

Preliminary

INFORMATION, SCREENING  
AND  
HUMAN CAPITAL\*

by

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John Riley

"I screen, You screen.

We all screen for I screen."

--Anonymous.

Central to human capital theory is the notion that an individual can, by foregoing earnings, augment the quality of his labor services in such a way as to raise his future market value. As perceived in the well-known studies by Becker and Mincer (1962), this augmentation takes place initially at school and is then continued in the form of on-the-job training.

Subsequent development of more refined theoretical models (Ben-Porath, Rosen, et al.) and of much larger data files, has served to strengthen greatly the Becker-Mincer view. This in turn has helped to stimulate the large amount of current research into the nature and extent of human investment decisions.<sup>1</sup>

Given the continuing interest in this area, it is somewhat surprising that there has, until recently, been little analysis of how information about an individual's productivity is transmitted to potential buyers of his services. Of course Stigler's 1962 discussion of information and search has led, over the last dozen years, to a much better understanding of decision-making by job seekers when there is imperfect information about available wage offers. However, it is only since Spence's work on "signaling" that decision-making by employers in the absence of full information about productivity levels, has been brought into focus.

Certainly in all the theoretical modelling of human capital accumulation it has been assumed implicitly that at each point in the life cycle potential employers are aware of an individual's marginal value product. That is, "traditional" human capital theory has included an assumption that information costs are negligible.

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<sup>1</sup>For a brief summary of recent theoretical and empirical advances, see F. Welch.

However, it is by no means clear that a firm can cheaply evaluate the productivity of an individual worker, especially when the nature of the job is non-specific (e.g., the management trainee). Equally important it is far from obvious that many of those entering the work force have tight prior probabilistic beliefs about their own lifetime productivity. If one accepts that the transmission of such information is expensive, it is necessary to ask how the transmission takes place.

Supposing firms spend resources to determine productivity, one might be tempted simply to reinterpret an estimated earnings function as a measure of marginal value product net of information costs. But if all other firms were incurring such expenditures, the earnings function would itself provide an unbiased estimate of individual productivity. Therefore by introducing an appropriate schooling requirement the smart employer could obtain on average the quality of worker he desired without incurring the costs of direct observation.

This leads naturally to the question of whether the earnings function might continue to fulfil this predictive role, for employer and employee alike, if all firms were to so use it. The initial study of this issue by Spence suggested that such an "informational equilibrium" would be sustained in a competitive environment. However, recent papers by Riley, and Rothschild and Stiglitz have indicated that the equilibrium question is a very delicate one. Some tentative conclusions are drawn in Section I.

Given the assumption of costly information transmission, the concept of an informational equilibrium is appealing. With sufficiently high direct testing costs every individual would be paid the average of all marginal products unless there were some alternative method of transmitting information about job skills. But such an alternative is available if progress at school is faster for those with higher productivity. The latter are then able to "signal" their talents by way of greater educational achievement. Just as in the traditional human capital model, each individual has an incentive to increase his educational capital until the market valuation of a further marginal investment is just offset by the marginal costs. This incentive remains even if education does not directly affect productivity. For this extreme case the role of educational investment is purely redistributive, with those of high productivity gaining at the expense of those with lesser talents.

It seems unfair however to characterize the above view as "the" screening model. Instead "screenists" would argue that education has two important roles: one being the traditional productivity role and the other the information transmission effect.

In section II, it will be argued that the usual earnings function approach employed by human capital theorists cannot shed light on the relative importance of these two roles. The potential gains to finding methods of directly measuring job productivity are also examined. Then in section III several recent attempts to test for the presence of screening are criticised. Finally in section IV two alternative tests of the screening hypothesis are suggested.

I. On the existence of Informational Equilibria.

As noted above, the question of whether there necessarily exist competitive equilibria in which information about quality is transmitted via prices has been a controversial one. In Spence's original contribution to the theory of information transmission in labor markets, two necessary conditions for equilibrium were introduced.

- c-1. Each job seeker facing some given set of contracts (that is, wage offers with associated minimum education requirements), chooses that which maximizes his own welfare.
- c-2. The gross income associated with any operative contract (that is, signed by at least one worker) must equal the mean of the marginal value products of those accepting.

Spence showed that in general there were infinitely many sets of contracts satisfying these two conditions, and that alternative sets could be ranked according to the Pareto criterion. However he did not give full consideration to the potential role of firms. It has since been shown by the present writer that with even simple extrapolative experimentation by firms, all but the Pareto-dominating member of the Spencian family of "equilibria" have a tendency to unravel. Moreover, sophisticated behaviour by firms may result in the unravelling of even the Pareto-dominating member. Formally there may be no set of contracts satisfying the following Nash equilibrium condition and c-1, c-2.

c-3. There exists no alternative contract which, if offered by any one firm, would yield that firm strictly positive profits.

Under the usual assumption of human capital theory that individual productivity is continuously distributed, it can be shown that there is no Nash equilibrium. It is therefore tempting to jump to the conclusion that one should expect to observe periodic breakdowns of any screening "equilibrium." Certainly this would provide a useful test!

