CHAPTER NINE

Testing the Breen-Goldthorpe Model of Educational Decision Making

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In 1997, Richard Breen and John Goldthorpe (henceforth B&G) published a model of educational decision making that sought to explain why differentials in educational attainment between young people from different social classes changed rather little, if at all, over the greater part of the twentieth century. The central mechanism that B&G used to account for this is "relative risk aversion": that is, young people (and their families) have, as their major educational goal, the acquisition of a level of education that will allow them to attain a class position at least as good as that of their family of origin. Some subsequent studies have found support for this argument (Need and de Jong 2001; Davies, Heisnen, and Holm 2002). Another (Schizzerotto 1997) has applied the model to explain cross-national differences in average levels of educational attainment. In this chapter we first reformulate the B&G model as a more general model of decision making when students are faced with a sequence of risky choices. One result of this reformulation is that some of the assumptions made by B&G prove to be unnecessary and so their model has wider applicability than might have appeared. The reformulated model is then tested using the case for which it seems most likely to apply: namely men (cf. B&G 1997:296) in England and Wales.

WHAT NEEDS TO BE EXPLAINED?

The starting point for the B&G model is the volume edited by Shavit and Blossfeld (1993). This volume comprised studies of thirteen countries: the United States, Germany, the Netherlands, Sweden, Britain, Italy, Switzerland, Taiwan, Japan, Czechoslovakia, Hungary, Poland, and Israel. In all cases, retrospctive data, collected mainly in the 1980s, were used to measure the extent of class and gender inequality in educational attainment in successive age cohorts born during the first two-thirds of the twentieth century. The major findings were that, notwithstanding substantial expansion of educational systems during the century, particularly at the lower secondary level, in only Sweden and the Netherlands (and, possibly, West Germany) was any clear reduction found in the strength of the association between social class origins and educational attainment. Blossfeld and Shavit (1993:19) conclude that "there has been little change in socioeconomic inequality of educational opportunity" (1993:21, italics in original). This conclusion echoed, to a large extent, earlier findings from the United States (Featherman and Hauser 1978), France (Garnier and Raffalovich 1984), the Netherlands (Drankers 1983), Britain (Halsey, Heath, and Ridge 1980), and elsewhere. It contrasted with the position with respect to gender: ten of the countries had data on both men and women and in all of them there was "a substantial reduction" in male/female differences in attainment.

CONSTANCY OF CLASS DIFFERENTIALS VIA RELATIVE RISK AVERSION

The B&G model was developed in order to explain the constancy of class inequalities over time as these derive from what Boudon (1974) calls "secondary effects." Primary effects are those that give rise to an association between social origins and children's academic ability: their explanation lies outside the B&G model. Secondary effects then come into play to account for educational choices conditional on differences in demonstrated ability or performance. The model is therefore concerned with why children of similar abilities but different class backgrounds are observed to make different educational choices (B&G 1997:277). It has three main elements. First is the structure of the decision problem. B&G argue that within all educational systems there exist points at which young people face the choice of pursuing a more risky or a less risky option. The examples they give are the choice of an academic (risky) versus a vocational (less risky) track; and the choice of continuing to a further educational level rather than leaving the educational system. Risk arises because of the pattern of expected utilities of the different
choices and because there exists the possibility that students who choose the more risky course may in fact fail to complete it. Second, the ith student has a threshold, $T_i$, that determines his or her minimum acceptable level of educational attainment. B&G define $T_i$ to be a social class position at least as good as that from which the student originated. Third, each student has a belief about the probability of succeeding in each of the risky options. B&G call their subjective belief parameter $\pi_i$.

The B&G model can in fact be given a simpler and more parsimonious expression as follows. The educational system consists of a set of levels, $k = 1, \ldots, K$, the first $M$ of which are compulsory. At each level of post-compulsory education there are two terminal educational outcomes (henceforth outcomes). These outcomes are failing ($F_k$ where $k$ indicates the level of education); and leaving having succeeded and chosen not to continue to the next level, $L_{k+1}$. Failing, in this context, means not completing (or not completing satisfactorily) the $k$th level of education and so being unable to continue to the $k + 1$th level. These terminal educational outcomes can be ranked in terms of (expected) utility and this ranking is agreed on by all students: $U(L_k) > U(L_{k+1})$ and $U(F_k) > U(F_{k-1})$ for all $k$.

Students who fail at a given educational level must leave the educational system. Students who complete a given educational level have the choice of leaving the system at that point or continuing to the next level of education. Thus, the utility of succeeding at level $k$ can be written:

$$U(S_k) = \max(U(L_k), V(k+1))$$

where $U(S_k)$ is the expected utility of succeeding at level $k$ and $V(k+1)$ is the expected utility of continuing to level $k+1$. $V$ can be written:

$$V(k) = \pi_k U(S_k) + (1 - \pi_k) U(F_k)$$

where $\pi_k$ is the student's subjective probability of succeeding at level $k$.

The student's decision rule is that she continues to level $k$ of the educational system if

$$V(k) > U(L_{k+1})$$

If this inequality is not met the student leaves the educational system. $V(k)$ then depends on the returns to leaving the educational system at all higher levels and the subjective probabilities of succeeding at these higher levels.

Let $(r_1, \ldots, r_M)$ be a set of outcomes that represent a (probabilistic) function of educational outcomes, $L_k$ and $F_k$, $k = 1, \ldots, K$, and $T_i$ be the outcome that acts as the threshold point for the ith student. For all outcomes, $U(r_m) = U(T)$, the change in utility, as a student moves to more preferred outcomes, is non-declining. For all outcomes having $U(r_m) > U(T)$ the marginal utility as a student moves to higher ranked outcomes, is declining.

