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Abstract

Although the expected returns to schooling is the central concept in economic thinking on educational behavior, economists have made almost no effort to learn how youth form their expectations; instead, the norm has been to make assumptions about expectations formation. But there is no evidence that prevailing expectations assumptions are correct nor reason to think that misspecifying expectations is innocuous. On the contrary, rudimentary treatment of expectations has placed the economics of education at an impasse: not knowing how youth perceive the returns to schooling, one cannot infer their decision processes from their schooling choices, and one cannot infer the objective returns to schooling from data on realized outcomes. I argue that the present impasse in the economics of education can be broken only if we ask how expectations influence schooling choices and learn how youth actually form their expectations.

Adolescent Econometricians: How Do Youth Infer the Returns to Schooling?

1. BASIC IDEAS

Economists analyzing schooling decisions assume that youth, having compared the expected outcomes from schooling and other activities, choose the best feasible option. Viewing education as an investment in human capital, we use the term returns to schooling to refer to the outcomes from schooling relative to nonschooling.

Given the centrality of the expected returns to schooling in economic thinking on educational behavior, it might be anticipated that economists would make substantial efforts to learn how youth form their expectations. But the profession has traditionally been skeptical of subjective data; so much so that we have generally been unwilling to collect data on expectations. Instead, the norm has been to make assumptions about expectations formation.

Prevailing Expectations Assumptions. Economic studies of schooling behavior have universally assumed that expectations formation is homogenous; all youth condition their beliefs on the same variables and process their information in the same way. On the other hand, the hypothesized conditioning variables and information processing rule have varied considerably across studies.

In his analysis of the major field decisions of male college students, Freeman (1971) assumed that these youth condition their expectations on their sex and on their common knowledge of the incomes realized by earlier cohorts. He assumed that expectations formation is myopic. Each youth believes that, should he select a given college major, he would obtain the mean income realized by the members of a specified earlier cohort who made that choice.[1]

Willis and Rosen (1979), in their study of college enrollment, took the personal conditioning variables to be sex, armed forces status, and ability. They assumed that youth have common knowledge of the actual process generating life-cycle incomes conditional on these personal variables and on schooling. They hypothesized that expectations are rational, each youth applying his knowledge of the true income-generating process to forecast his own future income should he enroll or not enroll in college.

In the Manski and Wise (1983, Chapter 6) analysis of college choice, youth condition their expectations for the utility of enrolling in a given college on their own SAT score and on the average SAT score of students enrolled at the college. Youth do not necessarily know either the outcomes realized by earlier cohorts or the actual process generating outcomes. Rather, they believe the returns to enrolling to be a function of the difference between their own SAT score and the average at the college.

The three studies just cited are noteworthy because they make explicit assumptions about expectations formation. In most economic analyses of schooling behavior, the expectations assumptions are implicit in the specification of the decision model. The recent literature shows little concern with expectations formation. The prevailing sentiment seems to be complacency. Researchers either are confident that their expectations assumptions are correct or they believe that misspecifying expectations is innocuous.

Two Identification Problems. In fact, there is no evidence that prevailing expectations assumptions are correct, nor is there reason to think that misspecifying expectations is innocuous. On the contrary, rudimentary treatment of expectations has placed the economics of education at an impasse, caught in a pair of basic identification problems that plague attempts to understand schooling behavior and to measure educational productivity.

The first problem is that, not knowing how youth perceive the returns to schooling, one cannot infer their decision processes from their schooling choices. The point can easily be made with a few symbols. The standard economic model assumes that a youth's schooling choice c is a function f(.) of his expected returns to schooling r; that is, $c = f(r)$. Suppose that one wishes to learn the decision rule f(.) mapping expectations into choices. If one observes the choices and expectations of a sample of youth, then one can infer the decision rule. But if one observes only the choices of these youth, then clearly one cannot infer f(.). The most that one can do is infer the decision rule conditional on maintained assumptions on expectations.