However, c-3 may be unnecessarily strong since any firm exploiting it must also fear the reaction of other firms. This idea can be formalized in the following weaker "reactive-equilibrium" condition.

c-4. There exists no alternative contract which, if offered by any one firm would yield that firm positive profits and which does not result in losses if (at least) one other firm responds by choosing from among alternative profitable set of contracts.

It should be noted that arbitrary threats are excluded by the requirement that the revised contracts of a second firm must yield profits to that firm. This seems appropriate in the context of large numbers of competing firms.

Given that in the skilled labor market individuals are very often implicitly signing long term contracts, it is necessary for each firm to develop a reputation about its salary structure, the opportunities for on-the-job training, etc. It therefore seems unlikely that any one firm could make a "quick killing" by switching to a contract offer which yields only short run gains. Then at least for this application of the screening model c-4 is perhaps sufficiently strong to yield an equilibrium.

For the model developed by Spence (and the human capital model of the following section) it can be shown that the Pareto-dominating member of the Spencian family of contract sets is the unique set satisfying c-1, c-2 and c-4.

Preliminary analysis suggests a similar conclusion holds for the wider class of screening models discussed by Stiglitz. Indeed it is my conjecture that whenever there exist potential methods of screening for unobserved

quality differentials EITHER there is a Nash equilibrium OR there is a Reactive equilibrium. Unfortunately screening theory at present consists of a wide variety of rather primitive models. Relating these models in a general framework would be a useful starting point for further consideration of the equilibrium question.

We now consider a simple human capital model with screening.

## II. Information Transmission via Educational Achievement

Given the natural primary interest of theorists in questions about the existence, uniqueness and efficiency of screening equilibria it is perhaps not very surprising that there has been no serious attempt to formulate a potentially testable model of some specific market in which screening may be important. Even in the discussions of labor market informational equilibria by Arrow, Spence, Stiglitz and the present author, the models analysed do not consider opportunity costs in more than a rudimentary manner. It therefore seems important to develop a human capital model with screening which incorporates such costs at more nearly the level of sophistication of the traditional human capital models. Certainly the model to be presented remains greatly over-simplified but despite this it will hopefully shed light on two critical issues. First what are the empirical implications of labor market screening and second, how costly is this transmission process in terms of output foregone?

Suppose the value of individual productivity  $m$  discounted to time  $t$  depends upon some unobservable characteristic  $n$  and educational achievement  $z(t)$  achieved prior to entering the labor market.<sup>2</sup>

$$(1) \quad m(t) = m(n, z(t)) \quad m_n, m_z > 0$$

Those with higher values of the unobservable characteristics are also assumed to be able to attain any given level of educational achievement,  $z$ , more quickly, that is:

$$(2) \quad z = z(n, t) \quad z_n, z_t > 0$$

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<sup>2</sup>It is simplest to think of  $m$  as the discounted value of an individual's marginal productivity over all points in the life cycle, where the profile of the latter, for any given level of  $n$  and  $z$  is determined exogenously. However  $m$  may also be interpreted as the solution of an on-the-job human-capital optimization problem.

Suppose further that firms are unable to observe  $m$  at the time of hiring. Instead they base their hiring decision entirely upon observable characteristics in this case education. Those with higher levels of  $z$  are offered higher lifetime wage offers  $w(z(t))$  where  $w$  is the value of wages discounted to time  $t$ .

An individual of type  $n$ , born at time zero and staying in school until time  $t$ , has present value of lifetime income  $e^{-rt} w(z(t))$  where  $z = z(n, t)$ . The necessary conditions for maximizing choice of  $t$  are therefore:

$$(3) \quad -r + \frac{w'(z)}{w(z)} \frac{\partial z}{\partial t} = 0$$

$$(4) \quad \frac{\partial}{\partial z} \left( \frac{w'}{w} \right) \left( \frac{\partial z}{\partial t} \right)^2 + \frac{w'}{w} \frac{\partial^2 z}{\partial t^2} \leq 0$$

Differentiating (3) with respect to  $n$  yields

$$\left[ \frac{\partial}{\partial z} \left( \frac{w'}{w} \right) \left( \frac{\partial z}{\partial t} \right)^2 + \frac{w'}{w} \frac{\partial^2 z}{\partial t^2} \right] \frac{dt^*}{dn} + \left( \frac{w'}{w} \right) \frac{\partial^2 z}{\partial n \partial t} = 0$$

From (3)  $\frac{w'}{w}$  is strictly positive. Therefore as long as those with higher  $n$  are more efficient in their use of an additional year for educational development ( $\frac{\partial^2 z}{\partial n \partial t} > 0$ ), it follows immediately that:

$$\frac{dt^*}{dn} > 0 \quad \text{and hence that} \quad \frac{dz^*}{dn} > 0$$

Thus those more favorably endowed with the unobservable characteristic  $n$  attain higher educational credentials and stay in school longer.

