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by

Edward Lazear*

Many studies have shown that the acquisition of schooling has a beneficial effect on wage rates. Ben-Porath (1967), Hanoch (1967), Johnson (1970), Taubman and Wales (1973), Griliches (1974), Griliches and Mason (1972), Lazear (1975a, 1975b) and Mincer (1974), to name a few, all find that the returns to schooling (gross as well as net of costs) are positive where returns are measured in terms of wage increases. Up to this point, however, no one has investigated the relationship between current schooling and current wage rates. The study that comes closest to doing this is that of Parsons (1974). Parsons makes the point that individuals who attend school also tend to work fewer hours per week, i.e., hold "part-time" rather than "full-time" jobs. Since hours worked are negatively related to wage rates, it is contended that the cost of schooling is understated when investigators ignore the lower wage rates of students.[1] This story confuses two effects. It is really a description of the relationship between hours and wage rates (a supply curve, perhaps?) rather than one of the schooling effects on wages per se. This paper is an attempt to get at the second relationship. Casual observation seems to reflect a discontinuity in wage rate growth which occurs when an individual completes school and joins the labor force as a permanent member. This suggests that the time spent in work while attending school is in some sense secondary. Here, the marginal value of the individual's time is considerably lower than the average value of his time. When the individual leaves school, the marginal value of time jumps up to some higher level so that it is now closer to the average value. However, if the student can move to this higher margin at will, why has he not done so in the past? The problem is essentially one of "anti-complementarities" between the production of human capital through formal schooling and working in the primary occupation. More generally, the productivity of an individual's time in one endeavor is not independent of how the rest of his time is spent. If this is the case, students will be willing to accept lower paying jobs which do not greatly diminish the productivity of school time in lieu of jobs offering higher wages at the cost of a greater reduction in school time productivity. One can imagine, for example, that low effort jobs which do not greatly tax the worker's ability would leave a student in better condition to complete his homework than would jobs which required a great deal of concentrated thought or physical exertion. Alternatively, some jobs may allow the student time during work hours to read and complete homework.[2] Others allow more flexible hours of work. Students will be willing to accept lower wages for these jobs than for jobs which do not permit this kind of activity. As will be shown, the wages of students, other things constant, are about 12% lower than those of non-students. The magnitude of this wage differential is surprisingly large and warrants investigation on empirical grounds alone. This paper explores the empirical relationship and examines various explanations for it. Finally, implications of the analyses are discussed.

The point can be made more formally. Let us postulate that

$$W_t/W_t^* = e^{\beta(\Delta S_t)} \qquad (1)$$

where W_t is the individual's observed wage rate in cents per hour,

$W_t{*}$ is the individual's potential wage where potential relates to the amount that could be earned if the individual were indifferent to the effect of work on school productivity.[3] (Temporarily assume that general human capital in the form of on-the-job training equals zero.)

ΔS_t is the grade of schooling completed in period t+1 minus that completed in period t.

Suppose also that[4]

$$W_\tau{*} = A\ W_t{*} e^{\gamma(\tau - t)} \tag{2}$$

where A is a shift parameter invariant across individuals, but unique to the period t to τ, and γ is the wage growth rate which depends upon variables pertaining to the acquisition of human capital, changes in worked hours and perhaps demographic characteristics as race and marital status.

Substituting (1) into (2), one obtains

$$\frac{W_\tau}{e^{\beta \Delta S_\tau}} = A\ \frac{W_t}{e^{\beta \Delta S_t}} \cdot e^{\gamma(\tau - t)} \tag{3}$$

or

$$W_\tau = A\ W_t\ e^{\beta(\Delta S_\tau - \Delta S_t) + \gamma(\tau - t)} \tag{4}$$

where $\beta < 0$, $\gamma > 0$.

Let γ be a function of the following form

$$\begin{aligned}\gamma = \theta_0 + \theta_1\ S_t + \theta_2\ E_t + \theta_3\ (S_\tau - S_t) + \theta_4\ (E_\tau - E_t) \\ + \theta_5\ \text{Age} + \theta_6\ (M_\tau - M_t) + \theta_7\ (H_\tau - H_t) + \theta_8\ D\end{aligned} \tag{5}$$

where S_t is the highest grade of schooling completed in period t,

E_t is the number of years of work experience as of period t,

Age is chronological age in period t and

$(E_\tau - E_t)$ is the number of weeks worked between period τ and period t divided by 52,

M_t is the number of years of military experience as of year t,

H_t is usual hours worked per week in year t and

D is a dummy set equal to one for white individuals.