The second problem is that, not knowing youths' decision processes, one cannot infer the objective returns to schooling from data on realized outcomes. As is well known, any attempt to learn the objective returns to schooling faces the selection problem. The problem arises because the youth who choose to enroll in school are those who expect schooling to have favorable outcomes for them. If expected outcomes are related to objective ones, then the outcomes experienced by youth who choose to enroll in school differ from those that nonenrollees would experience if they were to enroll. Likewise, the outcomes experienced by nonenrollees differ from those that enrollees would experience if they were not to enroll. (See, for example, Griliches, 1977; Heckman and Robb, 1985; and Manski, 1989.)

The selection problem implies that any effort to infer the objective returns to schooling from observations of realized outcomes requires at least some knowledge of the way youth make their schooling decisions. But we have already observed that, lacking data on youths' expectations, one can only learn youths' decision rules conditional on maintained assumptions on expectations. Hence one can only infer the objective returns to schooling conditional on the validity of expectations assumptions.

It is important to understand that these identification problems arise even in a stationary world, where the objective returns to schooling are constant over time. This will be illustrated through an example in Section 3. Further identification problems may arise in a world with aggregate productivity shocks, where the objective returns to schooling change with time.

The Econometrics of Expectations Formation. The two identification problems just described would not be of concern if there were reason to think that prevailing expectations assumptions are correct. Logic and some indirect empirical evidence suggest otherwise. In particular, there is little reason to think that all youth form their expectations in the same way.

The logical point is that youth forming expectations face the same kind of inferential problem as do econometricians measuring educational productivity. Youth and econometricians may possess different data on realized outcomes, may have different knowledge of the economy, and may process their information in different ways. But both want to use their data and knowledge to learn the objective returns to schooling conditional on the available information. It follows that youth, like econometricians, face the selection problem. If youth use data on realized outcomes to form their expectations, then their interpretation of these data must depend on how they think other youth make their schooling decisions. Expectations formation will be homogeneous only if all youth make the same assumptions about the behavior of their peers.

The empirical evidence is indirect but, I believe, compelling. Although we lack data on youths' expectations, we have extensive data on the practices of econometricians studying educational productivity. For thirty years, in perhaps hundreds of published studies, econometricians have sought to learn the objective returns to schooling. Reading this literature reveals that econometric studies of the returns to schooling vary greatly in the conditioning variables used, in the outcome data analyzed, and in their handling of the selection problem. Compare, for example, Willis and Rosen (1979) and Murphy and Welch (1989). The former study analyzes data from the NBER-Thorndike Survey, estimates returns to schooling conditional on measured ability, and is explicitly concerned with the effect of unmeasured ability on the selection of students into schooling. The latter piece analyzes data from the Current Population Surveys, which contain no ability measures, and implicitly assumes that the selection of students into schooling is unrelated to ability. If experts can vary so widely in the way they infer the returns to schooling, it is reasonable to suspect that youth do as well.

Elaboration on the Basic Ideas. The remaining sections of this paper elaborate on the foregoing basic ideas. Section 2 indicates that, if economists want to learn how youth perceive the returns to schooling, we cannot rely on the expectations research performed by other social scientists. Section 3 uses a simple formal model to show the different patterns of choices and outcomes that can result if youth do or do not condition their expectations on ability. Section 4 makes concluding comments on expectations research in economics.

2. EXPECTATIONS RESEARCH IN PSYCHOLOGY AND SOCIOLOGY

In contrast to economists, psychologists and sociologists routinely collect and analyze subjective data of many kinds, including expectations data from youth. I have sought to determine whether useful lessons can be extracted from these literatures. Unfortunately, my findings have been largely negative.

Measurement of Expectations. The prevailing measurement practice is to interpret responses to loosely worded questionnaire items as indicators of youths' expectations. Berndt and Miller (1990), for example, ask their sample of junior high school students to respond, on a five-point scale, to the question "How valuable do you think your education will be in getting the job you want?" Mickelson (1990) asks her sample of high school seniors to express their degree of agreement with the statement "Studying in school rarely pays off later with good jobs." Most of the literature poses such vague questions. An exception is a recent study of the income expectations of college seniors, by Smith and Powell (1990). These authors ask respondents to make unconditional forecasts of their "anticipated annual income in ten years" and their "expected earnings" in the first year of their first job. They also ask respondents to provide similar forecasts for the average member of their class.

