"Overeducation" in the Labor Market

Nachum Sicherman, *Rutgers University*

This article examines the reasons for the observed discrepancy between workers' actual and required levels of schooling and the resulting differences in returns to schooling, "Overeducated" workers are found to be younger and to have lower amounts of on-the-job training than workers with the required level of schooling. They also have higher rates of firm and occupational mobility, characterized by movement of higher-level occupations. The findings suggest that overeducation can be explained by the trade-off between schooling and other components of human capital and by the mobility patterns of overeducated workers.

I. Introduction

The synchronization between the education system and the labor market has been of major concern for several decades among educators, policymakers, and social scientists. The study of these relations has been conducted in two related directions. One is the study of the changes in returns to schooling over time.[1] The other focus is on the matching between workers' actual levels of schooling and that which is required by their jobs.

I am deeply indebted to Jacob Mincer for numerous discussions and suggestions. Useful suggestions and comments made by J. Altonji, D. Bloom, C. Friedland, J. Hartog, E. Lazear, J. O'Neill, C. Paxson, R. Topel, and seminar participants at Columbia University, Northwestern University, and the University of Chicago are gratefully acknowledged.

This work was supported by a grant from the John M. Olin Foundation through the Center for the Study of the Economy and the State, University of Chicago. I am also grateful to the National Center on Education and Employment for supporting this work.

[1] The increase in college attainment in the United States of the "baby boom" generation, and the resulting reduction in the returns to schooling, on the one

[*Journal of Labor Economics*, 1991, vol. 9, no. 2]

0734-306X/91/0902-0001$01.50

This article concerns the second issue. It is motivated by the following stylized facts.

i) Workers in occupations that require less schooling than they actually have (overeducated) earn lower wages than workers with similar levels of schooling who hold jobs that require the level of schooling they have obtained. These overeducated workers, however, earn more than their coworkers who are not overeducated (i.e., who have the required and, therefore, lower schooling).

ii) Workers in jobs that require more schooling than they have obtained (undereducated) receive higher wages than workers with the same level of schooling who work in jobs that require just their level of schooling. Undereducated workers, however, receive lower earnings that do their coworkers with the required and, therefore, higher schooling.

These observations have been made by other authors (e.g., Duncan and Hoffman 1981; Hartog 1986; Rumberger 1987; and Hartog and Oosterbeek 1988). I find them to be true as well using the Panel Study of Income Dynamics (PSID) (see my detailed results in App. A).

Previous studies have not provided wholly satisfactory or empirically verified explanations of the findings. Some authors have argued that such findings reflect disequilibrium or inefficiency in the labor market and/or the schooling system. Overeducated workers, according to these arguments, are underutilized workers (e.g., Rumberger 1981*a*). It has also been alleged that such findings challenge the validity of human capital theory (Becker 1964; Mincer 1974) in explaining the relations between wages and education. If the implicit assumption of human capital theory is that firms and workers adjust their schooling requirements and investments, respectively, to changes in demand and supply, then the existence of overeducation is, at most, a short-run phenomenon resulting from a lack of coordination between firms and individuals (Duncan and Hoffman 1981).

The objective of this article is to explore the reasons for the discrepancy between actual and required levels of schooling, and the resulting differences in returns of schooling, using a human capital mobility framework. The empirical implications provided by this framework will be contrasted with alternative theories. By doing this, I hope to provide better insights into the relations among schooling, the pattern of wages, and workers' mobility across firms and occupations. The following alternative explanations are examined.

---

hand, revived the notion of overeducation (Freeman 1976). The increase in the returns to schooling over the last several years, on the other hand, might indicate an inefficiency or inability of the education system to match the educational requirements of the labor market (see, e.g., Murphy and Welch, 1989). For a discussion and critique of this approach, see Mincer (1983). His article also examines the difference between "schooling" and "education."

The first explanation focuses on the potential trade-off between schooling and other components of the level of human capital (e.g., on-the-job training). Thus, workers may qualify for similar jobs by having different levels of schooling but similar levels of total human capital. The hypothesis that will be tested is that if workers are under- (over-) educated they would compensate in some other way, for example, by having more (less) on-the-job training, more (less) market experience, or more (less) innate, unmeasured ability.

The second explanation concerns the mobility patterns of workers. 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. I suggest two theories that are consistent with a temporary discrepancy between actual and required education. One involves matching theory, according to which the discrepancy may be treated as an indication of the quality of the match between worker and job.

The second is a theory of career mobility,[2] which predicts that workers may temporarily work in jobs that provide them with skills to be used later in a different, higher-level job. There it might be optimal, ex ante, to spend a limited period of time in a job in which the worker appears to be overqualified. Empirical predictions of this theory will, therefore, be made with respect to overeducation only.

In the next two sections, empirical predictions of these theories are made and tested with respect to occupational and firm mobility of workers who are observed having more (fewer) years of schooling than their job requires.[3]

II. The Incidence of Over- and Underschooling in the PSID

A sample of male heads of households, aged 18–60, was drawn from the PSID individuals tape and includes a "poverty subsample." The cross-section analysis is conducted with the 1976 and 1978 waves of the PSID, while the mobility models are estimated on the 1976–77 and 1978–79 waves.[4] Additional information on the data is provided in Appendix B.