On what basis do students determine $T_i$? B&G assume that $T$ is the securing of a class position equal to that of the student's family of origin and so $T$ is defined in terms of labor market outcomes, which are themselves probabilistic functions of educational outcomes. In other cases $T$ might simply be the highest level of education attained by one or other parent (as in Mare and Chang 1998; Need and de Jong 2001; Davies, Heinonen, and Holm 2002). The central point is that, given a definition of $T$, the fact that students differ in where $T$ is located implies that they will differ in their educational choices.

As an example of the application of the B&G model, we focus on the particular educational choice of staying in the system or leaving it as this is depicted in Figure 9.1 (reproduced from B&G 1997:280). Here there are three possible educational outcomes—$P$ (stay and succeed), $S$ (stay and fail), and $L$ (leave immediately)—and each is associated with probabilities of gaining access to positions in three particular classes: Professionals, Managers, and Administrators (denoted $S^*$ for service class), the working class ($W^*$) and the underclass ($U^*$). These probabilities are denoted by $\alpha$, $\beta$, and $\gamma$. Parameters subscripted $1$ refer to the conditional probability of entering the service class; $2$ to the conditional probability of entering the working class; and the conditional probability of entering the underclass is equal to one minus the sum of the other two parameter values. The $\alpha$ parameters relate to transitions to class positions among those who continue and succeed at a given educational level; $\beta$ among those who fail; and $\gamma$ those who choose not to continue to that level. B&G assume that continuing and succeeding is a sure way of avoiding the underclass (i.e., $\alpha_1 + \alpha_2 = 1$) though this is not a necessary feature of the model. B&G (1997:282) also impose four assumptions about the relative sizes of these conditional probabilities.

1. $\alpha > \beta$, and $\alpha > \gamma$. It is generally believed that remaining at school and succeeding affords a better chance of access to the service class than does remaining at school and failing or leaving school.
We now show that the definition of $T_\ast$ given above, together with the assumptions about the probabilistic relationship between educational outcomes and class positions, yields differences in the probabilities of continuing to further levels of education between students from service class ($S$) and working class ($W$) backgrounds.

Define, for $S$ students,

$$U(S^*) = U(W^*) + \lambda_1$$
$$U(W^*) = U(U^*) + \lambda_2$$

and for $W$ students

$$U(W^*) = U(U^*) + \varphi_1$$
$$U(W^*) = U(U^*) + \varphi_2$$

The $\lambda$ and $\varphi$ parameters capture the differences in utility between different class positions. Following B&G, the thresholds are set at $T_S = S^*$ and $T_W = W^*$.

Let $\pi_S^*$ be the subjective probability below which an $S$ student will prefer the $L$ option to continuing in education; and similarly for $\pi_W^*$ in the case of a $W$ student. The class difference that emerges from B&G's analysis is that $\pi_S^* \prec \pi_W^*$; that is, working class students will require a higher subjective probability of success than will service class students in order to choose to continue.

Write

$$\pi_S^* = (\gamma_1 - \beta_1)U(U^*) + \lambda_1 + \lambda_2 + \gamma_2 - \beta_1)/(\gamma_1 - \beta_1)U(U^*) + \lambda_2 + (\beta_2 - \gamma_2)/(\beta_1 - \beta_2)\lambda_1$$

In the case shown in Figure 9.1, $\alpha_1$ is equal to $\alpha$ and $\alpha_2$ is equal to B&G's $1 - \alpha$. A similar expression applies for $\pi_W^*$. Some algebra gives

$$\pi_S^* < \pi_W^* \Rightarrow \frac{\lambda_1}{\lambda_1}(\gamma_1 - \beta_1) + \frac{\lambda_2}{\lambda_2}(\gamma_2 - \beta_1)/(\beta_1 - \beta_2)$$

and this reduces to

$$\lambda_1 \Phi_1[(\gamma_1 - \beta_1)(\alpha_1 + \alpha_2 - \beta_1 - \beta_2) - (\alpha_1 - \beta_1)(\gamma_1 + \gamma_2 - \beta_1 - \beta_2)]$$

$$< \lambda_2 \Phi_2[(\gamma_1 - \beta_1)(\alpha_1 + \alpha_2 - \beta_1 - \beta_2) - (\alpha_1 - \beta_1)(\gamma_1 + \gamma_2 - \beta_1 - \beta_2)]$$

(4)

2. $\gamma_1 + \gamma_2 > \beta_1 + \beta_2$. Remaining at school and failing increases the chances of entering the underclass. This means that there is a risk involved in choosing to continue to the next level of education.

3. $\gamma_2 > \gamma_1; \gamma_2/\gamma_1 \approx (\beta_2/\beta_1)$. Students who leave immediately have a better chance of access to the working class than to the service class. The odds of entering the service rather than the working class are at least as good for those who leave immediately as for those who fail.