Theories of Expectations Formation. The looseness with which psychologists and sociologists measure youths' expectations is matched by looseness in their thinking about expectations formation. Researchers in these fields theorize verbally rather than mathematically. As a consequence, it is even difficult to determine whether different researchers interpret the term "expectations" in a common, coherent fashion.[2]

The central social psychological idea is that expectations formation is a social phenomenon, each person learning about his prospects by observing the experiences of others.

Bandura (1986, p.47) writes:

> If knowledge could be acquired only through the effects of one's own actions, the process of cognitive and social development would be greatly retarded.... Fortunately, most human behavior is learned by observation through modeling. By observing others, one forms rules of behavior, and on future occasions this coded information serves as a guide for action.... Much social learning is fostered by observing the actual performances of others and the consequences for them.

This statement seems sensible; indeed I could interpret it as endorsing the idea that youth learning the returns to schooling are implicit econometricians. Unfortunately, the social psychological literature does not go much beyond the generalities expressed by Bandura. A long line of research, beginning with Hyman (1942), has sought to operationalize the idea that individuals learn from their "reference groups"; Bank, Slavings, and Biddle (1990) give an interesting historical account. But the idea of a reference group appears as amorphous today as it was fifty years ago.

It appears to me that, if social psychologists are to make progress in understanding expectations formation, they must end their dependence on verbal reasoning, which invites conceptual ambiguity and logical inconsistency. Coherent analysis of complex social processes demands the discipline of formal modeling.

3. A MODEL OF INFORMATION, SCHOOLING CHOICES, AND OUTCOMES

I observed in Section 1 that some econometric studies, such as Willis and Rosen (1979) and Manski and Wise (1983), assume that youth condition their expectations on their ability while other studies, such as Freeman (1971) and Murphy and Welch (1989), assume that they do not. Given the variation in econometric practice, it is of interest to determine how observed patterns of schooling choices and outcomes may depend on this aspect of expectations.

To address the question, I pose a simple stationary human capital model and consider two alternative assumptions on expectations: myopic youth either (A) condition expectations on ability or (B) they do not (Section 3.1). I then derive the schooling choices and outcomes that result in the two cases (Section 3.2). It turns out that in both cases there is a unique equilibrium in which expectations, although myopic, are fulfilled. But the characteristics of these equilibria differ. The main findings are

- Assumption (A) yields a rational expectations equilibrium. Assumption (B) yields equilibrium expectations which are fulfilled yet systematically incorrect.
- Fewer low-ability and more high-ability youth enroll under expectations assumption (A) than under (B).
- The gross enrollment rate under (A) may be less or greater than under (B), depending on the values of the model parameters.
- For some parameter values, the mean income realized by enrollees is known to be higher under assumption (A) than under (B).

Having compared the two patterns of choices and outcomes, I consider the implications of misspecifying expectations for econometric analysis of schooling behavior (Section 3.3). It is found that, if youth do not condition their expectations on ability, then an econometrician who assumes they do so may mistakenly conclude from observed schooling behavior that youth are unconcerned with the returns to schooling.

3.1. The Model

Maintained Assumptions. Assume an overlapping-generations world in which each person lives for two periods. In the first period, a youth can choose to work (c=w) or to enroll in school (c=s); in the second period, all adults work. At the time of his schooling decision, a youth knows his real-valued ability z, his real-valued taste for schooling v, and the present discounted life-cycle log-income η that he would receive if he were to work immediately; for simplicity, assume that η is constant across the population and normalize the income scale by setting $\eta = 0$. A youth does not know the discounted log-income y he would receive if he were to enroll in school; y is a random variable whose realization becomes known after schooling is completed.

Each youth's value of (y,v,z) is independently drawn according to the following time-stationary process:

$$(1)\quad y = \alpha_1 + \beta_1 z + \epsilon_1, \quad \beta_1 \geq 0$$

$$v = \alpha_2 + \beta_2 z + \epsilon_2$$

$$(\epsilon_1, \epsilon_2, z) \sim N(0, \begin{matrix} \sigma_1^2 & 0 & 0 \\ 0 & \sigma_2^2 & 0 \\ 0 & 0 & 1 \end{matrix}).$$

Thus the objective probability distribution of (y,v,z) is trivariate normal. Letting z be a standard normal random variable and assuming that $\beta_1 \geq 0$ are normalizations that make ability a well-defined concept. Assuming the variance of $(\epsilon_1, \epsilon_2, z)$ to be diagonal is a real restriction; conditional on ability z, a youth's post-school income y and his taste for schooling v are statistically independent.