Of course (3) and (4) are not sufficient for an informational equilibrium. We must also satisfy condition 2 of the previous section. That is, the gross income of those choosing an educational level  $z(t)$  must equal their marginal value product.

$$(5) \quad w(z(t)) = m(n, z(t))$$

In principle one can eliminate both  $n$  and  $t$  from (3), using (2) and (5) and thereby obtain the first order differential equation

$$w'(z) = f(w, z).$$

Hence there are a whole family of wage profiles  $w = w(z, k)$  satisfying all the above necessary conditions. However, as noted in the previous section only one member of the family also satisfies c-4. This has the property that those at the bottom of the distribution of  $n$  ( $n = n_0$ ) choose to stay in school exactly as long as they would if  $m$  were observable.

There is an appealing intuitive argument as to why this should be the case. In contrast to those elsewhere in the distribution, those on the "bottom rung" have no one lower down the ladder from whom they must be distinguished in order to earn a higher income.

That everyone else stays in school longer if education is used as a screen is also easy to demonstrate. Differentiating (5) totally with respect to  $t$  and substituting into (3) yields

$$(6) \quad -r + \frac{m}{z} \frac{\partial z}{\partial t} = - \frac{m}{n} \frac{\partial z}{\partial t} \frac{dt^*}{dn}$$

$$< 0 \quad \text{for } n > n_0$$

If  $m$  were observable individuals would choose  $t$  in order to maximize  $e^{-rt}m$ , that is, a value of  $t$  such that the left hand side of (6) were zero.

We next introduce the specific functional forms  $z(n, t) = n^\alpha t^\beta$  and  $m(n, z) = nz^\gamma$ . From (5) we then have

$$(7) \quad w = nz^\gamma = z^{(1 + \alpha\gamma)/\alpha} t^{-\beta/\alpha}$$

Also the differential equation (3) reduces to

$$(3)' \quad -r + \frac{w'}{w} \frac{\beta z}{t} = 0$$

Eliminating  $t$  using (7) we then have the easily integrable equation:

$$w^{\alpha/\beta - 1} w'(z) = \frac{r}{\beta} z^{(1 + \alpha\gamma)/\beta - 1}$$

Integrating then yields

$$(8) \quad w^{\alpha/\beta} = k_0 + \frac{r}{\beta} \left( \frac{\alpha}{1 + \alpha\gamma} \right) z^{(1 + \alpha\gamma)/\beta}$$



where  $k_0$  is determined by the requirement that those at the bottom of the distribution are exactly as well-off as if  $m$  were freely observable.<sup>3</sup>

Eliminating  $z$  from equations (7) and (8) yields

$$(9) \quad \ln w = \frac{\beta}{\alpha} \ln k_0 - \frac{\beta}{\alpha} \ln \left( 1 - \frac{r\alpha}{1 + \alpha\gamma} t \right).$$

Then

$$\ln w \approx \frac{\beta}{\alpha} \ln k_0 + \left( \frac{\beta}{1 + \alpha\gamma} \right) rt$$

If there were no on-the-job training, earnings at age  $t + \tau$  would be proportional to  $w$ . More generally, with earnings first rising and then falling, any earnings profile can, to a first approximation, be related to lifetime income according to

$$E(t + \tau) = \exp(\lambda\tau - \mu\tau^2) w(t)$$

Substituting into (9) we then have the following reduced form:

$$(10) \quad \ln E(t + \tau) \approx \frac{\beta}{\alpha} \ln k_0 + \left( \frac{\beta}{1 + \alpha\gamma} \right) rt + \gamma\tau - \mu\tau^2$$

Of course this is precisely the Mincerian "earnings function" of traditional human capital theory! Note that even in the extreme case in which education adds nothing to productivity ( $\gamma=0$ ) there is a "rate of return" to years of schooling which is greater or less than the rate of interest as  $\beta$  is greater or less than unity.

Clearly then estimation of a single log earnings function is not helpful in answering the question as to the importance of screening. Recently Wolpin has suggested that a comparison between estimation earnings functions of pre-selected sub-samples may provide a useful test. Discussion of this is deferred to section III.

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<sup>3</sup> Straightforward calculations yield  $k_0 = \frac{1}{1 + \alpha\gamma} \left( \frac{\beta\gamma}{r} \right)^{\alpha\gamma}$ .

We conclude this section by asking how good the screening mechanism is as a method of calculating productivity differences. From expression (6) we know that all but those at the bottom of the distribution spend more time in school than in a world in which  $m$  were freely observable. Using the specific functional forms introduced above, we can go further and ask just how much worse off individuals are in the screening equilibrium. The greater the differential, the greater the potential gains to investments increasing the accuracy of direct on-the-job evaluation.

Utilizing expression (5) (6) and (7) it can be shown that for an individual who stays in school for  $t$  years the ratio of potential discounted earnings  $v^*(t)$  to actual discounted earnings  $v(t)$  is given by

$$\frac{v^*(t)}{v(t)} = e^{r(t-t_0)} \left(\frac{t}{t_0}\right)^{-rt_0}.$$

$t_0$  is the number of years spent in school by those at the bottom of the distribution. The ratio  $v^*/v$  is depicted in Figure 1 under three alternative assumptions about  $t_0$ . Clearly the 'cost' of screening is, for the functional forms chosen, very sensitive to the value of  $t_0$ . However even for the most conservative of the three values ( $t_0 = 12$ ), implying screening is used only for college students, the cost is hardly insignificant.