4. $\alpha > 0.5$. Staying in education and succeeding makes entry to the service class more likely than entry to the working class.
The assumption about the shape of the utility functions implies that

$$\frac{\lambda_1}{\lambda_2} > \frac{\varphi_1}{\varphi_2}$$  \hspace{1cm} (5)

In words: the change in utility between a $W^*$ and $S^*$ destination relative to the change in utility between $U^*$ and $W^*$ is larger for $S$ students (for whom these changes occur beneath their threshold) than for $W$ students. This means that the term in square brackets in (4) must be negative: that is

$$(\gamma_1 - \beta_1)(\alpha_1 + \alpha_2 - \beta_1 - \beta_2) < (\alpha_1 - \beta_1)(\gamma_1 + \gamma_2 - \beta_1 - \beta_2)$$

This reduces to

$$\gamma_1(\alpha_2 - \beta_2) - \beta_2(\alpha_1 - \beta_1) - \alpha_1\beta_2$$

or

$$\gamma_1 < \beta_1, \frac{(\alpha_1 - \beta_1)(\gamma_2 - \beta_2)}{(\alpha_2 - \beta_2)}$$  \hspace{1cm} (6)

But, if there are to be class differences in $\pi^*$, it must also be the case that at least $\pi^w_0 > 0$ and this requires that

$$\frac{\varphi_1(\gamma_1 - \beta_1) + \varphi_2(\gamma_1 + \gamma_2 - \beta_1 - \beta_2)}{\varphi_1(\alpha_1 - \beta_1) + \varphi_2(\alpha_1 + \alpha_2 - \beta_1 - \beta_2)} > 0$$

By assumption (i), $\alpha > \beta_1$, so the denominator of this expression is positive and $\pi^w_0 > 0$ requires

$$\frac{\beta_1 + \beta_2}{\beta_1 - \gamma_1} < \frac{\varphi_1}{\gamma_1 - \gamma_2}$$  \hspace{1cm} (7)

This condition can be met if either $\beta_1 > \gamma_1$ and $\gamma_1 + \gamma_2 > \beta_1 + \beta_2$ or $\beta_1 < \gamma_1$ and $\gamma_1 + \gamma_2 < \beta_1 + \beta_2$. The fact that $\gamma_1$ can be smaller or larger than $\beta_1$ means that it could, for example, be the case that a young person's chances of access to the service class are improved simply by acquiring more years of education, even if this does not lead to examination success. Alternatively—and, in many European educational systems, more plausibly—such time spent in education may be wasted in the sense that leaving school and embarking earlier on a career will yield a better chance of access to the service class. Of the assumptions invoked by B&G, it is perhaps the second, $\gamma_1 + \gamma_2 > \beta_1 + \beta_2$ (staying and failing yields a higher probability of underclass entry than leaving immediately), which might be thought most controversial.

We now see that such an assumption is not necessary for the model to produce their results. What is necessary is that the returns to staying and failing do not strictly dominate those to leaving immediately—it cannot be that case that both $\beta_1 > \gamma_1$ and $\beta_2 > \gamma_2$ hold. But this does not prohibit the expected return to staying and failing from being higher than that to leaving immediately—which is analogous to the result, reported in many American studies, of a marginal increase in lifetime earnings even for an uncompleted additional year of education.

The definition of a threshold, together with the assumptions that $T_S = S^*$ and $T_W = W^*$ and that (6) and (7) hold, are sufficient to show that $W$ and $S$ students have different probabilities of choosing the stay rather than leave option. Class differences in the distribution of $\pi$ (the subjective probability of succeeding if a student continues in education) and in the distribution of resources with which to meet the costs of education will then act to accentuate the class differences to which relative risk aversion gives rise. Such differences in $\pi$ will exist because "the mean level of ability is higher in the service class than in the working class" (B&G 1997:285) and this difference is reflected in differences in educational performance that students then use to form their expectations of success and failure in the future. "If pupils' expectations about how well they will perform at the next level of education are upwardly bounded by how well they have performed in their most recent examination... then ability differences will be wholly captured in differences in the subjective parameter $\pi$" (B&G 1997:286).

**Testing the model**

The data we use to test the model come from the National Child Development Study (NCDS). The NCDS is a longitudinal study of an entire cohort born in Britain in the week of 3–9 March 1958. The initial sample size was 17,414 (Shepherd 1995). To date, data have been collected at seven points: 1958 (shortly after birth), 1965 (when the studied children were age 7), 1969 (age 11), 1974 (age 16), 1991 (age 33), and 2000 (age 42).

The NCDS provides rich information. Parents were interviewed at the first three sweeps, providing detailed information on the children's social background. Data were also collected directly from the children through tests and questionnaires administered at school at ages 7, 11, and 16. Extensive information on examination results was also collected from the respondents'
schools in 1978. From the age of 16 onward, the respondents themselves were interviewed. We restrict the analysis to boys who were born in England and Wales (henceforth E&W, for short) or had emigrated there by age 5. Because of sample attrition (the achieved sample size in the 1974 survey was 14,761), the geographical and gender restriction of the sample we use and missing data our sample size is 2,804.

Since 1974 the minimum school leaving age in E&W has been 16. This limit applied to members of the NCDS cohort (who became 16 in March 1974). At this age respondents would normally take their first public examination (in 1974 these were either Ordinary Level General Certificate of Education—known as O-level—or the Certificate of Secondary Education, CSE). Reaching the minimum leaving age introduces pupils to their first decision concerning their career, and at this point they are faced with three main alternatives: leaving school and entering the labor market, leaving school and entering apprenticeship, or continuing in school. The next main decision point in the English educational system comes at the end of secondary school, usually at age 18. At this age respondents are expected to take their second public examination (Advanced Level), and to make their second decision concerning their career. At this point pupils are faced with three main alternatives: leaving school and entering the labor market, leaving school and entering non-university postsecondary education or training, or entering university.

We focus on the former decision because access to university or other tertiary course is determined by exam performance (as we show below). Thus, all choices at O-level are solved by backward induction. The decision tree is shown in Figure 9.2 and this also reports the proportion of our sample members who followed the different paths. Perhaps most striking is that only a minority—roughly one in five—of male pupils continued to A-level, but that just over half of them then entered university.