The youth in a given generation share certain information about the schooling choices and realized incomes of the preceding generation. Let $E^*(y \mid z,v)$ be a youth's subjective expected value of y conditional on (z,v) and the common information. The decision rule is

(2) $c = s$ if $E^*(y \mid z,v) + v > 0$,

$= w$ otherwise.

<u>Expectations Assumptions</u>. The model is complete when the subjective expected income $E^*(y \mid z,v)$ is specified. Although I have earlier criticized the prevailing assumption that expectations formation is homogeneous, I retain that assumption here.

The recent fashion in economics has been to assume that expectations are rational; youth a priori know that equation (1) holds and so set

(3) $E^*(y \mid z,v) = \alpha_1 + \beta_1 z.$

The realism of this assumption is most questionable. Having witnessed the struggles of econometricians to learn the returns to schooling, I find it difficult to accept the proposition that adolescents are endowed with this knowledge.

I instead assume that youth form their expectations in the manner of practicing econometricians; youth observe the incomes realized by members of the preceding generation who chose schooling, and they make inferences from these observations. But what information do youth possess about the experiences of the preceding generation, and how do they use this information to form their expectations? I shall consider two cases of myopic expectations. In each case a youth, having observed the mean income $E_0(y \mid \Omega, c=s)$ realized by those members of the preceding generation who chose schooling and who had specified characteristics Ω, believes that he will receive the same mean income.[3] The two cases differ in the characteristics Ω on which youth condition their expectations. They are

Assumption (A): $E^{*A}(y \mid z,v) = E_0(y \mid z,c=s)$

Assumption (B): $E^{*B}(y \mid z,v) = E_0(y \mid c=s)$.

Youth might form expectations as in (A) if they observe the abilities and realized incomes of those members of the preceding generation who chose schooling. Suppose, however, that youth cannot observe the abilities of their elders. Unaware that income varies with ability, they might then form expectations as in (B).[4]

3.2. Schooling Choices and Realized incomes

The two expectations assumptions imply systematically different patterns of schooling choices and realized incomes. To see this, I first derive the choice and income patterns that emerge under the two assumptions.

Expectations Conditioned on Ability and Schooling. By equation (2), a youth's schooling choice c is a function of his ability-taste pair (z,v). By equation (1), income y is statistically independent of v, conditional on z. Hence,

(4) $E_0(y \mid z,c=s) = E_0(y \mid z) = \alpha_1 + \beta_1 z$.

Thus, in the time-stationary environment equation (1), the myopic expectations (A) turn out to be rational. (These expectations would not generally be rational if the process generating (y,v,z) were not time-stationary.)

By (1), (2), and (4), the decision rule is

(5) $c = s$ if $\alpha_1 + \alpha_2 + (\beta_1+\beta_2)z + \epsilon_2 > 0$

$= w$ otherwise.

So the probability that a youth with ability z selects school is

(6) $P_A(c=s \mid z) = \Phi\{[\alpha_1+\alpha_2+(\beta_1+\beta_2)z]/\sigma_2\}$,

where $\Phi(.)$ is the standard normal distribution function. The unconditional probability of schooling is

(7) $P_A(c=s) = \Phi(\gamma_A)$,

where $\gamma_A \equiv (\alpha_1+\alpha_2)[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2}$.

The mean income realized by youth with ability z who choose schooling is $\alpha_1+\beta_1 z$. Thus, income expectations are fulfilled. The mean income realized by all youth who choose schooling is

$$(8)\quad E_A(y \mid c=s) = E[y \mid \alpha_1+\alpha_2+(\beta_1+\beta_2)z+\epsilon_2 > 0]$$
$$= \alpha_1 + \beta_1 E[z \mid \alpha_1+\alpha_2+(\beta_1+\beta_2)z+\epsilon_2 > 0]$$
$$= \alpha_1 + \delta_A \phi(\gamma_A)/\Phi(\gamma_A),$$

where $\delta_A \equiv \beta_1(\beta_1+\beta_2)[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2}$ and $\phi(.)$ is the standard normal density function.