For the individual spending 6 years in college the loss associated with screening is 11 per cent. Using \$200,000 as a rough estimate of the discounted value of the earnings of an average individual in this category, this translates into \$22,000 per individual.

Of course any implications drawn from one simple model are at best highly tentative. However it seems fair to conclude that the screening process described above may be a rather costly method of differentiating highly productive workers from the rest of the pack.

### III. Previous Attempts to Test the Educational Screening Hypothesis

Of the several recent empirical studies which purport to shed light on the screening hypothesis only one, that of Taubman and Wales, concludes that educational screening is important in labor markets. These authors suggest

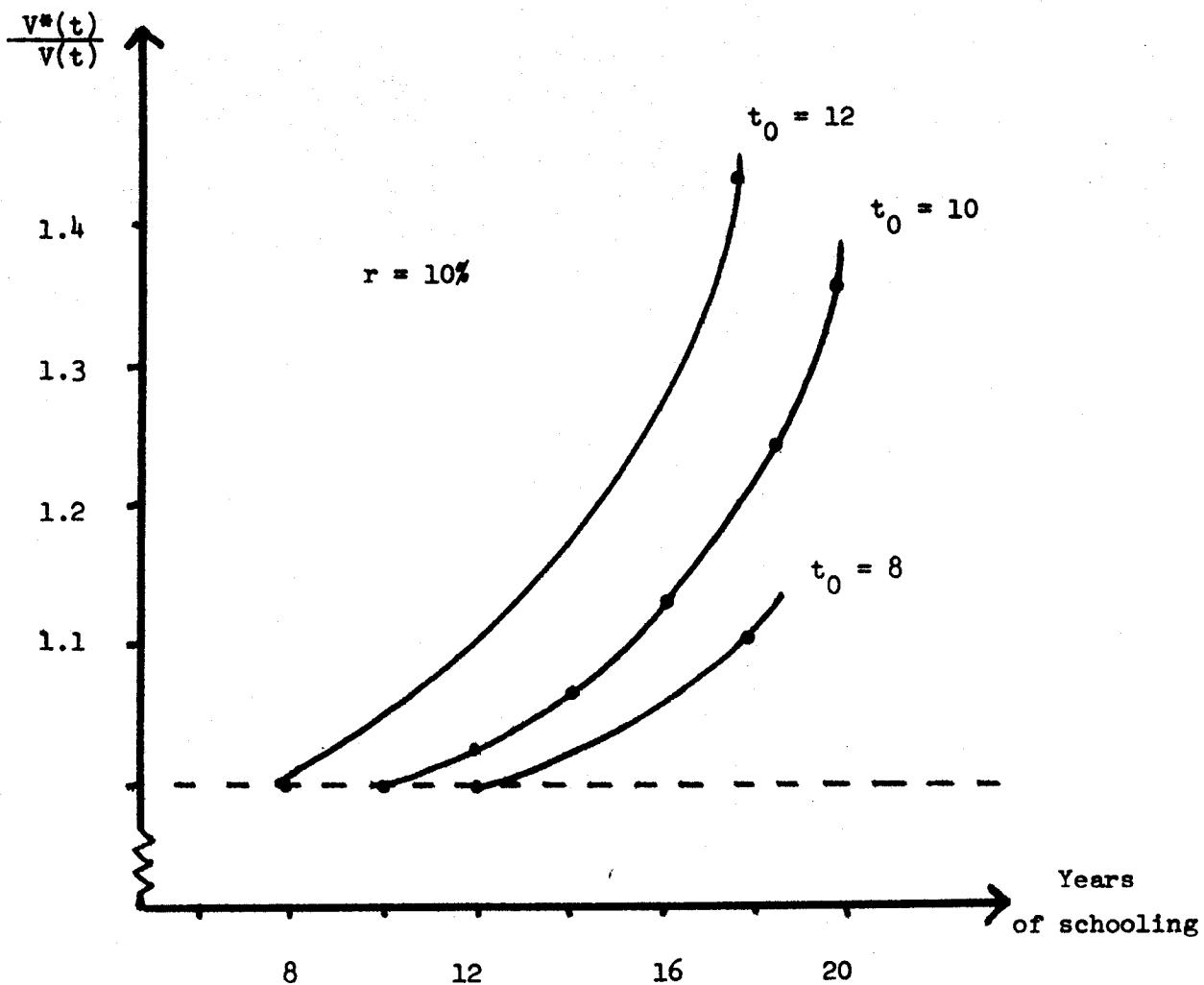


Figure 1. Potential Gains to Direct Measurement of Productivity

that the returns to education might be reduced by as much as 50% for high paying occupations in the absence of screening [Taubman and Wales, p. 118].<sup>4</sup> However as has been noted by Wolpin and others, the model used to derive these conclusions is not an equilibrium model. Credential requirements act as barriers to entry that are not consistent with competitive decision-making. Without an alternative (institutional?) explanation of these requirements such an approach should therefore be treated with caution. Certainly it is at odds with the equilibrium screening models discussed above.