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 seven classes: 0–5, 6–8, 9–11, 12, 13–15, 16, 17. Individuals are defined as over- (under-) educated if their reported years of schooling (last grade completed) lie outside the reported range of required years of schooling. Such a measure is superior to alternative mea-

[2] See Rosen (1972) and Sicherman and Galor (1990).

[3] The fact that education has consumption or other non–labor market values could also serve as a possible explanation of overeducation. This issue is not dealt with in this article.

[4] Only the results reported in table 4 are based on the 1976–81 waves.

sures that are based on mean levels per occupation mainly because schooling requirements for a specific job might differ from the occupation mean. Appendix B discusses in detail the construction of this variable and its advantage over using alternative measures (e.g., the *Dictionary of Occupational Titles*).

In table 1, the data sample is separated into three groups: those with overschooling, those with underschooling, and those with required schooling. It can be seen that around 40% of the workers in the sample report themselves as overeducated and 16% report themselves as undereducated.

Overeducated workers have low mean market experience, while undereducated workers are much more experienced. This finding supports the idea that skills obtained by labor market experience can substitute for insufficient schooling.

An alternative hypothesis is that the relations between over- (under-) education and market experience simply reflect a cohort effect. That is, on average, younger cohorts have higher schooling in all occupations than older cohorts. In order to test this possibility, I compared the reported schooling in the PSID to the mean levels of schooling by age and occupation in the 1970 census. I find that overeducated workers (by my definition) have, on average, higher levels of schooling than the average of their cohort in the same occupation. Undereducated workers have lower levels of schooling than their cohort within the occupation. The correlation between the deviation from required schooling and the deviation from the census mean of schooling (by age and occupation) is .34 and highly significant.

Table 1
Sample Means of Selected Variables PSID (1976, 1978), Males, Age 18–60

Sample	With Overschooling (a)	With Underschooling (b)	With Required Schooling (c)
Years of over/underschooling	4.15/4.73	2.49/2.72*	
Reported training	1.42	2.18	1.64
Wage growth	.0376	.0234	.0276
Experience	14.0408	22.0191	15.0857
Tenure	5.9697	11.1425	7.6912
Schooling	12.5870	10.2707	12.3979
Union	.3191	.3582	.3232
Race (1 = blacks)	.3352	.2985	.2758
In a large city	.2951	.3283	.3291
Married	.8420	.8912	.8801
Disabled	.0585	.0852	.0599
Changed firm	.1595	.0938	.1094
Changed occupation	.3408	.2814	.2707
No. of observations	2,100	830	2,230
(%)	(.408)	(.160)	(.431)

* Based on two alternative measured described in App. B.

The cohort hypothesis is therefore rejected as the sole reason for the observed correlation between years of experience and over- (under-) education.

Overeducated workers have less on-the-job training, while undereducated workers report more on-the-job training. These observations further support the hypothesis that a trade-off exists between schooling and other forms of human capital.

Racial differences in the incidence of overeducation could also be explained using the same line of reasoning. Whether due to discrimination or lower quality of education, for example, black workers are more likely to be found in jobs that require lower levels of schooling than the levels they have attained (overeducated). The findings reported in table 1 support this assessment.[5]

The differences in the mean levels of tenure suggest that the overeducated are more likely to change firms, while the undereducated stay much longer in the same firm. Indeed, overeducated workers report higher rates of firm and occupational mobility than the other two groups, while undereducated workers have lower rates of firm mobility but higher rates of occupational mobility than those with required schooling.[6] Since human capital obtained via on-the-job training contains larger amounts of firm- and occupational-specific capital, these differences in the patterns of mobility are consistent with the observed differences in the amounts of training received by the different groups. All these correlations hold up to a multivariate analysis (available in Sicherman 1978*b*).

III. Over- (Under-) Schooling and Labor Mobility

A. Matching

A possible reason to observe workers with characteristics that differ from those required by the job is a mismatch between the worker and the job. Overeducation might be an indication for a bad match in the sense that the worker's education might qualify him for a better-paying job. In such a case, it is likely that eventually the worker will change his job, that is, his occupation, firm, or both.[7] If, however, a worker has a good match

[5] Duncan and Hoffman (1981) report that 48.5% of black men have completed levels of schooling exceeding what is required, as opposed to 41.7% among white men (using the 1976 wave of the PSID). Rumberger (1981*b*) also reports a 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).

[6] Mean 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.

[7] In some studies it has been argued that "overeducation" results in dissatisfaction, hence lower productivity, as well as in higher rates of absenteeism, poor health,

with the firm in the sense that his formal education is less than the amount typically required for such a job, it is expected that the worker will stay on the job for a long time. It should be noted that, from the firm point of view, undereducation might be considered as a bad match, thus inducing the firm to lay off the worker. This possibility was rejected empirically. No indication of higher incidence of layoffs among the undereducated was found.

Empirical Results.—The estimation results of the separation models (both firm and occupational mobility), reported in table 2, confirm the hypothesis that workers with years of schooling that deviate from those required on the job have higher probabilities of changing both their occupation and their firm. The lower levels of firm tenure of overeducated workers reported in table 1 support the hypothesis of higher firm mobility among the overeducated and might be an indication of a bad match.[8]

As far as undereducated workers are concerned, it has already been pointed out that their tendency to change firm or occupation is much lower than that of overeducated workers.[9] Therefore, there is no evidence to support the hypothesis that undereducation reflects a good (or bad) match between the worker and the firm.