Expectations Conditioned on Schooling Only. Suppose that assumption (B) holds. Then the decision rule is

$$(9)\quad c = s \ \text{ if } E_0(y \mid c=s) + \alpha_2 + \beta_2 z + \epsilon_2 > 0$$
$$= w \ \text{ otherwise.}$$

So the probability that a youth with ability z selects school is

$$(10)\quad P_B(c=s \mid z) = \Phi\{[E_0(y \mid c=s)+\alpha_2+\beta_2 z]/\sigma_2\}$$

and the unconditional probability of schooling is

$$(11)\quad P_B(c=s) = \Phi(\gamma_B),$$

where $\gamma_B \equiv [E_0(y \mid c=s)+\alpha_2](\beta_2^2+\sigma_2^2)^{-1/2}$.

The mean income realized by youth with ability z who choose schooling remains $\alpha_1+\beta_1 z$ as before. The mean income realized by all youth who choose school is

$$(12)\quad E_B(y \mid c=s) = E[y \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2 > 0]$$
$$= \alpha_1 + \beta_1 E[z \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2 > 0]$$
$$= \alpha_1 + \delta_B \phi(\gamma_B)/\Phi(\gamma_B),$$

where $\delta_B \equiv \beta_1\beta_2(\beta_2^2+\sigma_2^2)^{-1/2}$.

Suppose, as seems reasonable, that the taste for schooling does not decrease with ability; that is, let $\beta_2 \geq 0$. Then there is a unique $E_0(y \mid c=s) \geq \alpha_1$ such that expectations are fulfilled. To see this, observe that expectations are fulfilled if (12) holds with $E_B(y \mid c=s) = E_0(y \mid c=s)$; that is, if

(13) $E_0(y \mid c=s) \;=\; \alpha_1 + \beta_1 E[z \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2 > 0]$.

If $\beta_2 = 0$, equation (13) is solved at $E_0(y \mid c=s) = \alpha_1$. If $\beta_2 > 0$, (13) is solved at some $E_0(y \mid c=s) > \alpha_1$; this is so because $E[z \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2 > 0]$ is a differentiable, strictly decreasing function of $E_0(y \mid c=s)$ whose value falls to 0 as $E_0(y \mid c=s)$ rises.

Observe that equilibrium expectations under assumption (B), even though fulfilled, are systematically incorrect except in the special case $\beta_2 = 0$. Unconditional on ability, a youth's objective expected income following schooling is α_1. But it has just been shown that, in equilibrium, youths' common subjective expected income exceeds α_1 whenever $\beta_2 > 0$.

The fulfilled-expectations equilibrium, equation (13), is globally stable when $\beta_1 < \beta_2$; I do not know the stability properties when $\beta_1 \geq \beta_2$. To show that $\beta_1 < \beta_2$ implies global stability, observe that global stability is guaranteed if the derivative of the right-hand side of (13) with respect to $E_0(y \mid c=s)$ is always less than one in absolute value. It is shown in Goldberger (1983) that $0 < \partial E(z \mid z<t)/\partial t < 1$ for all real t; hence $-1 < \partial E(z \mid z>-t)/\partial t < 0$. It follows that, for all $[E_0(y \mid c=s),\epsilon_2]$,

(14) $-\beta_1/\beta_2 \;<\; \beta_1 \partial E[z \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2>0,\epsilon_2]/\partial E_0(y \mid c=s) \;<\; 0$.

Taking the expectation over ϵ_2 of the derivative in (14) yields

(15) $-\beta_1/\beta_2 \;<\; \beta_1 \partial E[z \mid E_0(y \mid c=s)+\alpha_2+\beta_2 z+\epsilon_2>0]/\partial E_0(y \mid c=s) \;<\; 0$.

So the derivative is less than one in absolute value if $\beta_1 < \beta_2$.

