCHOOLING	-0.001279 (0.0014)	0.003014 (0.0027)	-0.002957 (0.0016)
EXPERIENCE	-0.006351 (0.0013)	-0.020063 (0.0093)	-0.001517 (0.0031)
EXPERIENCE ²	0.000100 (.00003)	0.000826 (0.0008)	-0.000007 (.00006)
UNION MEMBER	-0.008589 (0.0080)	-0.021585 (0.0137)	0.002049 (0.0095)
RACE (1=BLACK)	-0.018114 (0.0087)	-0.019567 (0.0138)	-0.014376 (0.0110)
LARGE CITY	0.004556 (0.0083)	-0.002217 (0.0135)	0.009478 (0.0102)
MARRIED	-0.007269 (0.0108)	-0.01376 (0.0152)	0.010620 (0.0160)
DISABLED	-0.004579 (0.0153)	-0.029479 (0.0289)	0.006891 (0.0170)
"OVER" SCHOOLING (1=YES, 0=NO)	0.006670 (0.0080)	-0.000048 (0.0124)	0.012178 (0.0102)
"UNDER" SCHOOLING (1=YES, 0=NO)	0.015592 (0.0114)	0.035346 (0.0235)	0.007256 (0.0123)
R ²	.0191	.0235	.0072
# of observations	3685	1688	1997

Standard Errors in parentheses.

* YOUNG = EXP≤10
 OLD = EXP>10

TABLE 8
WAGE GROWTH REGRESSIONS

Dependent variable (lnW _{it} -lnW _{it-1})	With over schooling	With under schooling	With required schooling
SAMPLE:	(a)	(b)	(c)
INTERCEPT	0.030677 (0.6455)	0.257774 (4.2535)	0.143739 (3.4999)
EXPERIENCE	-0.003597 (1.2007)	-0.012299 (3.5688)	-0.001997 (0.8049)
EXPERIENCE ²	0.000067 (0.8792)	0.000209 (2.7399)	0.000012 (0.1908)
TENURE	-0.005397 (1.6219)	-0.000925 (0.2643)	-0.008897 (3.4130)
TENURE ²	0.000189 (1.5305)	0.000023 (0.2093)	0.000241 (2.7830)
SCHOOLING	0.004533 (1.6276)	-0.007981 (2.1549)	-0.002562 (1.0726)
UNION	-0.020227 (1.3247)	0.005053 (0.2745)	-0.001720 (0.1331)
RACE (1=BLACK)	-0.023551 (1.4688)	-0.038889 (1.9138)	-0.008564 (0.5894)
SMSA	0.009646 (0.6072)	0.000636 (0.0340)	-0.001098 (0.0849)
MARRIED	-0.005074 (0.2597)	-0.000680 (0.0240)	-0.019716 (1.0755)
DISABLED	0.004760 (0.1624)	-0.049560 (1.6613)	0.002908 (0.1172)
SEPARATED	-0.012081 (0.5946)	0.063881 (2.0191)	-0.013626 (0.6729)
CHANGED OCCUP.	0.042572 (2.8019)	0.013204 (0.6945)	0.009662 (0.7024)
R ²	.0268	.0988	.0320
# of obs	1247	469	1352

Absolute t statistics in parentheses.

TABLE 9
THE SCHOOLING EFFECT ON CAREER MOBILITY AND WAGE*

OCCUPATIONAL CATEGORY	CAREER MOBILITY (a)	EFFECT ON WAGE (b)
10 PHYSICIANS, DENTISTS	-0.001381 (0.2677)	0.092096 (7.8764)
11 OTHER MEDICAL AND PARAMEDICAL	0.003380 (0.6705)	0.059134 (2.2734)
12 ACCOUNTANTS AND AUDITORS	-0.000542 (0.1090)	0.077502 (3.4171)
13 TEACHERS, PRIMARY AND SECONDARY SCHOOLS	0.002560 (0.5470)	-0.003364 (0.1779)
14 TEACHER(COLL.),SOC. SCI.,LIBRARIAN,ARCH	0.000463 (0.0975)	0.067732 (2.5479)
15 ARCHITECT,CHEMIST,ENGINEER,PHY.&BIO.SCI	-0.000274 (0.0577)	0.075679 (7.9143)
16 TECHNICIANS	0.008568 (1.5988)	0.050122 (6.3384)
17 PUBLIC ADVISORS	0.003620 (0.7114)	0.060651 (5.2189)
18 JUDGES, LAWYERS	-0.001054 (0.2230)	0.347471 (3.2359)
19 PROF.,TECHNICAL & KINDRED, NOT ABOVE	0.014697 (2.9029)	0.024039 (1.2215)
20 MAN.,OFFIC.&PROPR.(NONFARM)EXC.SELF-EM.	0.009989 (2.7956)	0.074033 (19.634)
31 LIKE 20, SELF EMPLOYED (UNINCORP.BUS.)	0.020626 (3.2840)	0.068493 (6.8170)
40 SECRETARIES, STENOGRAPHERS, TYPISTS	0.014957 (2.4884)	-0.062524 (1.3994)
41 OTHER CLERICAL WORKERS	0.019250 (4.1427)	0.031038 (5.1211)
45 SALES WORKERS	0.010175 (2.4145)	0.106548 (12.500)
50 FOREMEN, N.E.C.	0.013070 (4.3991)	0.037331 (4.3035)
51 OTHER CRAFTSMEN & KINDRED WORKER	0.011136 (4.1404)	0.037385 (12.759)
52 GOVT(FIRE,POLICE,MARSH.&CONSTABLES)	0.006736 (2.1562)	0.042988 (3.1096)
55 MEMBERS OF THE ARMED FORCES	0.003313 (0.2607)	0.082950 (6.0601)
61 TRANSPORT EQUIPMENT OPERATIVES	0.009500 (3.3585)	0.033794 (7.2564)
62 OPERATIVES, EXCEPT TRANSPORT	0.019294 (7.0108)	0.043912 (13.342)
70 UNSKILLED LABORERS (NONFARM)	0.029178 (9.6898)	0.038422 (9.3666)
71 FARM LABORERS AND FOREMEN	0.026619 (6.3352)	0.044839 (4.9204)
75 OTHER SERVICE WORKERS	0.014525 (5.0349)	0.031283 (6.1657)
80 FARMERS (OWNER & TENANT) & MANAGERS	-0.000658 (0.0934)	0.067441 (2.8314)