The alternative hypothesis, that the undereducated substitute training/experience for education and thus are not likely to change jobs, seems to be supported by table 2. The effect of undereducation on job changes is modest while overeducated workers tend to change both firms and occupations. Adding reported training to the regressions support the hypothesis that mobility differentials are partially explained by differences in training obtained by over- and undereducated workers.

B. 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 observed. Occupational change is

---

low energy, and turnover (see, e.g., Rumberger 1981*a*, chap. 5; Tsang and Levin 1985; Rumberger, Levin, and Tsang 1986). 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 below. In addition, the cause and effect may be reversed, i.e., those with poor health, low energy, and dissatisfaction work at inferior jobs, rather than the other way around (see Sec. IV for a note concerning quality differences).

[8] In a multivariate logit analysis, where the likelihood of being overeducated is estimated, the tenure coefficient is negative and highly significant (Sicherman 1987*b*).

[9] The partial correlation between tenure and the likelihood of being undereducated is not significantly different from zero (holding experience constant).

Table 2
Firm and Occupational Mobility of Workers with Over/Underschooling (Maximum Likelihood [Logit] Estimations)

	Changed Firm				Changed Occupation			
Dependent Variable	(a)	(b)*	(c)	(d)*	(e)	(f)*	(g)	(h)*
INTERCEPT	.4948	.0655	.4264	.0590	.6227	.1321	.4928	.1057
	(1.9)		(1.6)		(3.0)		(2.3)	
SCHOOLING	−.0821	−.0108	−.0690	−.0095	−.0759	−.0161	−.0603	−.0129
	(4.9)		(3.8)		(5.9)		(4.3)	
EXPERIENCE	−.0875	−.0115	−.0846	−.0117	−.0577	−.0122	−.0535	−.0115
	(5.8)		(5.4)		(5.1)		(4.5)	
EXPERIENCE^2	.0007	.0001	.0007	.0001	.0007	.0001	.0006	.0001
	(1.6)		(1.6)		(2.4)		(2.0)	
UNION MEMBER								
(1 = yes; 0 = no)	−.6399	−.0847	−.6531	−.0904	−.0390	−.0083	−.0280	−.0060
	(6.2)		(6.2)		(.55)		(.38)	
RACE								
(1 = black)	−.1955	−.0259	−.2693	−.0373	.1690	.0358	.1388	.0297
	(2.0)		(2.7)		(2.2)		(1.77)	
LARGE CITY	.1713	.0227	.1563	.0216	−.0251	−.0053	−.0526	−.0113
	(1.89)		(1.7)		(.36)		(.71)	
MARRIED	−.3186	−.0422	−.2923	−.0405	−.0568	−.0120	−.0346	−.0074
	(3.1)		(2.7)		(.64)		(.37)	
DISABLED	.3621	.0479	.3214	.0445	−.0654	−.0139	−.1076	−.0231
	(2.2)		(2.0)		(.51)		(.80)	
OVERSHOOLING								
(1 = yes; 0 = no)	.3594	.0476	.3440	.0476	.2340	.0496	.1988	.0426
	(4.1)		(3.8)		(3.4)		(2.8)	
UNDERSCHOOLING								
(1 = yes; 0 = no)	.1102	.0146	.2111	.0292	.1576	.0334	.1757	.0377
	(.8)		(1.6)		(1.6)		(1.7)	
RQT			−.0486	−.0067			−.0441	−.0094
			(2.1)				(2.6)	
No. of observations	5,061		4,547		5,066		4,552	
Log-likelihood	−2,033		−1,895		−3,031		−2,746	

NOTE.—Asymptotic (absolute) t-statistics are in parentheses.
* Estimated derivatives for the probabilities. The sample is limited to the 1976–77 and 1978–79 waves. All regressors are measured in the base periods (1976, 1978). Observations with missing variables are omitted.

defined to occur when the two-digit occupational category in the PSID reported by the worker in two successive surveys is different.[10] The implicit 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. Since each category is a combination of a number of detailed occupational titles, it is possible that some individuals move between relatively *different* occupations in the same category with no change observed, while others move between relatively *similar* occupations that fall into different categories, and a change will be observed. I assume that, on average, workers who move across categories experience a bigger change in tasks than those who move across occupations within a category.

Occupational mobility that is due to *career mobility* is considered mobility to a higher-level occupation.[11] The vertical distance between occupations is measured as the difference in the mean levels of human capital needed to work in the occupations after required training is completed. These levels are constructed by summing up the weighted means of the levels of schooling, market experience prior to entering the occupation, and the amounts of training required in order to be qualified to work in the different occupations. The weights are the estimated coefficients of these variables in a wage regression. Since the scaling of occupations is continuous, horizontal mobility does not occur. For a formal derivation, see Appendix D.

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, workers with different levels of human capital may work (for a limited period) in the same occupation and get 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 that 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 profiles. 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 for another higher-level occupation (private detective).[12]

It can be easily seen that observing a worker in a job where the schooling requirements are lower than his actual level of schooling is consistent with,

[10] See App. C for the list of the 25 categories using this classification. Due to measurement errors, the measured rate of transitions is expected to be much higher than the real rate. It is expected that such errors will weaken but not bias the estimation results.