Comparative Schooling Choices. The remainder of this section compares the patterns of schooling choices and realized incomes that emerge under the two expectations assumptions. In this discussion, I assume that the taste for schooling does not decrease with ability; that is, $\beta_2 \geq 0$. In discussing expectations assumption (B), I restrict attention to the fulfilled-expectations equilibrium, equation (13).[5]

Let us first compare the ability-conditioned enrollment probabilities $P_A(c=s \mid z)$ and $P_B(c=s \mid z)$, given in equations (6) and (10). Recall that the solution to equation (13) is $E_0(y \mid c=s) = \alpha_1$ if $\beta_2 = 0$ and satisfies $E_0(y \mid c=s) > \alpha_1$ if $\beta_2 > 0$. Hence, evaluated at $z = 0$,

(16) $P_A(c=s \mid z=0) \; = \; P_B(c=s \mid z=0)$ if $\beta_2 = 0$

$P_A(c=s \mid z=0) \; < \; P_B(c=s \mid z=0)$ if $\beta_2 > 0$.

This and the fact that $(\beta_1+\beta_2) > \beta_2$ imply that

(17) $P_A(c=s \mid z) \; < \; P_B(c=s \mid z)$, all $z < 0$.

On the other hand, equation (16) and the fact that $(\beta_1+\beta_2) > \beta_2$ imply that there exists a $z_0 \geq 0$ such that

(18) $P_A(c=s \mid z) \; > \; P_B(c=s \mid z)$, all $z > z_0$.

Thus, fewer low-ability youth and more high-ability youth enroll under expectations assumption (A) than under (B).

Overall, enrollments under assumption (A) may be less or greater than under (B), depending on whether γ_A is less or greater than γ_B (see equations 7 and 11). We find that

(19) $\gamma_B \; < \; \gamma_A \; < \; 0$ if $\alpha_1+\alpha_2 < 0$ and $\beta_2 = 0$

$\gamma_A \; < \; \min(0,\gamma_B)$ if $\alpha_1+\alpha_2 < 0$ and $\beta_2 >> \beta_1$

$\gamma_A \; = \; \gamma_B \; = \; 0$ if $\alpha_1+\alpha_2 = 0$ and $\beta_2 = 0$

$\gamma_A \; = \; 0 \; < \; \gamma_B$ if $\alpha_1+\alpha_2 = 0$ and $\beta_2 > 0$

$0 \; < \; \gamma_A \; < \; \gamma_B$ if $\alpha_1+\alpha_2 > 0$.

Hence,

$$(20)\quad P_B(c=s) < P_A(c=s) < 1/2 \quad \text{if } \alpha_1+\alpha_2 < 0 \text{ and } \beta_2 = 0$$

$$P_A(c=s) < \min[1/2, P_B(c=s)] \quad \text{if } \alpha_1+\alpha_2 < 0 \text{ and } \beta_2 >> \beta_1$$

$$P_A(c=s) = P_B(c=s) = 1/2 \quad \text{if } \alpha_1+\alpha_2 = 0 \text{ and } \beta_2 = 0$$

$$P_A(c=s) = 1/2 < P_B(c=s) \quad \text{if } \alpha_1+\alpha_2 = 0 \text{ and } \beta_2 > 0$$

$$1/2 < P_A(c=s) < P_B(c=s) \quad \text{if } \alpha_1+\alpha_2 > 0.$$

If $\alpha_1+\alpha_2 < 0$ and if β_2 and β_1 are the same order of magnitude, then the ordering of $P_B(c=s)$ and $P_A(c=s)$ appears to depend on the specific values of the model parameters.

Comparative Realized Incomes. The mean income realized by a youth of ability z who enrolls in school is $\alpha_1+\beta_1 z$, whether expectations assumption (A) or (B) holds. The mean income of all enrollees depends on the ability distribution of enrollees and so varies with the expectations assumption, as follows.