For a more detailed discussion of other difficulties with the Taubman-Wales model the reader is referred to the paper by Wolpin (op. cit.) or Layard and Psacharopoulos. The latter authors defend the traditional view of human capital accumulation with the following observations.

- (i) Rates of return to 'drop outs' are as high as to those who gain credentials.
- (ii) Private returns to education do not fall with work experience.
- (iii) Education would not be demanded if there were cheaper methods of screening.

To this writer none of these observations provide convincing evidence one way or the other. Screenists have never argued that firms pay exclusive or even primary attention to credentials per se but to a vector of information about educational achievement. The model of the previous section is a case in point. One of the implications derived from it was that the rate of return to years of schooling should on average be the same at all observed educational levels. Also ignored is the difficulty of distinguishing between those drop-outs who are pushed-out by the educational process and those who are pulled out by superior alternatives. The latter group would tend to raise the rate of return to drop-outs.

Layard and Psacharopoulos next claim that screening models predict rates of return to education should "fall with work experience as employers come to have better information about their employees' real productivity" [L.P., p. 992].

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<sup>4</sup>In a follow-up paper Haspel finds that when taste variables are included this estimate is greatly reduced.

However here they seem to be stumbling into the same trap as Taubman and Wales. It is a necessary condition of screening equilibrium that employers find out that on average their predictions based on educational attainment are correct. Then one would not expect the private return to education to fall even in the absence of on-the-job training. Of course when the latter is included the observed rise is not surprising.

Their final point, (iii), is a convincing challenge to the hypothesis that screening is education's only role. However as has already been noted, this is not the presumed hypothesis. It is necessary to determine how great are the costs of screening by educational achievement, if the latter also enhances productivity. The results of the previous section are a first step in that direction.

Another attempt to estimate the extent of educational screening has recently been conducted by Albrecht. Arguing that if screening were important one should expect to observe different hiring decisions for insiders and outsiders, Albrecht estimates the following logit model of the probability of being hired,

$$\ln \mu_{ijk} = \mu + \alpha_i + \beta_j + \gamma_{ij} + \epsilon_k \cdot x_k$$

where  $\mu_{ijk}$  = odds of individual  $k$  being hired with education level  $i$ , and information level  $j$ .

$\alpha_i$  = primary effect on the log odds of being at education level  $i$ .

$\beta_j$  = primary effect on the log odds of being at information level  $j$  (insider  $j = 1$ , outsider  $j = 2$ ).

$\gamma_{ij}$  = interaction effect.

Albrecht's claim is that if education were important in the screening of outsiders, one should be able to reject the hypothesis;

$$H_0 : \gamma_{11} - \gamma_{12} = 0$$

His finding was that  $H_0$  could not be rejected. Because of problems associated with the particular data set employed no strong conclusions were drawn, however it is not clear that this test is appropriate. For insiders one should expect that other measures of productivity become more important than education. But unless these other measures are included there is no reason for the contribution

of education to be different for the two sub-groups. Those insiders who are known to have done better than average will have a higher probability of being hired than outsiders. This effect, by itself would result in an interaction term  $\gamma_{11}$  smaller than  $\gamma_{12}$ . However possibly entirely offsetting such an effect are those individuals who are known to have done worse than average.<sup>5</sup>

A fourth recent examination of the screening hypothesis is that by Wolpin (op. cit.). His approach is to split up the NBER - Thorndike sample of World War II veterans into the self-employed and privately-employed and to estimate earnings functions for the two sub-samples. He argues that "if a major portion of schooling's private return is merely informational, it should manifest itself in a smaller earnings increment to the self-employed and/or a lower average schooling level" (p. 20). Finding that the average time in school is only slightly lower for the self-employed (whether or not professionals are excluded) and that schooling has a differentially larger impact on earnings among the self-employed he concludes that a major screening role is not indicated.

I shall argue in the following section that the latter result is exactly what one should expect in the presence of educational screening, hence that this part of Wolpin's analysis provides mild support for the "screenist" interpretation of human capital accumulation. The other evidence--similar average time in school--does appear to contradict such an interpretation. However, for all the sub-samples used, average earnings were at least one third higher for the self-employed. It then seems reasonable to conclude that the time required to achieve a given earnings level was on average significantly lower for the self-employed. As we shall see this is also a prediction of the screening view although surely not of traditional human capital models.

Before interpreting Wolpin's results as a vindication of the former however, it should be noted that his data set is a rather special one. World War II veterans were on average considerably older and more experienced than today's college entrants. It seems likely that an abnormally large number from this group were pulled out of school by good job opportunities. A further possible problem with Wolpin's study was his choice of "self-employed" as those

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<sup>5</sup>A further complicating factor that Albrecht notes is the accumulation of specific human capital by insiders.

less screened by the educational process. On the one hand many privately employed skilled workers have jobs for which it would appear that productivity can be readily observed. On the other, would-be self-employed are often highly dependent upon institutions for financial support. If educational screening were of value to employers it would surely be also of value to potential lenders. Perhaps then an alternative split of some data set would yield more convincing conclusions.