[11] I use this criterion in order to distinguish career mobility from other types of occupational mobility, although it is possible that mobility to a lower-level occupation (based on my ranking) will be part of the worker's career mobility.

[12] For a formal presentation of the model described in this section, see Sicherman and Galor (1990).

and even implied by, such a model of career mobility. Implications of this theory will, therefore, concern overeducation only. Below I suggest two empirical implications specific to this theory and test them using the PSID.

The first implication is that workers who work in jobs that 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 3, the estimation results of a career-mobility model are reported. The results indicate that overeducated workers are more likely to move to a higher-level occupation than workers with the required level of schooling.

The results also indicate that undereducated workers have a higher probability of upward mobility. The coefficient is much lower without a control for market experience. Since the theory of career mobility makes predictions only with respect to overeducated workers, I do not discuss

Table 3
Upward Occupational Mobility, Maximum Likelihood (Logit) Estimations
Dependent Variable: 1 = if moved to a higher-level occupation;
0 = otherwise.

	(a)	(b)*	(c)	(d)*
INTERCEPT	−1.194	−.1601	−.3157	−.0424
	(−5.3)		(−1.2)	
SCHOOLING	−.0314	−.0042	−.0676	−.0091
	(−2.1)		(−4.2)	
EXPERIENCE	...	...	−.0536	−.0072
			(−3.8)	
EXPERIENCE^2	...	...	.0000	.0001
			(1.6)	
UNION MEMBER				
(1 = yes; 0 = no)	.1713	.0229	.2050	.0275
	(2.0)		(2.4)	
RACE				
(1 = black)	.2064	.0277	.1076	.0144
	(2.2)		(1.2)	
LARGE CITY	−.1499	−.0201	−.0949	−.0127
	(−1.7)		(−1.1)	
MARRIED	−.3223	−.0432	−.1631	−.0219
	(−3.1)		(−1.5)	
DISABLED	−.1964	−.0263	−.1091	−.0146
	(−1.2)		(−.67)	
"OVER" SCHOOLING				
(1 = yes; 0 = no)	.2373	.0318	.2181	.0293
	(2.8)		(2.5)	
"UNDER" SCHOOLING				
(1 = yes; 0 = no)	.1991	.0267	.3103	.0416
	(1.7)		(2.6)	
No. of observations	5,093		5,064	
Log-likelihood			−3,510	

NOTE.—Asymptotic *t*-statistics are in parentheses. The sample is limited to the 1976–77 and 1978–79 waves. All regressors are measured in the base periods (1976, 1978). Observations with missing variables are omitted.

* Columns b and d report the estimated derivatives for the probabilities.

the relations between undereducation and career mobility. So far I do not have a good explanation for this result.

The second implication concerns differences in the returns to schooling across occupations. 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. While some occupations provide the better workers with skills that 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. Below I present the econometric specification for testing this hypothesis.

Consider the following fixed effect models:

$$Y^*_{ijt} = X_{ijt}\beta_1 + \tau_j ED_i + \delta_j + \varepsilon_{ijt}, \tag{1}$$

where

$$Y^*_{ijt} \equiv \text{the probability that the worker will move "up"}$$

and

$$\ln(W_{ijt}) = X_{ijt}\beta_2 + \alpha_j ED_i + \mu_j + \varepsilon'_{ijt}. \tag{2}$$

Equation (1) is the career-mobility equation, where the schooling effect (τ_j) is occupation specific (obtained by interacting schooling and occupational dummies). Mobility ($y = 1$) occurs when the latent variable $Y^*_{ijt} > 0$, where

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

Since Y^*_{ijt} is unobserved, the probability of a transition is $\text{prob}(y = 1) = 1 - F(-Z\Gamma)$, where $F(\cdot)$ is the cumulative distribution function of ε. In practice, I assume that ε is logistically distributed and estimate the parameters by maximum likelihood.

Equation (2) is a wage equation where the occupational specific schooling effect is given by α_j. In both equations I assume occupational fixed effects, which are estimated by using dummy variables (δ_j and μ_j).

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

$$\text{corr}(\alpha_j, \tau_j) < 0. \tag{3}$$

Estimates of α_j and δ_j are presented in table 4.

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 −.61 (with .95 level of confidence).

Since each of the coefficients is measured with a different level of error (see the standard errors in the regressions), it can be shown that the measured correlation given above is underestimated (while the standard error is overestimated). This result is based on the assumption that the estimation errors are independent. Since the two sets of returns are derived from the same sample, this assumption might not hold. In order to ensure such an independence, I divided the data into two random subsamples and reestimated the regressions using a different subsample for each regression. The estimated correlation between the two sets of returns this time was −.53 and, again, significantly different from zero. The reduction in the correlation is the result of avoiding the positive correlation between the regressions estimated errors and/or the increase in the standard errors of the estimated coefficients due to the smaller number of observations.

IV. Quality Differences: A Note

As was mentioned in the Introduction, the discrepancy between actual and required schooling and the observed wage differentials could also be explained by quality differences among the different groups. Overeducated workers might have lower quality of schooling and/or general ability, both unobserved in the data. The opposite would be true for undereducated workers.