Substituting (5) into (4) and taking the log of both sides we may write

$$\ell_n W_\tau - \ell_n W_t = \beta_0 + \beta_1 (\Delta S_\tau - \Delta S_t) + \beta_2 S_t + \beta_3 E_t + \beta_4 (S_\tau - S_t) + \beta_5 (E_\tau - E_t) + \beta_6 \text{Age} + \beta_7 (M_\tau - M_t) + \beta_8 (H_\tau - H_t) + \beta_9 D \tag{6}$$

where $\beta_0 = \ell_n A + \theta_0$ and $\beta_1 = \beta$.

This relationship can be estimated easily.[5] The data come from the National Longitudinal Survey sample of young men 14-24 years old in 1966. The original sample had 5225 individuals. This number was reduced to 1424 to meet the following criteria: First, it was necessary for the purpose that individuals have wage rates reported in period t and τ (1966 and 1968).[6] Second, individuals who reported their wage rates as either less than 50 cents per hour or greater than 10 dollars were dropped on the grounds that reported wages were unlikely to be correct in those cases. Finally, observations were dropped for which there was incomplete information on variables used in this analysis.

Estimation of (6) by OLS yielded

$$\begin{aligned} \ell_n W_{68} - \ell_n W_{66} = & \underset{(.145)}{.92731} - \underset{(.02612)}{.10551} (\Delta S_{68} - \Delta S_{66}) \\ & - \underset{(.01218)}{.01597} S_{66} - \underset{(.00770)}{.01487} E_{66} + \underset{(.01918)}{.01409} (S_{68} - S_{66}) \\ & + \underset{(.02600)}{.06292} (E_{68} - E_{66}) - \underset{(.00753)}{.02695} \text{Age} + \underset{(.05240)}{.03526} (M_{68} - M_{66}) \\ & + \underset{(.00076)}{.00134} (H_{68} - H_{66}) - \underset{(.02603)}{.06206} D \end{aligned} \tag{7}$$

R^2 = .116

SEE = .4160

SSR = 244.733

The primary finding is that the coefficient on $(\Delta S_{68} - \Delta S_{66})$ is negative and significant. Dropping out of school causes an increase in observed wage growth because students receive lower wages than do non-students, even holding hours of work constant. The effect is large in an absolute sense. Equation (6) may be rewritten as

$$W_{68} - W_{66} = W_{66}\,[(e^{\beta_0 + \cdots + \beta_9 D}) - 1] \tag{8}$$

so that

$$\frac{\partial(W_{68} - W_{66})}{\partial(\Delta S_{68} - S_{66})} = W_{66}(e^{\beta_0 + \cdots + \beta_9 D})\,\beta_1 \tag{9}$$

Letting all variables assume their mean values except for D which is set equal to 1, and $(\Delta S_{68} - \Delta S_{66})$ which is set equal to -1, (9) becomes

$$\frac{\partial(W_{68} - W_{66})}{\partial(\Delta S_{68} - \Delta S_{66})} = -197.31\ [e^{.37300}]\ (.10551) \tag{10}$$

$$= -30.2$$

An individual who has completed one year of schooling between 1966 and 1967, but who did not attend school between 1968 and 1969 would anticipate a 30.2 cents increase in hourly wages as the result of dropping out of school in addition to the return from the year of schooling per se. This change amounts to about 15% of initial wages (or 12% of current wages)--a very significant component in the measurement of the price of time.

The importance of this effect is underscored by comparing it to the effect of a change in the stock of schooling. The size of the latter is given by

$$\frac{\partial(W_{68} - W_{66})}{\partial(S_{68} - S_{66})} = W_{66}\ [e^{\beta_0 + \cdots + \beta_9 D}]\ \beta_4 \tag{11}$$

$$= 4.037$$

for the variable values described above. Thus, the immediate effect of leaving school appears to be about 7-1/2 times the size of the immediate effect of attending school. This exaggerates the difference for two reasons. First, since $(\Delta S_{68} - \Delta S_{66})$ is held constant, β_4 is the effect of a change in the stock of schooling, given that the individual did not vary his school status between 1966 and 1968. But for the same reason that wages are unlikely to reflect the true potential productivity of student workers, wage growth is unlikely to reflect the true effect of schooling on the potential productivity of student workers. Instead, it reflects schooling's influence on productivity in the "secondary" job, which is understandably small.