**VARIABLES**

The B&G model argues that, even when controlling for ability and financial resources, there will still be class differences in educational decisions, and thus we need to measure three factors that should affect pupil’s educational choices: financial resources, class background, and ability.

![Figure 9.2. Pathways in the English and Welsh Educational Systems](image)

To tap the available financial resources of the respondent’s family we use a dummy variable for type of accommodation (council, rented, private) when the respondent was 16 (N2471). We also control for the number of rooms in that accommodation (N2476). Ideally we would have used a more direct variable, such as household income, but it is not possible to compute a valid household income variable because, at the time of the 1974 wave, industrial action led to an unspecified share of the sample working a three-day week.

To control for ability and performance we have three measures. First, we use the results, on an 80-point scale, of a General Ability Test at age 11 (N920). As Breen and Goldthorpe (1999) point out, performance on this test would appear to give the best proxy available in the NCDS data set to IQ scores. Second, we control for demonstrated ability measures at age 16 as these stem from performances in public examinations in England and Wales. The NCDS data set includes equivalent scales of 21 CSE and O-level exams (1 = O-level, grade A or B; 2 = O-level, grade C and CSE grade 1; 3 = O-level, grade D or E and CSE grade 2 or 3; 4 = CSE grade 4 or 5; 5 = other result; 6 = no entry), which we inverted and summarized. We further identify all those with no entry score across all the twenty-one subjects (i.e., with 0 score) with a dummy variable. Third, we control for performance in the Advanced level (A-level) at age 18 (i.e., in 1976 irrespective of where these exams were taken). The NCDS data set includes A-level grades in the form of a 15-point scale formed by summing the three best A-level grades (A = 5). Again, we identify those with zero score with a dummy variable.
We use the Goldthorpe class schema (see Erikson and Goldthorpe 1992, chapter 2 for a complete description) to identify seven classes: (I) upper service class, (II) lower service class, (III) routine non-manual class, (IV) petty bourgeoisie, (V) skilled manual class, (VI) unskilled manual class. In the NCDS data the respondent's class at age 33 is coded to the Goldthorpe class schema, and other class variables, such as class origins and respondent's class prior to age 33, are coded to the Office of National Statistics' Socio-Economic Groups (SEGs). However, a fair approximation to the Goldthorpe schema in its seven class version can be derived from the latter (Heath and McDonald 1987). For class origins, then, we derived the Goldthorpe class schema from information on the respondent's father's SEG at respondent's age 16 (N2385), or, if that information was missing, at age 11 (N1175). If the information was missing at both sweeps we derived class from the information on the respondent's mother's SEG at respondent's age 16 (N2394), or, if necessary birth (N490). We also use three measures of class destination: first class position after completion of highest qualification, current or last class position by age 23, and current or last class position by age 33. For the first two of these we derived the Goldthorpe class schema from the respondent's SEG (N6130 and N6147, respectively), while the latter is already coded to the Goldthorpe class schema (N540080).

In the analysis we also omit the self-employed and petty bourgeoisie (class IV). We do this for two main reasons: first, an important aspect of the B&G theory is that educational attainment is governed by the desire for intergenerational class maintenance: but among the self-employed and petty bourgeoisie, education is much less important in maintaining class position than is the direct inheritance of capital (Ishida et al. 1995; Marshall et al. 1997). Secondly, the model requires that the class categories should have a clear rank order and this can be easily achieved only among employees. A key criterion for the way in which one can hierarchically order the employees' class categories is that of employment relations (Goldthorpe 2000). Thus, after omitting class IV we rearranged the Goldthorpe class schema into four hierarchical categories: Class I (higher service relationship), II (lower service relationship), III + V + VI (classes with mixed employment relations), and VII (labor contract).

The distinctive feature of the B&G model is the predictions that it makes about the propensities of children from different classes to make different educational choices, even when they differ neither in their subjective beliefs about the probability of succeeding in the educational system nor in their capacities to meet the relevant costs. We therefore devise a test for such differences that is based on the idea that the threshold expected utility of success required to make a student choose more over a less risky alternative should show significant differences according to class origins.

For the educational setup that we have just described and that is shown in Figure 9.2, the expected utility of leaving the educational system after completing a particular level is

$$EU(k) = \sum_{i=1}^{v} U_i p_i^k$$

(8)

Here \( k \) denotes the educational outcomes \( V^k \) (enter vocational training after O-level or CSE—henceforth, for brevity, we refer only to O-level), \( L^0 \) (enter the labor market after O-level), \( V^j \) (enter vocational training after A-level), \( L^j \) (enter the labor market after A-level), and \( T \) (enter university or "tertiary" education). We use \( p \) to denote the probability of entering destination class \( j \) \((j = 1, II, II + V + VI, and VII)\) conditional on the \( k \)th educational outcome.\(^{13}\)

If we let \( \pi \) denote the subjective probability of doing well enough at A-level to enter university and \( \delta \) the subjective probability of doing well enough at A-level to enter vocational training, we can write the choice of whether to stay in the educational system after O-level rather than enter vocational training immediately after O-level as

$$\pi EU(T) + \delta EU(V^A) + (1 - \delta)EU(L^A) > EU(V^O)$$

(9)

and a similar expression can be written for the choice of whether to stay rather than leave the educational and training system. Because it is easier to enter post-A-level vocational training than to enter university we specify \( \delta \) as a function of \( \pi \) thus:

$$\delta = \pi + (1 - \pi)m$$

(10)

where \( m \) is a constant. Using (10) and rearranging (9) we get an expression for the threshold value of \( \pi \) required to continue to A-level:

$$\pi > \frac{EU(V^O) - EU(L^A) - m[EU(V^A) - EU(L^A)]}{EU(T) - EU(L^A) + (1 - m)[EU(V^A) - EU(L^A)]}$$