Although this argument could be correct, a direct test would require some measure of individuals' ability (such as I.Q.) or their quality of schooling. Such information is not available in the PSID. The results reported in this article might be consistent with the quality argument as a partial explanation, but they reject the hypothesis that such an argument is dominant. If overeducation is merely a compensation for low ability or low quality of education, the patterns of mobility reported in this article would not be consistent with such an argument.

V. Summary and Conclusions

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

Several theories have challenged the validity of human capital theory in explaining the relations between wages and education. Occasionally, the observed discrepancy between schooling and job requirements has been used to support 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 overeducation is subject to empirical inves-

Table 4
Schooling Effect on Career Mobility and Wage: Interaction between Schooling and Occupational Dummies in Career Mobility (Logit) and Wage Regressions

Occupational Category	Career Mobility Model*		Wage Model
	Coefficient (a)	Probability (b)	(c)
10 Physicians, dentists			.0922
			(7.88)
11 Other medical and paramedical	.05784	.0073	.0594
	(.94)		(2.28)
12 Accountants and auditors	−.06144	−.0078	.0780
	(.82)		(3.44)
13 Teachers, primary and secondary schools	.02547	.0033	−.0028
	(.45)		(.14)
14 Teacher (college), social scientist, librarian, archivist	−.06757	−.0086	.0686
	(.84)		(2.58)
15 Architect, chemist, engineer, physical and biological sciences	−.14642	−.0186	.0755
	(1.73)		(7.90)
16 Technicians	.1175	.0149	.0501
	(1.84)		(6.33)
17 Public advisors	.05762	.0073	.0605
	(.93)		(5.21)
18 Judges, lawyers	−.33584	−.0426	.3487
	(.98)		(3.24)
19 Professional, technical and kindred, not above	.1564	.0198	.0237
	(2.69)		(1.20)
20 Managers, officials, and proprietors (nonfarm) except self-employed	.3885	.0493	.0739
	(5.15)		(19.6)
31 Like 20, self-employed (unincorporated businesses)	.2153	.0273	.0681
	(3.26)		(6.77)
40 Secretaries, stenographers, typists	.1138	.0144	−.0627
	(2.19)		(1.40)
41 Other clerical workers	.1426	.0181	.0308
	(3.48)		(5.09)
45 Sales workers	.07513	.0095	.1064
	(1.98)		(12.5)
50 Foremen, not elsewhere classified	.2164	.0274	.0372
	(6.08)		(4.29)
51 Other craftsmen and kindred workers	.1953	.0248	.0371
	(5.85)		(12.7)
52 Government (fire, police, marshals, and constables)	.1176	.0149	.0429
	(2.71)		(3.10)
55 Members of armed forces	.06732	.0085	.0830
	(.43)		(6.06)
61 Transport equipment operatives	.05677	.0072	.0336
	(2.32)		(7.21)
62 Operatives, except transport	.1198	.0152	.0437
	(5.09)		(13.3)
70 Unskilled laborers (nonfarm)	.1101	.0140	.0382
	(5.18)		(9.30)

Table 4 (*Continued*)

Occupational Category	Career Mobility Model*		Wage Model
	Coefficient (a)	Probability (b)	(c)
71 Farm laborers and foremen	.08899	.0113	.0446
	(3.12)		(4.90)
75 Other service workers	.04436	.0056	.0311
	(2.17)		(6.12)
80 Farmers (owner and tenant) and managers	.06254	.0079	.0666
	(.30)		(2.79)

* The logit parameter estimates are in col. a, and the derivatives for the probabilities are reported in col. b (calculated as $\beta[p(1-p)]$). Workers employed in the highest-level occupation in the initial period are excluded from the sample. The other independent variables are market experience, firm tenure, union membership, race, standard metropolitan statistical area, if married, if disabled, and occupation of origin. See App. C for full occupational titles. The sample is based on the 1976–81 waves. All regressors are measured in the base periods. Observations with missing variables are omitted.

tigation and will depend on the efficiency of schooling as a screening device, as well as on 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 on other characteristics. These characteristics allow employers to estimate the costs of providing 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 as the baby boom generation reached college age, and the resulting reduction in the returns to schooling, revived the notion of overeducation.[13] The question was raised as to how fast the market (both demand and supply) could adjust to such a situation, and what policies should be pursued to restore equilibrium.

The objective of this article was to provide a theoretical explanation for the discrepancy between workers' level of schooling and what is required by their job and to see to what extent that explanation can be supported empirically.

Using human capital mobility framework, I provide two basic explanations for this discrepancy. First, a trade-off might exist between schooling and other forms of human capital so that workers might qualify for similar

[13] See, e.g., Freeman (1976).

jobs by having different levels of schooling but similar levels of total human capital. Thus, many combinations of education and training/experience can produce a given amount of total human capital. Therefore, the observation that a certain fraction of workers are undereducated or overeducated does not by itself imply an inefficient use of resources. Inefficiency must be judged by looking at the matter in a broader context.

Second, such a discrepancy might be the result of a mismatch between the worker and the job or a temporary stage of her career where skills acquired in a lower-level job will be useful later in a different job.