Second, the effect of dropping out of school is a once-and-for-all effect whereas that of schooling acquisition may not be. For example, if the stock of schooling affects production of on-the-job training by more than it does current wages, regarding a change in schooling as a once-and-for-all phenomenon leads to an understatement of the magnitude of the true effect. It should be stated, however, that when the regression was run with multiplicative interaction terms between previous levels of schooling and experience and current acquisition of schooling and experience, no significant effect was observed.

Be that as it may, it has been established that independent of the effect of hours worked, individuals who are in school obtain lower (current) wages. It was suggested that this was partially the result of a conscious choice on the part of students who are willing to accept lower wages in order to conserve energy or maintain flexibility for human capital production. Alternative explanations can be examined.

First, one might argue that since schooling and simultaneous acquisition of on-the-job training are likely to be substitutes in the production of human capital, using observed wages biases the results. This is, in fact, likely to be the case, but the bias works in the opposite direction. That is, when an individual drops out of school and takes "real" employment, he may spend a greater proportion of his time investing in on-the-job training than he did when he was concurrently enrolled in school. If so, a smaller proportion of the total wages paid (including human capital) will be observed on his post-school job than was observed on his in-school job. This would imply that dropping out of school would have a negative effect on wage growth, i.e., β_1 should be positive. The fact that it does not implies that the effect is sufficiently large to swamp the upward bias on β_1.

An alternative explanation may be offered. It may be the case that schooling productivity is not a function of other time at all. Instead, schooling may be correlated with a geographical limitation on job search which causes individuals to experience a wage gain when this search constraint is lifted. For example, an environmental engineer specializing in tropical climates may find it difficult to obtain employment in his field while he is attending MIT. This explanation can be tested empirically. The NLS data contain information on the location of an individual's residence each time the survey is taken. One may therefore hold constant the effect of moving between 1966 and 1968 in order to isolate the effect of leaving school per se. Define G as a dummy set equal to one if the individual changes his residence between 1966 and 1968. The results of estimation with G are contained in Table 1. In regression (12), note that the effect of a change in residence enters significantly and is roughly of the same magnitude as the effect of dropping out of school. However, the effect of dropping out of school is essentially unchanged. Moving and dropping out of school both affect wage growth, but the effect of one does not replace that of the other. This can be seen more clearly by examining regression (13). The effects of schooling and moving imply that if an individual were to drop out of school and move, the resultant change in the log of wages

TABLE 1

THE EFFECT OF MOVING

Dependent Variable = $\ell n\ W_{68} - \ell n\ W_{66}$

Variable	Regression (12)	Regression (13)
S_{66}	-.01640 (.01216)	-.01626 (.01216)
E_{66}	-.01351 (.00772)	-.01392 (.00772)
Age	-.02745 (.00752)	-.02751 (.00752)
D	-.06256 (.02599)	-.06019 (.02604)
$(S_{68} - S_{66})$	.01763 (.01921)	.01616 (.01923)
$(E_{68} - E_{66})$	.06552 (.02600)	.06604 (.02595)
$(H_{68} - H_{66})$	.00133 (.00076)	.00133 (.00076)
$(M_{68} - M_{66})$	.03490 (.05232)	.03496 (.05230)
$(\Delta S_{68} - \Delta S_{66})$	-.10095 (.02615)	-.08949 (.02739)
G	.09380 (.04095)	.06825 (.04482)
$G(\Delta S_{68} - \Delta S_{66})$		-.10773 (.07698)
Constant	.9259 (.145)	.9255 (.145)
R^2	.119	.120
SEE	.4154	.4153
SSR	243.8	243.5

would be .0895 + .0682 + .1077 = .265 as opposed to .0895 without the move.[7]

Nor can we argue that lifting of the moving constraint equalizes wages across groups due to factor mobility. The results tell us that individuals who do not move experience a smaller wage increase upon graduation than those who do move. If the explanation for depressed student wages rested on something like a "glut" of student workers in the school's vicinity, lifting the moving constraint, i.e., graduation, should have no greater effect on those who leave than those who remain. Factor mobility would now guarantee that their prices should be equalized across communities. This result is not obtained. School leaving, coupled with a geographical move, produces more rapid wage growth than moving itself. This is probably because all movers also change jobs and job changing is the primary way by which one changes from a "secondary" to a "primary" worker. (This is discussed in more detail below.) Finally, the "glut" explanation of depressed student wages has problems on theoretical grounds as well. Although students may be constrained from relocating, in the long run, firms are not. One expects a tendency for firms to move to these "glutted" areas until wages per unit of productivity are equalized across areas.