#### IV. Alternative Approaches

Suppose, following the line suggested by Wolpin, that there are two classes of jobs: those in which educational screening is used and those in which productivity is readily observable. Suppose also that both classes of jobs require the whole spectrum of individual skill levels. Then in order to attract workers of a given type  $n$  into jobs in both classes it must be that marginal productivity in unscreened jobs,  $m^u(n, z)$ , is such that the discounted value of earnings are identical.

$$(11) \quad e^{-rt^u} m^u(n, z^u(n)) = e^{-rt^s} w^s(z^s(n))$$

Using the simple model of section II we can invert the education function  $z = z(n, t)$  and express time spent in school as

$$t = t(n, z)$$

If type  $\tilde{n}$  chooses a job for which there is educational screening he does best by maximizing

$$e^{-rt(\tilde{n}, z)} w^s(z)$$

or, equivalently,

$$(12) \quad \log w^s(z) - rt(\tilde{n}, z)$$

The solution  $z^s(\tilde{n})$  is depicted in figure 2. Assuming that an individual with higher  $n$  and the same  $z$  is more productive in any job<sup>6</sup>, we now show that the optimal  $z^u(\tilde{n})$  must lie to the left of  $z^s(\tilde{n})$ .

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<sup>6</sup>In Stiglitz' terminology we are assuming that the world is "hierarchical".