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

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

Workers who work in jobs that require more schooling than they have (undereducated) receive lower wages than their coworkers but get more than workers with the same level of schooling who work in jobs that require their level of schooling.

2. Overeducated workers are less experienced and report lower amounts of training. Undereducated workers report significantly higher amounts of on-the-job training and are more experienced. These results support the hypothesis that, if workers are under- (over-) educated, they compensate in some other way and that the total amount of human capital is what determines whether a worker is qualified for a job.

3. (*a*) Overeducated 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.

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 or movement along a career path. The quality hypothesis is rejected as a dominant explanation for the discrepancy.

4. In those occupations in which the schooling effect on wages is lower, the schooling effect on the probability of moving to a higher-level occupation is greater. The fact that the occupation-specific returns to schooling are not correlated with the occupational ranking suggests that upward occupational mobility is due more to career mobility than to a matching process.

Appendix A

The Returns to Over- (Under-) Schooling

In this section, I test the hypothesis that the return to years of schooling that deviate from those required by the job differ from the

return to required years of schooling. For this purpose two equations are estimated. The first is given in (A1) and is similar to the approach taken by other authors who have attempted to investigate the effects of "surplus" or "overschooling" on wages.

Consider the following wage regression:

$$\ln(W_{it}) = X_{it}\beta + \alpha E^r_{it} + \tau E^o_{it} + \delta E^u_{it} + \varepsilon_{it}, \qquad \text{(A1)}$$

where total schooling (E) is decomposed to schooling required by the job (E^r) and that which exceeds or falls below the required schooling (E^o and E^u),

$$E \equiv E^r + E^o - E^u. \qquad \text{(A2)}$$

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

$\tau \equiv$ the return to an additional year of schooling that exceeds the job requirement, relative to coworkers (workers with the same required schooling who have the required level of schooling);

$\tau - \alpha \equiv$ the return to an additional year of schooling that exceeds the job requirement, relative to workers with the same level of schooling who have the required schooling on the job;

$\delta \equiv$ the loss of wage due to a year of underschooling, relative to coworkers (with the same required schooling); and

$\alpha + \delta \equiv$ the wage differences between workers who work in jobs that require an additional year of schooling (a year more than they have) and workers who have the same level of schooling but work in jobs that require that level of schooling.

In contrasting the over- (under-) educated workers and 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 an appropriate and direct comparison:

$$\ln(W_{it}) = X_{it}\beta' + \alpha'(\text{OVER})_{it} + \tau'(\text{UNDER})_{it} + \varepsilon'_{it}, \qquad \text{(A3)}$$

where

$$\text{OVER} = \begin{cases} 1 & \text{if the worker is overeducated,} \\ 0 & \text{if he has the required or underschooling,} \end{cases}$$

$$\text{UNDER} = \begin{cases} 1 & \text{if the worker is undereducated,} \\ 0 & \text{if he has the required or overschooling.} \end{cases}$$

Table A1
The Returns to Schooling: Wage Regressions Estimated Coefficients

	(a)	(b)	(c)	(d)	(e)	(f)
Years of schooling	.038	.049		.051	.038	.046
	(14.0)	(17.0)		(12.0)	(7.9)	(7.0)
Years of required schooling (α)			.048			
			(16.)			
Years of "overschooling" (τ)			.039			
			(11.)			
Years of "underschooling" (δ)			−.017			
			(3.4)			
"Overschooling" (1 = yes, 0 = no)		−.053				
		(4.3)				
"Underschooling" (1 = yes; 0 = no)		.072				
		(4.2)				
R^2	.48	.49	.49	.52	.45	.505
No. of observations	3,133	3,133	3,133	1,369	1,253	511

NOTE.—Absolute *t*-statistics are in parentheses. The sample in columns a, b, and c include all workers; in column d, only workers with required schooling; in column e, only workers with overschooling; and in column f, only workers with underschooling. All regressions include market experience, firm tenure, union membership, race, marital status, disability, required training, and dummies for one-digit occupational classification. For full regressions estimates, see Sicherman (1987*b*).

The different estimates of the returns to schooling obtained by estimating equations (A1) and (A3) are summarized in table A1. In addition, standard wage regressions are estimated separately for overeducated workers, undereducated workers, and workers with required schooling (cols. d–f).

The returns to years of schooling that are above what is needed for the job are lower, although positive. This means that workers who are working in occupations that demand less schooling than they actually have (overeducated) get higher wages than their coworkers (holding other characteristics constant) but lower wages than workers with similar levels of schooling who work in jobs in which their schooling equals what is required. These differences are statistically significant. The hypothesis that $\tau - \alpha = 0$ is strongly rejected by a Wald test ($F = 21.38$).

Workers who work in jobs that require more schooling than they have (undereducated) receive lower wages than their coworkers but get more than workers with the same level of schooling who work in jobs that require their level of schooling (−.017 and (.048−.017) in table A1, col. c). These differences are statistically significant. The hypothesis that $\alpha + \delta = 0$ is strongly rejected by a Wald test ($F = 34.64$).

The possibility that these results reflect a concavity in the returns to schooling, regardless of any discrepancy between actual and required schooling, was rejected empirically by including a quadratic term of schooling in a standard wage regression.