Before moving on, however, there is one piece of evidence found which is quite consistent with the student glut hypothesis. If student gluts were important, one would expect the effects to show up more significantly in rural than in urban schools. Dropping out of an urban school should have no effect on wages since one could hardly argue, for example, that Columbia students glut the New York labor force. Thus, let U be a dummy equal to one for individuals whose 1966 and 1967 residences were in an SMSA. Regression (14) in Table 2 reveals that the effect of $(\Delta S_{68} - \Delta S_{66})$ is much smaller $\left(\underset{(.064)}{-.1968 + .1454 = -.0514}\right.$ for urban than rural workers. This suggests that school leaving is not as important for individuals who attend urban schools. This result is also consistent with the anticomplementarity explanation, however. Since students in rural schools are more likely to move upon graduation, they are also more likely to undertake the job switch through which the effort or flexibility change occurs.

It is interesting to ask whether movers are intrinsically different from non-movers. It can be argued, for example, that individuals who have a relative preference for risk will be more inclined to move since changing location offers a higher expected wage at the price of a higher variance in the potential wage.[8] This proposition is testable and can be distinguished from the hypothesis that movers are higher quality workers who are able to acquire human capital more efficiently. If the latter is the case, moving between 1968 and 1969 will have the same effect on wage growth between 1966 and 1968 as will moving during the two-year period. On the other hand, if movers are in fact paid a premium for moving which is unrelated to their "quality," but rather to their willingness to take risk, a move between 1968 and 1969 should have no effect on wage growth previous to 1968. Table 2, regressions (15),(16) and (17) contain these results.

The MOVED dummy which is set equal to one for individuals who changed residence between 1968 and 1969 does not enter significantly into the regression, nor is there any effect on the other coefficients when the sample is split up into movers (MOVED = 1) and non-movers (MOVED = 0). (The $F(10, 1404)$ is computed to be 1.205.) These findings suggest that the quality explanation of movers' wage growth is invalid. Instead, the premium to moving is a direct payment made to individuals who are willing to take risk and bear the costs of dislocation.

The most difficult alternative explanation to refute is that the causality runs from high wages to school leaving rather than from the reverse. That is, the negative $(\Delta S_{68} - \Delta S_{66})$ coefficient reflects the fact that when an individual

TABLE 2

MOVERS AND NON-MOVERS

Dependent Variable = $\ell n\ W_{68} - \ell n\ W_{66}$

Variable	Regression (14)	Regression (15)	Moved = 1 Regression (16)	Moved = 0 Regression (17)
S_{66}	-.01593 (.01216)	-.01602 (.01218)	-.01847 (.04042)	-.01779 (.01274)
E_{66}	-.01521 (.00768)	-.01417 (.00771)	-.006041 (.02580)	-.017067 (.00806)
Age	-.02619 (.00751)	-.02703 (.00754)	-.04367 (.02322)	-.02324 (.00797)
D	-.06115 (.02596)	-.06249 (.02605)	-.17056 (.08805)	-.04905 (.02722)
$S_{68} - S_{66}$	.01511 (.01917)	.01427 (.01919)	.02961 (.05898)	.01859 (.02031)
$\Delta S_{68} - \Delta S_{66}$	-.19678 (.04053)	-.10448 (.02619)	-.17927 (.07727)	-.09126 (.02801)
$U(\Delta S_{68} - \Delta S_{66})$	.14538 (.04958)			
$E_{68} - E_{66}$	.06188 (.02584)	.06292 (.02600)	.12324 (.08476)	.05252 (.02704)
$H_{68} - H_{66}$	.00141 (.00076)	.00136 (.00076)	.00283 (.00227)	.00103 (.00081)
$M_{68} - M_{66}$	.03314 (.05228)	.03538 (.05241)	-1.3352 (.7165)	.04416 (.05187)
Moved		.01857 (.03419)		
U	-.01779 (.02367)			
Constant	.9241	.92663	1.286	.8845
R^2	.123	.116	.201	.109
SEE	.4146	.4161	.4566	.4101
SSR	242.8	244.68	33.35	209.3
N	1424	1424	170	1254

receives a high wage offer, he is more likely to leave school. There is, however, no necessity that the individual leave school to accept the job. He could just as well "leave" leisure. Put differently, the fact that employers often discourage their employees from simultaneous attendance of school reflects their belief that school attendance adversely affects current productivity at work. Neither employers nor workers are indifferent with respect to the way in which employees' off time is spent. Thus, in order for the reverse causality argument to hold, one must implicitly believe that there is a reason why an individual leaves school rather than leisure. The explanation offered here is that of time anticomplementarities. Evidence below on summer employment sheds additional light on this question.