* Columns (a) and (b) report the estimation results of equations (4) and (5) respectively. The other independent variables are Experience, Tenure, Union, Race, SMSA, Married, and Disability. See Appendix 1 for full occupational titles.

Appendix 1

**OCCUPATIONAL CLASSIFICATION
(Used in the PSID)**

2 digit classification

- 10 Physicians (Medical and Osteopathic), Dentists.
- 11 Other Medical and Paramedical.
- 12 Accountants and Auditors.
- 13 Teachers, Primary and Secondary Schools.
- 14 Teachers, college ; Social Scientists; Librarian; Archivists.
- 15 Architects; Chemists; Engineers; Physical & Biological Scientists.
- 16 Technicians.
- 17 Public Advisors.
- 18 Judges, Lawyers.
- 19 Professional, Technical and kindred workers, not listed above.
- 20 Managers, Officials and Proprietors (except farm), not self-employed.
- 31 Like 20, Self Employed (unincorporated businesses).
- 40 Secretaries, Stenographers, Typists.
- 41 Other Clerical Workers.
- 45 Sales Workers.
- 50 Foremen, n.e.c.
- 51 Other Craftsmen and Kindred Workers.
- 52 Government Protective Service Workers (Fire, Police, Marshals and Constables).
- 55 Members of the Armed Forces.
- 61 Transport Equipment Operatives.
- 62 Operatives, except transport.
- 70 Unskilled Laborers (nonfarm).
- 71 Farm Laborers and Foremen.
- 73 Private Household Workers.
- 75 Other Service Workers.
- 80 Farmers (Owners and Tenants) and Managers.

1 digit classification

- 10-19 PROFESSIONAL/TECHNICAL&KINDRED WORKERS
- 20 MANAGERS, OFFICIALS OR PROPRIETORS
- 30-31 SELF EMPLOYED BUSINESSMEN
- 40-49 CLERICAL AND SALES WORKERS
- 50-52 CRAFTSMEN/FOREMEN/KINDRED WORKERS
- 61-62 OPERATIVES AND KINDRED WORKERS
- 70-75 LABORERS AND SERVICE WORKERS
- 80 FARMERS AND FARM MANAGERS

Appendix 2
The vertical Ranking of Occupations

Consider the following wage regression:

$$\ln(W_{ijt}) = X_{it}\beta + \alpha E_i + \tau \text{PEXP}_{ijt} + \delta \text{TEN}_{ijt} + \mu \text{RQT}_{ijt} + \epsilon_i \quad (1)$$

where:

X = a vector of observed characteristics.

E = the worker's level of schooling.

PEXP = market experience prior to entry the present occupation.

TEN = tenure in the occupation.

RQT = the amount of training the worker received in order to be fully qualified to work in the present occupation.

i = individual's index.

j = occupation index.

t = time index.

Define the level of human capital the worker needed in order to be qualified for working in the occupation as:

$$\text{HC}_{ij} = \alpha E_i + \tau \text{PEXP}_{ijt} + \mu \text{RQT}_{ijt} \quad (2)$$

Then, the mean level of human capital needed to be fully qualified to work in occupation j is given by:

$$\text{HC}_j = \frac{\sum_i \text{HC}_{ij}}{N_j} \quad (3)$$

and the vertical distance between occupations k and l is given by:

$$\text{DV}_{kl} = \text{HC}_k - \text{HC}_l \quad (4)$$

Since not all variables were observed in the data set, some modifications were made while estimating these equations. For details, see Sicherman (1987).

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