(11)

If we now write the origin class specific marginal utilities between one class and another as
where \( i \) indexes origin classes. Using these marginal utilities (and omitting the \( i \) superscript for convenience) we can write

\[
\pi > \frac{\Delta_1 a_1 + \Delta_2 a_2 + \Delta_3 a_3}{\Delta_1 b_1 + \Delta_2 b_2 + \Delta_3 b_3}
\]  
(12)

where

\[
\begin{align*}
a_1 &= p_1'^m - p_1'^r - m(p_1' - p_1^r), \\
a_2 &= a_1 + p_2'^m - p_2'^r - m(p_2' - p_2^r), \\
a_3 &= a_1 + a_2 + p_3'^m - p_3'^r - m(p_3' - p_3^r), \\
b_1 &= p_1^r - p_1^r + (1 - m)(p_1'^m - p_1'^r), \\
b_2 &= b_1 + p_2'^r - p_2^r + (1 - m)(p_2'^m - p_2'^r), \\
b_3 &= b_1 + b_2 + p_3'^r - p_3^r + (1 - m)(p_3'^m - p_3'^r)
\end{align*}
\]

A similar expression to (12), and coefficients corresponding to \( a_1 \) to \( a_3 \) and \( b_1 \) to \( b_3 \), can also be derived for the choice of whether to continue in education rather than leave and enter the labor market. In terms of B&G’s theory, the \( a \) and \( b \) coefficients capture the beliefs that individuals hold about the class returns to different levels and types of education (what we earlier labeled, following B&G, the \( \alpha \), \( \beta \)s and \( \gamma \)s) while the \( \Delta \)s capture the marginal utility attached to different class destinations.

**Deriving Testable Hypotheses**

Testable hypotheses can be derived from (12) provided, of course, that we can replace the coefficients in that expression with actual values. We have no independent measures of the \( \Delta \)s but we assume that, for all classes, all the marginal utilities are positive, and, following our earlier reformulation of the model, that

\[
\Delta_1' \geq \Delta_1' \geq \Delta_1',
\]

\[
\Delta_2' \geq \Delta_2' > \Delta_2',
\]  
(13)

\[
\Delta_3' > \Delta_3' > \Delta_3'.
\]

As far as beliefs about the returns to different levels of educational attainment (the \( a \) and \( b \) coefficients in [12]), B&G say nothing about how they might be formed and the NCDS data contain no questions from which we might empirically establish these beliefs. We therefore investigated a number of different proxies. Our first, and most preferred among the methods available to us, uses the Oxford Mobility Survey (OMS). This was a survey of adult men, fielded in 1972, shortly before the NCDS cohort had to make the educational decisions with which we are concerned, and it provides data on the Goldthorpe class position of respondents and on their education: furthermore, the latter can be coded to approximately the same five categories as we have used for the NCDS respondents. We therefore assume that the educational attainment and class position of adult men who have reached ‘occupational maturity’ (which we take to mean between ages 35 and 60) are a good proxy for the information that young people in our data used to form their beliefs about the social class returns to educational attainment. To operationalize this we cross-tabulated current class position by educational attainment, and the probabilities of being found in each of our four destination classes, conditional on having reached one of our five terminal educational states, \( V^0 \), \( L^0 \), \( V^4 \), \( L^4 \), and \( T \), are reported in Table 9.1.14 As we might have anticipated, the probability of being found in classes I and II increases the higher the educational attainment, while the risk of being found in class VII is greatest among those who enter the labor market directly after one or other public examination.

Using the figures shown in Table 9.1 we derive the following expression for the threshold subjective probability of success at A-level that makes a pupil indifferent between continuing in school and entering vocational training:

\[
\pi_y > \frac{-\Delta_3 0.007 - \Delta_3 0.075 + \Delta_3 0.022}{\Delta_3 0.259 + \Delta_3 0.240 - \Delta_3 0.150}
\]  
(14a)

and the same in respect of the choice of staying in school versus leaving and entering the labor market:

\[
\pi_t > \frac{-\Delta_3 0.032 - \Delta_3 0.160 + \Delta_3 0.021}{\Delta_3 0.259 + \Delta_3 0.240 - \Delta_3 0.150}
\]  
(14b)
As far as the choice of staying rather than entering training is concerned, it is clear from (14a) that any pupil for whom $\Delta_3 \geq \Delta_2$ always prefers to continue in education, regardless of the value of $\pi$. As we saw in (13), this is true of pupils from origin classes I and II. But pupils from classes III $+$ V $+$ VI and VII attach greater weight to $\Delta_2$ than to $\Delta_3$ and this is particularly true of those from class III $+$ V $+$ VI for whom $\Delta_2$ is the difference in utility between downward mobility and maintaining their class position. For pupils from both these class origins, we can expect that not all will choose to continue in education (note that more weight attached to $\Delta_2$ increases the numerator and decreases the denominator), and that those from class III $+$ V $+$ VI will be particularly likely to leave at this point and take up some vocational training. Thus our first hypothesis is:

Controlling for the subjective probability of success at A-level and for family resources, there will be class differences in the choice of continuing in school or entering vocational training. Pupils from classes I and II will be most likely to continue, followed by those from class VII, with those from class III $+$ V $+$ VI the least likely to do so.