The results (table A1, col. b) show that, on average, the wage of workers who report higher levels of schooling than required by their job is around 5% lower. Workers with less schooling than required have a wage rate that exceeds by 7% that of similar workers with the same level of schooling, who work in jobs that require the level of schooling they actually have.

Appendix B

Data Appendix

I. Measuring the Level of Required Schooling

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 7 classes: 0–5, 6–8, 9–11, 12, 13–15, 16, 17. I translated the answer "college, no degree necessary; associate degree" to 13–15, "college degree, B.A. or B.S." to 16, and "college, advanced or professional degree" to 17 (reported education in the PSID is truncated at 17). Individuals are defined as over- (under-) educated if their reported years of schooling (last grade completed) lie outside the reported range of required years of schooling.

When defining the number of years of over- or underschooling, two alternatives were used. The first was to take the difference between reported schooling and the years of schooling most of those within each bracket reported as their schooling levels (0–5: 4; 6–8: 8; 9–11: 10; and 13–15: 14). The second alternative was to take the difference between the reported years of schooling and the "boundaries" of the range of required years of schooling. Both alternatives were tried at each step of the analysis, and only when the differences were significant were both results reported. In most of the analysis, I use the first alternative, but when constructing a dummy variable, workers were considered over- (under-) educated if their reported level of schooling was not within the interval of required schooling. Due to the different intervals of the reported required schooling, a measurement error in reported schooling might cause a nonrandom error in the incidence of over- (under-) schooling. The different effects of years of over- and underschooling in the various regressions suggest that the variation is not pure measurement error.

There are few possible definitions of "required schooling." One is "the average amount of schooling employers require of the average worker who enters the job." By this definition, different workers (e.g., with different levels of market experience) might face different required levels of schooling for similar jobs. Another possibility is that workers referred to the required level of schooling at the time of the survey (as the question seems to imply), which might differ from the level required at the time they entered the job.

Another way is to treat "required" as a minimum necessary condition. A discrepancy might also exist between the required and "needed"

amount of schooling. If "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 other interpretations were used, such as those mentioned above.

Rumberger (1987) used an additional measure based on the *Dictionary of Occupational Titles* (DOT). Hartog and Oosterbeek (1988) obtain similar results using workers' self-report and job analysts' grading (on Dutch data).

The measure of required schooling used in this article seems to be superior to that obtained by the DOT for several reasons: The first and most important is that the DOT *does not* report a measure of required schooling but rather three different measures of "General Educational Development" (GED), each having six categorical values, not specified in terms of years of schooling (see U.S. Department of Labor 1972). Translating these values into a single continuous variable of years of schooling is highly subject to errors (Cain and Treiman 1981).

Second, the best measure that one could obtain using the DOT would be occupation specific and, therefore, similar to that obtained by using mean levels of schooling per occupation. Such a variable is likely to differ from the job-specific requirement, even if one uses a very detailed occupational analysis. The schooling requirements for police officers vary across police departments in the United States, and policemen with identical levels of schooling might be over- or undereducated, depending on the specific police department.

And last, whether the measure is based on job analysts' or union representatives' reports (DOT), or workers' self-report (PSID), there is no apparent reason to consider one as more objective than the other. I do not see any reason for a bias in workers' self-report for the amount of schooling their job requires. The data and the results reported in this article seem to support this assessment.

II. Notes on Variables Used in the Empirical Analysis

SCHOOLING = number of grades completed. This variable takes on values from 0 to 17.

EXPERIENCE = number of years worked since age 18. This question was asked only of new heads of households in 1975 and 1977–81. Experience was imputed for years in which it was missing in the following way. First, an individual was imputed to have a year of work experience if hours worked in that year were greater than 100. Then, years worked since age 18 were computed by counting backward or forward from a year in which the experience question was actually asked. Also, experience was considered missing if it was greater than AGE − EDUCATION − 5.

UNION MEMBERSHIP = 1 if the individual is a member of a labor union; 0 if not.

MARITAL STATUS = 1 if married; 0 if single, widowed, or divorced.

DISABLED = 1 if the individual indicates that he has a health problem that affects his ability to work; 0 if not.

WAGE MEASURE = reported hourly wage, on the main job, at the survey date (typically March), divided by the implicit price deflator for consumption expenditures. For hourly paid workers the number is given as reported. Salaried workers may report an hourly, weekly, monthly, or yearly quantity. This value is then transformed into an hourly measure. The variable does not include individuals paid by nonstandard methods such as piece work or profit sharing.

TRAINING = required training (RQT). In 1976 and 1978 waves, workers were asked the following question: "On a job like yours, how long would it take the average new person to become fully trained and qualified?" Minor modifications were made in the original reports in order to correct or delete clear errors.

Appendix C

Occupational Classification Used in the PSID and Ranked by the Level of Human Capital Required to Work in the Occupation (see App. D)

Two-Digit Classification

10 Physicians (medical and osteopathic), dentists
18 Judges, lawyers
11 Other medical and paramedical
14 Teachers, college; social scientists; librarian; archivists
15 Architects; chemists; engineers; physical and biological scientists
13 Teachers, primary and secondary schools
17 Public advisors
12 Accountants and auditors
20 Managers, officials and proprietors (except farm), not self-employed
19 Professional, technical, and kindred workers, not listed above
16 Technicians
45 Sales workers
31 Like 20 but self-employed (unincorporated businesses)
50 Foremen, not elsewhere classified

80 Farmers (owners and tenants) and managers
52 Government protective service workers (fire, police, marshals, and constables)
55 Members of the armed forces
40 Secretaries, stenographers, typists
51 Other craftsmen and kindred workers
41 Other clerical workers
61 Transport equipment operatives
62 Operatives, except transport
75 Other service workers
70 Unskilled laborers (nonfarm)
71 Farm laborers and foremen
73 Private household workers (not ranked, due to zero observations)

One-Digit Classification (Not Ranked)

10–19 Professional/technical and 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

The occupational codes are those used in the PSID.