It is interesting to look at the actual mechanism through which the cross-productivity effect works. The stylization contained in earlier paragraphs was that individuals take low effort or highly flexible jobs while currently attending school and then switch to higher effort, less flexible, higher paying jobs upon graduation. Job changing is therefore considered. Define J as a dummy equal to one when the first post-school job is the same as the school-time job.[9] First, only 11% of those who left school and were working during school had the same post-school job,[10] i.e., had J = 1. Second, regression (19) in Table 3 reveals that individuals who drop out of school, but remain in the same job, experience a partial effect on $\ell n\ W_{68} - \ell n\ W_{66}$ of $-.102 + .116 - .028 = -.014$. Those who switch jobs upon graduation expect a partial change of .116. This suggests that incompatibilities between work and school operate through the types of jobs an individual chooses. School leaving, when accompanied by a job switch, results in little wage change. Caution must be exercised, however, when interpreting the result since the coefficients on J and $J(\Delta S_{68} - \Delta S_{66})$ are not jointly significant.

TABLE 3

JOB CHANGING

Dependent Variable = $\ell n\ W_{68} - \ell n\ W_{66}$

Variable	Regression (18)	Regression (19)
S_{66}	-.01300 (.01240)	-.01232 (.01241)
E_{66}	-.01407 (.00773)	-.01446 (.00773)
Age	-.02709 (.00753)	-.02705 (.00753)
D	-.06239 (.02603)	-.06156 (.02603)
$S_{68} - S_{66}$	.01543 (.01920)	.01552 (.01920)
$\Delta S_{68} - \Delta S_{66}$	-.10510 (.02611)	-.11639 (.02746)
$E_{68} - E_{66}$	.06240 (.0260)	.06188 (.0260)
$H_{68} - H_{66}$	.00131 (.00076)	.00123 (.00076)
$M_{68} - M_{66}$	.03847 (.05245)	.03796 (.05244)
J	.03892 (.03093)	.02837 (.03193)
$J(\Delta S_{68} - \Delta S_{66})$		.10275 (.07752)
Constant	.9024 (.146)	.8929 (.147)
R^2	.117	.118
SEE	.4159	.4158
SSR	244.5	244.2
N	1424	1424

TABLE 4

SUMMER WORKERS

Dependent Variable = $\ell n\ W_{68} - \ell n\ W_{66}$

Variable	Regression (20)	Regression (21)
S_{66}	-.01884 (.01217)	-.01910 (.01216)
E_{66}	-.01572 (.00768)	-.01560 (.00768)
Age	-.02725 (.00751)	-.02697 (.00750)
D	-.05931 (.02596)	-.05829 (.02594)
$S_{68} - S_{66}$	.00645 (.01926)	.00651 (.01924)
$E_{68} - E_{66}$	.10528 (.02891)	.10535 (.02891)
$H_{68} - H_{66}$	.00114 (.00076)	.00113 (.00076)
$M_{68} - M_{66}$	.03805 (.05223)	.03806 (.05219)
$\Delta S_{68} - \Delta S_{66}$	-.12290 (.02656)	-.13102 (.02694)
R	.17432 (.05318)	.18420 (.05344)
$R(\Delta S_{68} - \Delta S_{66})$		.24851 (.1412)
Constant	.8889 (.145)	.8841 (.145)
R^2	.1222	.1242
SEE	.4146	.4143
SSR	242.9	242.4
N	1424	1424

Some of the individuals who worked during school did so during the summer only. If the effect being picked up by the coefficient on $(\Delta S_{68} - \Delta S_{66})$ relates to an optimal effort or flexibility allocation between work and school, one would expect that school leaving would have a smaller effect for those whose in-school job was worked during the summer only. That is, summer workers are less likely to save effort for use at school since they are not simultaneously attending school. This prediction does not result from the reverse causality explanation. Regression (21) in Table 4 bears this out. R is a dummy equal to one when the school job is worked during the summer only. The effect of school leaving and having been employed during the summer is .1310 + .1842 - .2485 = .0667 compared to .1310 for individuals who were not in the summer only group.[11] This finding lends support to the incompatibility hypothesis. Also note that correcting for summer jobs makes the effect of experience $(E_{68} - E_{66})$ much more important. This suggests that summer jobs produce less on-the-job training than other jobs--a hardly surprising result.