As for the choice of staying rather than entering the labor market directly, the same considerations apply, though in this case, only pupils who attached very considerable weight to $\Delta_3$ would choose to leave rather than continue to A-level. Thus our second hypothesis is:

Controlling for the subjective probability of success at A-level and for family resources, only those pupils who attached a great deal of utility to entering classes

$$III + V + VI \text{ relative to VII, and very little additional utility to gaining access to classes II and I will choose to leave school and enter the labor market.}$$

In cases where both leaving and entering a vocational course are preferred to staying, we expect the latter to be preferred to the former if

$$c_1 \Delta_1 + c_2 \Delta_2 + c_3 \Delta_3 > 0$$

where

$$c_1 = p_1^{2n} - p_1^1,$$

$$c_2 = c_1 + p_1^{2n} - p_1^2,$$

$$c_3 = c_2 + p_1^{2n} - p_1^3$$

Given the OMS data, all the $c$ coefficients in (15) are positive, leading to our final hypothesis:

pupils from all class backgrounds should prefer a vocational course to direct labor market entry after O-level.

**Testing the Hypotheses**

These hypotheses can then be tested quite straightforwardly. Table 9.2 shows the estimated coefficients from a multinomial logit model in which the dependent categories are the choices at A-level. As we can see by comparing the columns labeled 1 with those labeled 2, once we control for educational performance at A-level there are no class differences in choices whatsoever. This confirms our earlier argument that access to university or other tertiary course is determined by exam performance and that the decision after O-level is the only one of any consequence.

Table 9.3 then reports the coefficients from a multinomial logit model of decisions after O-level. Columns (1a) and (1b) show the gross class differences in the odds of choosing to enter vocational training rather than continue to A-level and in the odds of entering the labor market rather than continuing to A-level, but these are greatly reduced when we control for ability, performance, and family resources. Nevertheless, in support of H1, pupils from origins in classes III $+$ V $+$ VI and VII are significantly more likely to enter vocational training in preference to staying to A-level than are pupils from classes I and II, though there is no significant difference between the propensities of class III $+$ V $+$ VI and class VII students. To assess hypothesis H2 would require information on the detailed shape of students' utility.
functions, but it would seem to follow from B&G's arguments that the largest value of $\Delta_3$ should be held by pupils from class III + V + VI, and therefore they should be the most likely to prefer to leave and enter the labor market. In fact, it is pupils from class VII origins who are significantly more likely than all others to go directly into the labor market after O-level. The class difference that persists here is due neither to poorer resources nor to lower expectations of success, and it can be attributed to the mechanism of relative risk aversion that B&G propose only if we assume that pupils from class VII origins attach zero marginal utility to attaining any position higher than class VII (i.e. $\Delta_3 = \Delta_3 = 0$). This seems implausible (though not impossible), and there must therefore be something else about coming
from class VII that depresses the likelihood of continuing to A-level. Lastly, hypothesis H3 is confirmed by our data: given the choice of leaving and entering the labor market or leaving and entering vocational training, pupils of all classes would prefer the latter (as we see from the larger coefficients in column 2b compared with those in 2a).

Although these results are favorable to the B&G hypothesis, it should be noted that the OMS data are far from ideal for the purpose to which we have put them. As well as the problem of the small sample it is also the case that these men experienced an educational system that was in some respects quite different from that experienced by the NCDS cohort (for example, O-levels and A-levels were not introduced until 1950). Thus, although it is certainly plausible that these data provide a reasonable proxy to whatever sources of information young people in the early 1970s might have used as the basis for their educational decisions, there are also good grounds for skepticism.

Thus far it appears that the B&G model has not fared too badly. But the major difficulty of testing the model is to find estimates of the beliefs that young people hold about the class returns to various educational options and so we examined three other sets of estimates using empirical probabilities derived from the sample members’ own experiences after leaving the educational system. In other words, we took the jobs that respondents later occupied and used the observed relationship between educational attainment and the class of those jobs as a proxy for the beliefs they held when they made the choice of education. Recall that we have three measures of post-education class position, based on first job, most recent job held at age 23, and most recent job held at age 33. Assuming that respondents’ expectations are accurate but somewhat myopic, we begin with first job. This yields the cross-tabulation shown in Table 9.4a and from that we derive threshold values as follows:

\[ \hat{\pi}_V > \frac{\Delta_1 0.048 - \Delta_2 0.152 + \Delta_3 0.104}{\Delta_1 0.269 + \Delta_2 0.458 + \Delta_3 0.151} \]  

\[ \hat{\pi}_L > \frac{\Delta_1 0.034 - \Delta_2 0.133 - \Delta_3 0.119}{\Delta_1 0.269 + \Delta_2 0.458 + \Delta_3 0.151} \]  

These results are similar to equations 14a and 14b but more straightforward because the denominator is now always positive. In this case, men for whom \( \Delta_1 \) is sufficiently large compared to \( \Delta_2 \) and \( \Delta_3 \) will certainly prefer to leave after O-level to enter vocational training: given our assumptions about the relative sizes of the \( \Delta \)s this is most likely to be true of men of class III + V + VI, followed by men of class VII. On this basis, then, we should expect young men from these two classes to be more likely than those from classes I and II to leave school and enter training after O-level, and as we have already seen in Table 9.3, this is true of both classes III + V + VI and VII. But the numerator of equation (16b) is negative suggesting that no pupils would choose to leave school and enter the labor market directly in preference to continuing to A-level, and, as we have already seen, the survey does not support this.