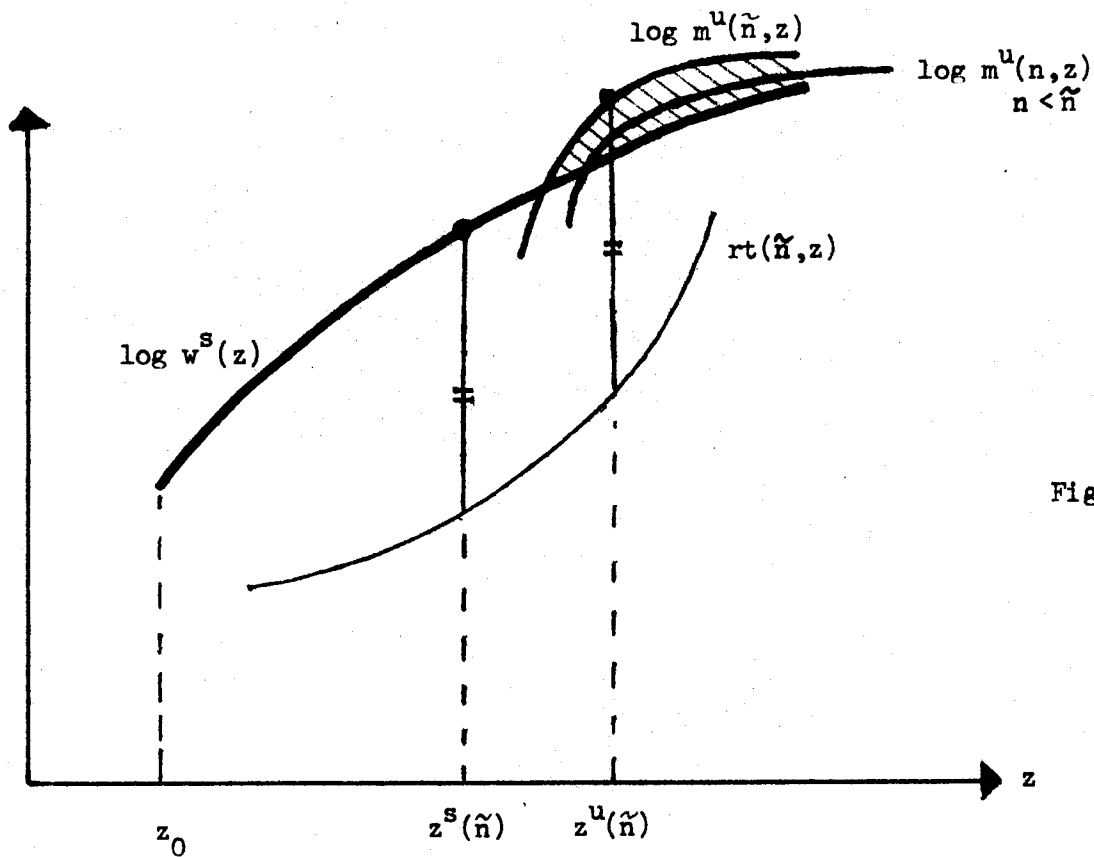


Figure 2a

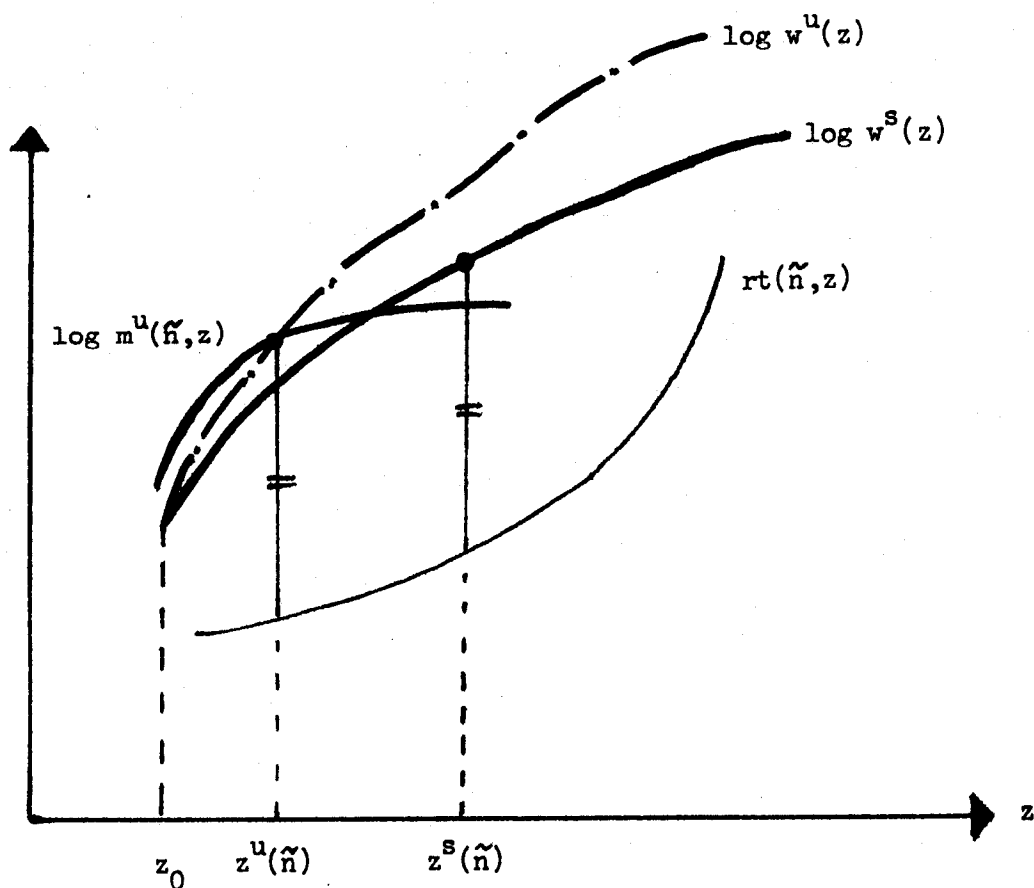


Figure 2b



The proof is by contradiction. If  $z^u(\tilde{n})$  is to the right as in Figure 2a the curve  $\log m^u(\tilde{n}, z)$  must be above  $\log w(z)$  for some  $z > z^s(\tilde{n})$  and below this curve for  $z = z^s(\tilde{n})$ . Also the equilibrium condition (11) implies that for all  $n$

$$\log m^u(n, z^u(n)) = \log w^s(z^u(n))$$

Then for all  $n$  in  $[n_0, \tilde{n}]$  the non-screening solution  $(\log m^u, z)$  must lie in the shaded region. But this is impossible since for those at the bottom of the distribution ( $n = n_0$ ) educational levels must be the same for the two job categories ( $z = z_0$ ).

The curve  $\log m^u(n, z)$  therefore lies as depicted in figure 2b with the envelope of wage levels in non-screened jobs,  $w^u(z)$ , lying strictly above  $w^s(z)$  except at  $z_0$ .

The following inferences can then be drawn.

- (i) For any level of  $n$  those in unscreened jobs spend less years in school and earn lower earnings (discounted to the time of employment).
- (ii) For individuals choosing the same level of  $z$ , wages discounted to the time of employment will be higher in jobs where there is no educational screening.
- (iii) For any given number of years in school, lifetime earnings are higher in jobs where there is no educational screening.
- (iv) At least near the bottom of the distribution the rate at which the log of discounted lifetime earnings rises with  $t$ , is higher for those in jobs with no educational screening.

Since only the first of these inferences requires knowledge of  $n$ , they would seem to provide considerable scope for testing the educational screening hypothesis.

A second very different potential test of the "screenist" view follows from the observation that one would not really expect the screening process to identify productivity levels exactly. Plausibly for a given type  $n$ , with identical educational advancement function,  $z(n, t)$ , productivity is distributed according to

$$m(n, e, z) = em(n, z)$$

where  $\theta$  is an unobservable random variable with  $E(\theta)$  equal to unity. It follows that firms hiring according to the policy described in section II will be correct only on average.

Consider then the earnings profile of a group of workers with the same years of schooling and in the same job category. If  $m$  were indeed initially unobservable, one should not expect to observe much increase in the variance of earnings of this group for a number of years. Eventually however one should expect firms to identify those with above and below average productivity. Hence a fanning out of the earnings profiles should be observed.