A restriction may be placed on the value of the coefficients in (6). It is known that in the absence of direct costs, the marginal cost of a year of schooling in year t is

$$C_t = HW_t - \left(\frac{\partial W_t}{\partial \Delta S_t} \cdot \frac{\partial \Delta S_t}{\partial S_t}\right) T = HW_t - \frac{\partial W_t}{\partial \Delta S_t} \cdot T \tag{22}$$

where H is the number of hours of school attendance (per year) and T = 8760 is the number of hours per year. The second term on the right-hand side of (22) is the effect that attending school has on depressing the productivity of time during that period.[12]

The marginal returns to an additional year of schooling in year t are

$$R_t = \int_{t+1}^{N} T \frac{\partial W_\theta}{\partial S_t} \Big|_{\Delta s_t \ldots} e^{-r\theta} \, d\theta \tag{23}$$

where N is the age at retirement and it is assumed that schooling is sufficiently general human capital to cause a like increase in the productivity of time in all uses. Further, assume for simplicity that $\frac{\partial W_\theta}{\partial S_t}$ is the same for all $t < \theta \leq N$.

From (6) we know that

$$(24) \qquad W_t = A\, W_{t-1}\, e^{[\theta_0 + \beta_1 (\Delta S_t - \Delta S_{t-1}) + \beta_2 S_{t-1} + \ldots \beta_9 D]}$$

so that

$$(25) \qquad \frac{\partial W_t}{\partial S_t} \Big|_{\Delta S_t} = \beta_4 W_t$$

(since $\Delta S_{t-1} = S_t - S_{t-1}$) and

$$(26) \qquad \frac{\partial W_t}{\partial \Delta S_t} = \beta_1 W_t \quad .$$

Substituting (24) into (22) gives

$$(27) \qquad R_t = \int_{t+1}^{N} T\, \beta_4 W_t\, e^{-r\theta}\, d\theta \; .$$

In equilibrium, the marginal cost of schooling must equal the marginal returns to schooling. Thus, in the final year of schooling, it is true that

$$(28) \qquad \int_{t+1}^{N} T\, \beta_4\, W_t\, e^{-r\theta}\, d\theta = HW_t - \beta_1\, W_t\, T$$

where the right-hand side is obtained by substituting (26) into (22). Note that this relationship holds only for the final unit of schooling since the previous units are expected to yield a return greater than the cost and thereby increase wealth. Only for the final unit of schooling is the individual indifferent between investing and not investing.

Equation (28) can be rewritten as

(29)
$$\left.\frac{T\ \beta_4\ W_t\ e^{-r\theta}}{-r}\right|_{t+1}^{N} = (H - T\ \beta_1)W_t$$

or

$$\frac{T\ \beta_4\ (e^{-r(t+1)} - e^{-rN})}{r} = H - T\ \beta_1$$

so that

$$\beta_4 = \frac{r(H - T\ \beta_1)}{T(e^{-r(t+1)} - e^{-rN})}$$

or

(30)
$$\beta_4 = \frac{r}{e^{-r(t+1)} - e^{-rN}} \cdot \frac{H}{T} - \frac{r\ \beta_1}{e^{-r(t+1)} - e^{-rN}} \ .$$

If H = 1500, T = 8760, r = .10, t+1 = 20, and N = 65, then (30) becomes

(31)
$$\beta_4 = .0583 - .3409\ \beta_1 \ .$$

The restriction is testable and the restricted version of the model is estimated below.

Table 5 contains the results of regressions on groups of individuals for whom the observed year of schooling was and was not the marginal year. (The marginal year is defined as a year of schooling which is followed by a year of non-school attendance.) Regressions (33) and (35) impose the linear constraint that $\beta_4 = .0583 - .3409\ \beta_1$, while regressions (32) and (34) are unconstrained. The result is that for the group for which the current year of schooling is the marginal year, the constrained estimates do not differ significantly from the unconstrained ones. Thus the constraint appears to be valid for this group. In addition, for the group which is attending a non-marginal year of school, there is a significant difference between the constrained and unconstrained estimation as one would expect. (The two F-tests yielded, respectively, $F(1,127) = .362$;