The distribution of classes by educational attainment at age 23 shown in Table 9.4b yields threshold equations as follows:

\[ \hat{\pi}_V > \frac{\Delta_1 0.064 - \Delta_2 0.337 - \Delta_3 0.127}{\Delta_1 0.285 + \Delta_2 0.215 - \Delta_3 0.404} \]  

\[ \hat{\pi}_L > \frac{\Delta_1 0.075 - \Delta_2 0.304 - \Delta_3 0.272}{\Delta_1 0.285 + \Delta_2 0.215 - \Delta_3 0.404} \]  

and using the data at age 33 (shown in Table 9.4c) yields equations as follows:

\[ \hat{\pi}_V > \frac{\Delta_1 0.261 - \Delta_2 0.390 - \Delta_3 0.140}{\Delta_1 0.196 + \Delta_2 0.179 - \Delta_3 0.102} \]  

\[ \hat{\pi}_L > \frac{\Delta_1 0.230 - \Delta_2 0.345 - \Delta_3 0.252}{\Delta_1 0.196 + \Delta_2 0.179 - \Delta_3 0.102} \]  

In all four equations, the numerator will always be negative, showing that the relative risk aversion mechanism will lead to no class differences in choice of educational option. The reason is evident in Tables 9.4b and 9.4c, where the class returns to entering the labor market directly after A-level (i.e., the worst outcome for someone who chose to remain in school after O-level) dominate those to entering vocational training after O-level (i.e., the best outcome for those who chose to leave school after O-level). There is therefore no risk involved in continuing in education and so no incentive to leave at this point. The reason for the difference in the expectations we would hold when using these measures of class position, rather than the class of first job, arises from the massive upward mobility that this cohort experienced between their first job and the job they held at age 33. This appears part of a more general upward shift in the British class structure over the period from the late 1970s to 1991. The NCDS respondents could not have been expected to know that this would happen and so their actual class positions at a point near “occupational maturity” cannot really be taken as a
guide to their beliefs. On the other hand, to take their class position derived from their first job as their beliefs about the class that their educational choices will finally lead them to attain is to attribute to them an unreasonable degree of myopia. 21

CONCLUSION

We have reformulated the B&G model of educational decision making and derived hypotheses, which we then tested using data on young men in England and Wales in the early 1970s who were making the transition from compulsory to post-compulsory secondary education. Our tests follow from the idea that, because young people from different class origins have different threshold levels of education that they seek to reach as a minimum, they will differ in the marginal utility they attach to higher educational levels, giving rise to different propensities to choose alternative educational and non-educational options. These class differences in the incentives to continue in education can be derived from the reformulated model, but the tests also depend on our ability to operationalize the assumed common (among students of all class origins) beliefs about the returns to educational attainment. These were not measured in the NCDS data set we used, and it turns out that our results depend on which particular source of information about the class returns to different levels and types of educational attainment we use. But, we suggest, the most plausible of these is the first source, the OMS survey, and the results from this survey give some measure of support to the B&G model. Hypothesis 1 predicted that, as far as the choice of whether to continue to A-level studies or enter vocational training is concerned, students from classes I and II would be most likely, those from VII less likely, and those from III + V + VI least likely, to prefer A-level. Our results suggested that, while I and II were indeed the most likely, there was no difference between students from the other two classes. Hypothesis 2 predicted that students from class III + V + VI would be most likely to prefer direct entry into the labor market over continuing to A-level; this was not borne out by our analysis in which students from class VII were most likely to do this, with the other classes showing no significant differences. Lastly, hypothesis 3, that all students would prefer vocational training to direct labor market entry, was supported by our results.

However, perhaps the clearest conclusion that comes from our analysis is, indeed, the important role played by students' beliefs and the difficulty of
adequately proxying them. Our results are sensitive to our choice of proxy: when we used beliefs based on the students’ own first job the results were somewhat less supportive of the B&G model, and when we used proxies based on their later jobs the predictions of the model were not borne out at all. The difficulty of adequately proxying beliefs is an old refrain: Manski’s (1993) paper is perhaps the best known plea for attempts to measure pupil beliefs, and it is one that we can only echo. Our analysis clearly shows the dependence of the success or failure of the B&G model on whether or not pupils hold the “right” set of beliefs.

It is noticeable that the earlier attempts to test the B&G model, to which we referred at the start of this chapter, have circumvented this problem by assuming that pupils define the threshold value, $T$, not in terms of their future class position, but in terms of a particular level of educational attainment (typically the level attained by one or other parent). One way of reconciling this with the original formulation of the model would be to suppose that, in the absence of adequate information about the likely future returns to education, students simply use parents’ educational level as a heuristic: that is, they assume that attaining the same educational level as their parents is likely to lead them to attain much the same class position. But whether or not this is so is better dealt with as an empirical matter than as an assumption.