In contrast, for a group with initially identifiable productivity and the same years of education, the initial variance of earnings should be a much higher fraction of the total variance after some  $T$  years of employment. This is depicted in Figure 3. Testing might therefore proceed by comparing the profile of variance ratios in a job category where screening seems most plausible with some other job category.

Of course the model depicted is overly simple. Individuals choosing a given level of educational training are not a homogeneous group.

Instead, it may be argued, those with above or below average on-the-job capacities have offsetting differences in learning ability. Mincer (1974) has suggested that such heterogeneity within any schooling group can lead to a decline in within-group variance over the first decade of work experience. Indeed there does seem to be empirical evidence of such a decline. However it seems reasonable to assume that this "overtaking" phenomenon is of the same order of magnitude in both sub-samples. Therefore, if screening is important, systematic differences between the variance profiles should still be evident.

I conclude with a cautionary comment. The above discussion has been presented with the primary aim of stimulating further debate about the empirical implications of educational screening. Given the rather primitive modelling to date by screening theorists, the two proposed tests (which I hope soon to undertake) are relatively unsophisticated. Decisive results may therefore have to await further theoretical analysis. It may also be that careful consideration of intra-firm promotion data, rather than the wide samples common in human capital studies, will provide much additional insight.

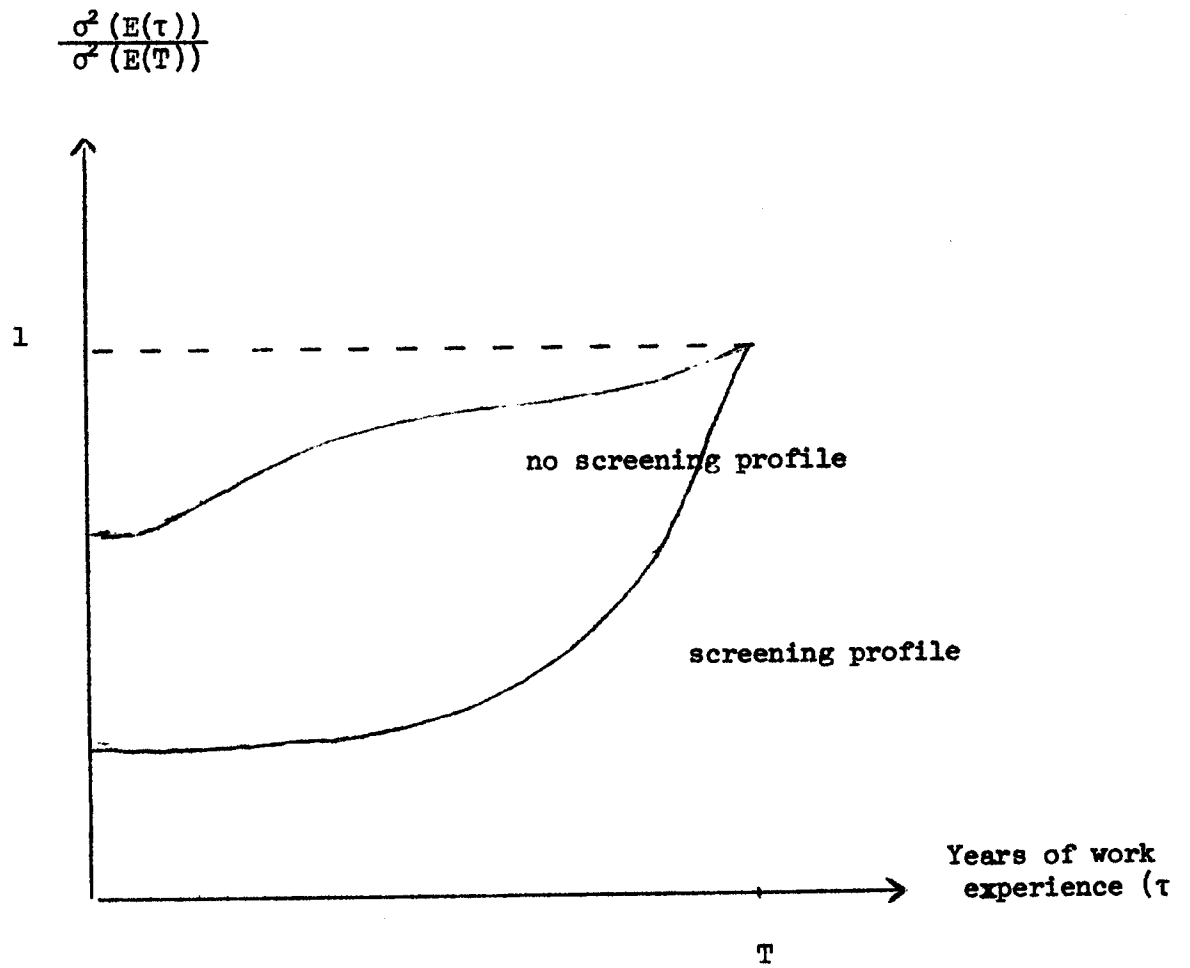


Figure 3. Profiles of Earnings Variance Ratios

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