TABLE 5

Restricted Estimation: $\beta_4 = .0583 - .3409\ \beta_1$

Dependent Variable = Variable	Sample = Margin: Regression (32) $(\ell nW_{68}-\ell nW_{66})$	Sample = Margin: Regression (33) $(\ell nW_{68}-\ell nW_{66})$ $-.0583(S_{68}-S_{66})$	Sample = Non-Margin: Regression (34) $(\ell nW_{68}-\ell nW_{66})$	Sample = Non-Margin: Regression (35) $(\ell nW_{68}-\ell nW_{66})$ $-.0583(S_{68}-S_{66})$
66	.06499 (.05484)	.07769 (.05049)	-.02257 (.01280)	-.02244 (.01284)
66	-.07041 (.05668)	-.06734 (.05631)	-.01514 (.00787)	-.01465 (.00789)
ge	-.06424 (.03222)	-.06209 (.03194)	-.02538 (.00777)	-.01888 (.00747)
	-.03885 (.08577)	-.03937 (.08549)	-.06420 (.02750)	-.07841 (.02716)
$_{68}-S_{66}$	.02343 (.08848		.01758 (.02036)	
$_{68}-\Delta S_{66})$	-.07736 (.07942)		-.09551 (.02876)	
$_{68}-E_{66})$	.11492 (.07020)	.10868 (.06916)	.05564 (.02860)	.08580 (.02652)
$_{68}-H_{66})$	-.00089 (.00217)	-.00069 (.00214)	.00170 (.00082)	.00190 (.00082)
$_{68}-M_{66})$	1.82 (5.41)	1.48 (5.37)	.03492 (.05233)	.02872 (.05245)
$_{68}-\Delta S_{66})$ 3409$(S_{68}-S_{66})$		-.04910 (.06390)		-.04314 (.02265)
nstant	.60326	.36589	.98613	.78900
	.120	.0990	.11809	.07460
E	.4242	.4232	.4154	.4167
R	22.85769	22.92289	220.28701	221.87972
	137	137	1287	1287

$F(1,1277) = 8.65$.) On closer examination, however, one finds that the signs go the wrong way! For the non-marginal investment group, it turns out that β_4 is significantly <u>less</u> than $.0583 - .3409\ \beta_1$ rather than significantly greater. The phenomenon discussed above can also be called upon to explain this finding. Since individuals who are not in the marginal group and have positive values for $S_{68} - S_{66}$ are necessarily enrolled in school in 1968, their wages reflect productivity in their secondary job. For the reasons discussed above, one would not expect schooling to affect wages in the secondary job in the same way that it will affect wages when school attendance is complete. Thus, the schooling coefficient understates the true effect of schooling more for this group than for the "margin" group. If the findings that $\beta_1 \approx -.11$ are correct, the constraint would imply that $\beta_4 \approx .095$. This number is not an unreasonable marginal "rate of return" to schooling.

The notion of the anticomplementarity between work and schooling can be extended. It has been observed that women earn lower wages than do their male counterparts having similar experience and schooling characteristics.[13] Since, as an institutional fact, women are more likely to produce home-related commodities (as child raising, cooking, etc.), they may optimally choose to take less demanding, more flexible jobs which offer lower salaries. This does not suggest that no discrimination exists, or that discrimination does not cause the relative concentration of women in the production of home-type goods. It simply allows that given the constraints, part of the difference between male and female wages results from optimization which depends primarily on the nature of non-market time.

Another extension relates to moonlighting. If an individual spends his non-worked hours in work rather than in leisure, one might expect that his wage rate would be lower on his primary job. Define T_{66} as a dummy equal to one if the individual kept one job throughout 1966, but at some time during 1966, was also employed on another job. Similarly define T_{68}. Since moonlighting in 1966 should depress initial wages while moonlighting so in 1968 depresses final wages, in the wage growth context, the sign on T_{68} should be negative while that on T_{66} should be positive. The results are shown below:

(36)
$$\begin{aligned} \ell_n W_{68} - \ell_n W_{66} = & \underset{(.147)}{.9487} - \underset{(.01221)}{.01670}\, S_{66} - \underset{(.00771)}{.01498}\, E_{66} \\ & - \underset{(.00755)}{.02732}\, \text{Age} - \underset{(.02607)}{.06106}\, D \\ & + \underset{(.01919)}{.01423}\, (S_{68} - S_{66}) + \underset{(.02652)}{.06110}\, (E_{68} - E_{66}) \\ & + \underset{(.00076)}{.00132}\, (H_{68} - H_{66}) + \underset{(.05250)}{.03504}\, M_{68} - M_{66} \\ & - \underset{(.02615)}{.10489}\, (\Delta S_{68} - \Delta S_{66}) - \underset{(.03111)}{.02761}\, T_{68} \\ & + \underset{(.03004)}{.00279}\, T_{66} \end{aligned}$$

$R^2 = .116$

SEE = .4162

SSR = 244.6

N = 1424

Although both signs on T_{68} and T_{66} are as predicted, neither is significant. No support of an important moonlighting effect is present.