**Notes**

1. Partial exceptions to this are Britain, where the data come from cohorts born between 1913 and 1952; Japan, where they come from cohorts born between 1905 and 1955; and Switzerland, where the data come from two cohorts one born in 1950, the other in 1960.
2. Subsequent research has confirmed Sweden (Jonson and Erikson 2000) and Germany (Jonson, Mills, and Muller 1996) as exceptions to this pattern of stability, and research using more recent French (Thelot and Valler 2000) and Dutch (Ganseboom and Luijks, 2004) data suggests declining class inequalities there too.
3. This reformulation of the model is taken from Breen (2001).
4. This may also be true of the less risky choice but for simplicity of exposition B&G assume that there is no chance of educational failure in this case.
5. For convenience we drop the student-specific subscript except where this would cause confusion.
6. B&G (1997:286) add a second condition. Students will continue in education at level $k$ only if both condition (3) and the condition $r > c_k$ are met, where $r$ is the student's family's resources and $c$ is the cost of education at that level. Because the latter condition is rather straightforward we do not discuss it any further.
7. The model is thus a special case of Kahneman and Tversky’s (1979) prospect theory.
8. We are here following B&G’s original choice of classes, which are chosen for illustrative purposes and are not meant to be exhaustive. So, for example, $S^*$ does not include clerical workers. $U^*$ would include unskilled workers, the chronically unemployed and similar.
9. Although, as noted in the introduction, there have been a number of recent tests of the model that have been largely supportive of it, the assumptions of the model might themselves be subjected to further empirical scrutiny. The model assumes that students hold beliefs about the relationship between educational attainment and the attainment of class position that do not vary by class background, and that they have a threshold level of attainment, which does. In principle these assumptions could be tested. Additionally, some consideration might be given to the degree of sensitivity of the results of the model to these assumptions. Certainly if the model were to be extended to explain, say, ethnic group differences in educational decision making, it would be unrealistic to assume common beliefs about the returns to education given that minority groups often believe themselves to be discriminated against. As Macleod’s (1995) work illustrates very well, this diversity of beliefs about educational returns can be an important explanation for variation in educational decisions.
10. B&G examine two sets of values for the $\alpha$ and $\varphi$ parameters. Initially they set the utility of outcomes $S^*$ and $W^*$ to one for working class students while $U(U^*)$ is zero, and to $U(S^*) = 1$ for service class students and both $U(W^*)$ and $U(U^*)$ are set to zero. This implies $\lambda_1 = 1; \lambda_2 = 0; \varphi_1 = 0; \varphi_2 = 1$. Later B&G allow $S$ students to attach different utility to $W^*$ and $U^*$ and $W$ students to attach more utility to $S^*$ than to $W^*$. So we have: $U(S^*) = 1; U(W^*) = 0; and U(U^*) = -x$, for $S$ students; and $U(S^*) = x^*; U(W^*) = 1; and U(U^*) = 0$ for $W$ students. These give

$$\lambda_1 = 1; \lambda_2 = x; \varphi_1 = (x^* - 1); \varphi_2 = 1$$

The earlier formulation is consistent with the requirement that $\lambda_1 / \lambda_2 > \varphi_1 / \varphi_2$ and, if one sets $1 \leq x^* < 2$ and $x \leq 1$, so is the latter. Setting $x^* = 1$ and $x = 0$ in the latter reduces to the earlier formulation.
12. The reason for this is that some of those with a zero score may in fact be cases whose examination results were not reported.
13. Our $p_i^*$ are thus equivalent to the $\alpha$, $\beta$, and $\gamma$ parameters in the original formulation of the B&G model.
14. It should be noted that, although the OMS sample is large (just over 10,000 men), we have rather small numbers at each educational level, and this is mainly because a very high proportion of men in the survey had not taken O-level or an equivalent examination: thus the estimates shown in Table 9.1 will, in some cases, have rather large standard errors.

15. Both (14a) and (14b) are derived setting \( m = 0.1 \). Other values of \( m \) do not change the signs of any coefficients in either equation but a larger value of \( m \) (which corresponds to easier access to post-A-level vocational training) makes it less likely that pupils of classes III + V + VI and VII will choose to enter post-O-level vocational training (as one would have expected since this reduces the risk associated with remaining in school).

16. For example, given \( \Delta_1 = 1 \) and \( \Delta_2 = 2 \), (13a) implies that for \( 5.21 < \Delta_3 < 7.14 \) the threshold value of \( \pi \) required in order to continue in school declines as \( \Delta_3 \) increases. For \( \Delta_3 > 7.14 \) all pupils prefer to stay.

17. Continuing the example from the previous note, given \( \Delta_3 \) in the range 6.38 to 16.76 the threshold value of \( \pi \) needed to remain at school declines as \( \Delta_3 \) increases and for \( \Delta_3 > 16.76 \) all prefer to remain.

18. We also experimented with other specifications and measures of resources, including the number of siblings, persons per room, and whether the respondent received free school lunches, but our results remained unchanged.

19. The exception, as earlier noted, would be any student who held \( \Delta_1 = \Delta_2 = \Delta_3 = 0 \).

20. Again, the figures in the text are based on \( m = 0.1 \).

21. Using the respondents' fathers' education and class position to proxy beliefs is not possible in the NCDS because father's education cannot be coded to the five educational categories we are using.

References


Mental Ability—Uni or Multidimensional?  
An Analysis of Effects  
David Epstein and Christopher Winship

For the better part of the past century, psychologists have argued about whether mental ability is unidimensional or multidimensional. This debate has focused almost exclusively on the appropriate interpretation of results from various factor analyses of test score data. Although these analyses typically indicate that much of the variance in test items can be explained by a single factor, there has been sharp disagreement as to whether this outcome supports the claim that mental ability is unidimensional or rather whether this is simply evidence that different abilities are highly correlated with each other.

Research by psychologists has focused solely on the internal structure of various test batteries. That is, the issue of unidimensionality versus multidimensionality has only been examined in terms of the appropriateness of different models for observed covariance structures of test items. Totally unexamined by psychologists has been the question of whether the effects of mental ability on different outcomes can be adequately modeled by assuming that mental ability is unidimensional or whether it is necessary to posit multiple dimensions. In fact, John Carroll, one of the most prominent psychologists currently working on the dimensionality of mental ability, has asserted that it makes no sense to examine the possible effects of mental ability until research has resolved the question about its internal structure (Carroll 1993).

What Carroll and other psychologists have overlooked is that the relationship between performance on a test battery and various outcomes

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