Appendix D

Vertical Ranking of Occupations

Consider the following wage regression:

$$\ln(W_{ijt}) = X_{it}\beta + \alpha E_i + \tau \mathrm{PEXP}_{ijt} + \delta \mathrm{TEN}_{ijt} + \mu \mathrm{RQT}_{ijt} + \varepsilon_i, \quad \text{(D1)}$$

where

$X \equiv$ a vector of observed characteristics;
$E \equiv$ the worker's level of schooling;
PEXP $\equiv$ market experience prior to entry into the present occupation;
TEN $\equiv$ tenure in the occupation;
RQT $\equiv$ the amount of training the worker received in order to be fully qualified to work in the present occupation;
$i \equiv$ individual's index;
$j \equiv$ occupation index; and
$t \equiv$ time index.

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

$$HC_{ij} \equiv \alpha E_i + \tau \mathrm{PEXP}_{ijt} + \mu \mathrm{RQT}_{ijt}. \tag{D2}$$

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

$$HC_j = \frac{\sum_i HC_{ij}}{N_j}, \tag{D3}$$

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

$$DV_{kl} = HC_k - HC_l. \tag{D4}$$

Since tenure in occupation is not reported in the PSID, it was replaced by "tenure in position." The sensitivity of the vertical ranking to different functional forms and its correlation with other measures are discussed in Sicherman (1987*a*).

References

Becker, Gary S. *Human Capital.* New York: National Bureau of Economic Research (NBER), 1964.

Cain, Pamela S., and Treiman, Donald J. "The Dictionary of Occupational Titles as a Source of Occupational Data." *American Sociological Review* 46 (June 1981): 253–78.

Duncan, Greg J., and Hoffman, Saul D. "The Incidence and Wage Effects of Overeducation." *Economics of Education Review* 1, no. 1 (Winter 1981): 75–86.

Freeman, Richard B. *The Over-educated American.* New York: Academic Press, 1976.

Hartog, Joop. "Allocation and the Earnings Function." *Empirical Economics* 11, no. 2 (1986): 97–110.

Hartog, Joop, and Oosterbeek, Hessel. "Education, Allocation and Earnings in the Netherlands: Overschooling?" *Economics of Education Review* 7, no. 2 (1988): 185–94.

Mincer, Jacob. *Schooling, Experience, and Earnings.* New York: NBER, 1974.

———. "Over-education or Under-education?" Discussion Paper no. 248. New York: Columbia University, 1983.

Murphy, Kevin M., and Welch, Finis. "Wage Premiums for College Graduates: Recent Growth and Possible Explanations." *Educational Researcher* 18, no. 4 (May 1989): 17–26.

Rosen, Sherwin. "Learning and Experience in the Labor Market." *Journal of Human Resources* 7, no. 3 (Summer 1972): 326–42.

Rumberger, Russell W. *Overeducation in the U.S. Labor Market.* New York: Praeger, 1981. (*a*)

———. "The Rising Incidence of Overeducation in the U.S. Labor Market." *Economics of Education Review* 1, no. 3 (Summer 1981): 293–314. (*b*)

———. "The Impact of Surplus Schooling on Productivity and Earning." *Journal of Human Resources* 22, no. 1 (Winter 1987): 1–50.

Rumberger, Russell W.; Levin, Henry M.; and Tsang, Mun C. "The Impact of Surplus Schooling on Worker Productivity." Stanford Education Policy Institute Discussion Paper no. 86-SEPI-15. Stanford, Calif.: Stanford University, School of Education, November 1986.

Sicherman, Nachum. "Occupational Mobility and Human Capital Theory." Ph.D. dissertation, Columbia University, Department of Economics, 1987. (*a*)

———. "Over-education in the Labor Market." Working Paper no. 48. Chicago: University of Chicago, Center for the Study of the Economy and the State, August 1987. (*b*)

Sicherman, Nachum, and Galor, Oded. "A Theory of Career Mobility." *Journal of Political Economy* 98, no. 1 (February 1990): 169–92.

Spence, Michael. "Job Market Signaling." *Quarterly Journal of Economics* 87, no. 3 (August 1973): 355–74.

Thurow, Lester C. *Generating Inequality.* New York: Basic, 1975.

Tinbergen J. "On the Theory of Income Distribution." *Weltwirtchaftliches Archiv* 77 (1956): 156–75.

Tsang, Mun C., and Levin, Henry M. "The Economics of Overeducation." *Economics of Education Review* 4, no. 2 (1985): 93–104.

U.S. Department of Labor. *Handbook of Analyzing Jobs*, pp. 210–11. Washington, D.C.: U.S. Government Printing Office, 1972.