Implications

The most obvious implication of the previous analysis is that the cost of schooling is seriously understated when foregone earnings are assumed to be equal to the wage rates multiplied by hours of school. This is true for two reasons: First, the observed wage rate does not include payment in human capital. (This issue is discussed more thoroughly in Lazear (1975a).) Second, even if total payment were measured "correctly," this would understate the true potential wage rate since marginal productivity, and therefore the wage rate, is a function of how an individual spends the rest of his time. Nor is this latter effect second order in magnitude. Foregone observed wages in 1968 were, at the mean, equal to \$2.51 per hour. It was shown that by dropping out of school, an individual's hourly wage rate would rise by about 12 to 15%.

The point may be generalized. Once it is recognized that the level of school time affects the productivity of work time, it is not difficult to imagine that other activities affect the value of time in alternative activities. The effect may be positive as well (e.g., sleep increasing the value of time used at work). This suggests that employers will be somewhat paternalistic and will take an active interest in how the worker spends his non-market time. It also suggests that governmental programs such as the establishment of child care centers may have beneficial effects on GNP which are understated by the wage rate based calculations. Similarly, programs geared toward increasing the value of an individual's leisure may also indirectly affect his ability to produce while on-the-job. The notion of complementarities between various uses of time is not an especially surprising one. What is important, however, is that these complementarities (or anti-complementarities) have been shown, in the case of schooling and work, to be quite important in magnitude.

A second and related implication is that estimates of the returns to schooling depend upon the age range of the group in question. For example, if one were looking at very young workers, the effect of schooling tends to be understated for two reasons: First, as already mentioned, schooling may not have as large an impact on wages in jobs which are regarded as secondary. Since most young workers are attending school simultaneously, their wage rates do not truly reflect the schooling effect. Second, since dropping out of school causes an increase in the observed wage rate, and since at very young ages it is only the individuals with relatively few years of schooling who drop out of school, less schooled workers (using a cross-sectional approach) will be observed to have artificially higher wages, relative to highly schooled workers which biases downward estimates of the returns to schooling. In a wage growth context, the schooling coefficient is biased upward when those who experience positive changes in schooling are on net school leavers rather than school returners.

A final implication is an empirical one. If there are systematic biases such that the observed wage rate is a greater understatement of the true price of time for individuals who are currently enrolled in school, a categorization which lumps all individuals into a group, irrespective of school status, is likely to mislead investigators.

Summary

This paper shows that, other things constant, students' wage rates are about 88% that of non-students. An explanation which operated through the "anticomplementarity" of school and work was offered, but the emphasis of the paper remains empirical. The magnitude of the student differential is large and significant. It varies significantly between urban and rural environments. Other findings were:

1. Moving positively affects wage growth, but school leaving increases wages even in the absence of a move. Furthermore, the return to moving is a direct one: it does not result from intrinsic differences between movers and non-movers.

2. It appears that 89% of students who work, change jobs upon graduation and that capturing the return to school leaving may depend crucially upon the switch.

3. Individuals are not as likely to desire low effort jobs if they only work during school vacations. Furthermore, it seems that less human capital is produced in summer jobs than in less temporary employment.

School attendance does depress wages, but it appears to be the result of an optimal allocation of effort and time flexibility between labor and learning.

FOOTNOTES

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1. The positive relationship between hours and wage rates is presumably a reflection of employer preferences rather than the normal supply of labor response.

2. This situation differs from the first somewhat in that here school time and work time are incorrectly measured. I.e., part of the time spent at the work place is school time so that the observed hourly wage understates the true hourly wage.

3. The effect of taking an easier job on the margin must cause the wage rate to be reduced by the same amount as the value of time used in the production of human capital is increased. If not, the individual would continue past (or stop short of) this point of job effort reduction.

4. See Lazear (1975a) for a more complete discussion of this specification.

5. Dummy variables for presence in school in 1968 and 1966 could be used instead of ΔS_{68} and ΔS_{66}. The regressions were run with the replacement and the obtained results were virtually identical.

6. Data are contained on 1969, but the analysis below requires information from year $\tau + 1$.

7. This difference is jointly significant at the 5% level.

8. R. Hall (1972) discusses the point in the context of unemployment differences across cities.

9. "Same" is defined as having the same employer and reported occupation in both jobs without an interruption in employment.

10. Since most individuals leave school in June, and the survey is taken in October, the duration between school leaving and the date of the post-school job is for the most part four months.

11. The joint test for significance of R and $R(\Delta S_{68} - \Delta S_{66})$ yielded an $F(2,1412) = 6.8$.

12. This assumes that the effect of ΔS on all units and types of time throughout the period is the same.

13. See, for example, Landes (1974). She finds that other things equal, women receive wage rates which are only 16% lower than men's wage rates.

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