By equations (8) and (12),

$$(21)\quad E_A(y \mid c=s) - E_B(y \mid c=s) = \delta_A\phi(\gamma_A)/\Phi(\gamma_A) - \delta_B\phi(\gamma_B)/\Phi(\gamma_B).$$

It can be shown that $\delta_A > \delta_B$ for all values of the model parameters; moreover $\delta_B = 0$ if $\beta_2 = 0$.[6] The Mills Ratio $\phi(.)/\Phi(.)$ is strictly decreasing in its argument, so

$$(22)\quad \gamma_A \leq \gamma_B \Rightarrow E_A(y \mid c=s) > E_B(y \mid c=s).$$

Hence, by (19),

$$(23)\quad E_A(y \mid c=s) > E_B(y \mid c=s) \quad \text{if } \alpha_1+\alpha_2 < 0,\ \beta_2 >> \beta_1$$

$$\text{or if } \alpha_1+\alpha_2 \geq 0.$$

Equation (23) shows that, for some values of the model parameters, the mean realized income of school enrollees is higher under expectations assumption (A) than under (B). I have not been able to determine the relationship between $E_A(y \mid c=s)$ and $E_B(y \mid c=s)$ for other parameter values.

3.3. Econometric Analysis with Misspecified Expectations

Analysis of Behavior. It remains to inquire into the consequences for econometric analysis of misspecifying expectations. Consider the following idealized description of an econometric analysis of schooling choices: For each member of a random sample of youth, an econometrician observes (c,z) and observes y when c = s; he does not observe v. The econometrician assumes that equation (1) describes the objective probability distribution of (y,v,z) and that equation (2) is the decision rule youth use to make their schooling choices. As is common in the literature, he assumes that tastes for schooling are independent of ability; that is, $\beta_2 = 0$. Moreover, he makes the conventional assumption that expectations are rational.

Believing that equation (6) describes choice behavior and that $\beta_2 = 0$, the econometrician would form the probit model

(24) $P[c=s \mid E^{*}(y \mid z,v)=\alpha_1+\beta_1 z] \;=\; \Phi(\pi_0+\pi_1 z)$

and estimate (π_0,π_1) by maximum likelihood. He would interpret π_0 to be $(\alpha_1+\alpha_2)/\sigma_2$ and π_1 to be β_1/σ_2.

Suppose that the econometrician is correct in assuming equations (1) and (2) but incorrect otherwise; in fact, β_2 may be positive and assumption (B) holds. Then equation (10) describes actual choice behavior and the econometrician's interpretation of (π_0,π_1) is incorrect. In reality, $\pi_0 = [E_0(y \mid c=s)+\alpha_2]/\sigma_2$ and $\pi = \beta_2/\sigma_2$.

The misinterpretation of π_1 is of particular interest. The econometrician believes π_1 to measure the sensitivity of educational decisions to changes in the income returns to schooling. In fact, π_1 measures the degree to which tastes for schooling vary with ability. Suppose, for example, that $\beta_2 = 0$ as assumed. Then $\pi_1 = 0$. Finding this, the econometrician would conclude that, in making their schooling choices, youth are unconcerned with the income returns to schooling. This conclusion would, of course, be incorrect. If the returns to schooling were to shift through a change in α_1, then the intercept π_0 would change and so would the probability of enrolling.

Analysis of the Returns to Schooling. I have made the idealized assumption that the econometrician observes ability z without error. Given this, data on enrolled youths' abilities and realized incomes can be used to obtain a consistent least squares estimate for the parameters (α_1,β_1). It might therefore seem that, if z is observed, analysis of the objective returns to schooling requires no knowledge of how youth make their schooling choices. But there is an implicit expectational assumption, namely that youth do not know ϵ_1 at the time of their schooling decisions. If this assumption fails, then the econometrician's estimate of (α_1,β_1) is not consistent. The selection problem implies that an econometrician analyzing the returns to schooling must take a stand on the information youth use in forming their expectations.

4. CONCLUSION: EXPECTATIONS RESEARCH IN ECONOMICS

The question posed in the title of this paper cannot be answered at this time. Having chosen to make assumptions rather than to investigate expectations formation, economists do not know how youth infer the returns to schooling. If youth form their expectations in anything like the manner that econometricians study the returns to schooling, then prevailing expectations assumptions cannot be correct. Without an understanding of expectations, it is not possible to interpret schooling behavior nor to measure the objective returns to schooling. As a consequence, the economics of education is at an impasse.

As I see it, progress is possible only if economists become more willing to entertain the use of subjective data in empirical analysis. Decisions under uncertainty reflect the interplay of preferences, expectations, and opportunities. Choice data alone cannot disentangle these factors. The identification problem can be solved if choice data are combined with interpretable subjective data on expectations and/or preferences.

The question, of course, is whether interpretable subjective data can be obtained. The dominant view expressed by economists today is negative. In particular, economists often assert that respondents to surveys have no incentive to answer questions carefully or honestly; hence, they conclude, there is no reason to think that subjective responses reliably reflect respondents' thinking. But this reasoning is not applied consistently. Empirical economic analyses of schooling behavior routinely use respondents' self-reports of their backgrounds, choices, and outcomes. Many analyses use scores on tests administered with surveys to measure respondents' ability. Thus, ironically, economists' own revealed preferences in empirical analysis are somewhat at variance with their expressed views about the interpretability of survey data.

It should be noted that economists' views on the use of subjective data have not always been so negative. In the 1940s, it was common to interview businessmen about their expectations and decision rules. In an influential article, Machlup (1946) sharply attacked existing survey practices as not yielding credible information. This article apparently played an important role in damping the enthusiasm of economists for subjective data. But Machlup only sought to criticize the collection of subjective data through standardized questionnaires. He stressed that cost and revenue expectations are subjective. He advocated research in which the economist learns the institutional peculiarities of a firm and then questions its managers in language they understand.

From the mid-1950s through the mid-1960s, economists analyzed data on consumers' buying intentions (see, for example, Juster, 1966). Although this practice has since almost ceased among economists, it remains firmly entrenched among demographers and market researchers. I have recently reviewed and reinterpreted this literature (Manski, 1990).

The early literatures on businessmen's expectations and on consumers' intentions may hold lessons for efforts to learn youths' expectations. The present problem, however, seems more difficult than those treated previously. Whereas past efforts have sought to elicit unconditional forecasts from adult respondents, here we need to elicit choice-conditioned forecasts from adolescent respondents. We shall not know whether this is feasible until we try.

Notes

[1]In the final chapters of his book, Freeman reported findings from a one-time survey of college students regarding their income expectations in various occupations. But his analysis of these data sheds no light on the realism of the myopic expectations assumption made earlier on.

[2]Some mathematical psychologists interpret expectations in the same subjective probabilistic way as do economists. (See, for example, Kahneman and Tversky, 1979; or Camerer and Kunreuther, 1989.) Their work, however, seems to have had no impact on psychologists or sociologists concerned with schooling behavior.

[3]The mean income $E_0(y \mid \Omega, c=s)$ is well defined only if there exist members of the preceding generation who chose schooling and who had characteristics Ω. The assumptions made in this section guarantee that this condition is satisfied (see Manski, 1991).

[4] Other specifications for Ω may be of interest. For example, Streufert (1990) assumes that youth observe the abilities, choices, and incomes of residents of their neighborhoods. He also supposes that neighborhoods are segregated by income classes. These assumptions suggest the expectations model

$$E^{*}(y \mid z,v) \;=\; E_0\{y \mid z, y \epsilon [a,b], c=s\},$$

where [a,b] is the interval of incomes found in a youth's neighborhood.

[5] Thus, this discussion is not concerned with the dynamic adjustment questions studied by Freeman (1971).

[6] To prove that $\delta_A > \delta_B$, observe that

$$\delta_A - \delta_B = \beta_1\{(\beta_1+\beta_2)[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2} - \beta_2(\beta_2^2+\sigma_2^2)^{-1/2}\}.$$

$\beta_1 = 0 \Rightarrow \delta_A - \delta_B = 0$. The expression $(\beta_1+\beta_2)[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2}$ increases with β_1, as

$$\partial(\beta_1+\beta_2)[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2}/\partial\beta_1$$

$$= [(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2} - (\beta_1+\beta_2)^2[(\beta_1+\beta_2)^2+\sigma_2^2]^{-3/2}$$

$$= [(\beta_1+\beta_2)^2+\sigma_2^2]^{-1/2} \{1 - (\beta_1+\beta_2)^2[(\beta_1+\beta_2)^2+\sigma_2^2]^{-1}\}$$

$$> 0.$$

Hence $\beta_1 > 0 \Rightarrow \delta_A - \delta_B > 0$.

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