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TEST SCORES, EDUCATIONAL OPPORTUNITIES, AND INDIVIDUAL CHOICE

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ABSTRACT

A model combining student preferences for college with university admissions decisions is estimated to provide information on the role of test scores in the determination of post-secondary educational opportunities. In contrast to implications of much of the recent criticism of tests and their use, we find that scholastic aptitude test scores are more strongly related to student application and choice of college "quality" than to college admissions decisions. In addition, although there is a substantial correlation between test scores and high school performance, we find that both post-secondary school preferences and ultimate opportunities are related as much to performance in high school as to test scores themselves. Although SAT scores certainly exclude some persons from schools, our findings indicate that they do not represent a dominating constraint on the college opportunities of high school graduates.

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TEST SCORES, EDUCATIONAL OPPORTUNITIES, AND INDIVIDUAL CHOICE

by

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The role of test scores in the determination of post-secondary school opportunities has been the focus of considerable public discussion and of recent court decisions. These expressions of public interest and conventional wisdom more generally, however, are often based on limited evidence and may not be informed by the most relevant or appropriate information. Our goal is to provide in this paper quantitative information on the current effect of Scholastic Aptitude Test (SAT) scores and other individual attributes on the college preferences of high school graduates and the admissions decisions of post-secondary schools. We hope that the evidence will enlarge the background for and will help to inform future discussion and decisions on the subject.

A great deal of criticism has centered around the validity of college entrance examinations as predictors of college success, while other criticism has questioned the cultural fairness of the tests. Both lines of criticism are reflected in calls for "truth in testing"

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legislation in several states and in movements to deemphasize the role of tests in college admissions.[1] An apparent concern is that test scores may have an extreme influence on post-secondary educational opportunities and thus presumably on subsequent occupational opportunities. This concern may be heightened by the limited evidence on the relationship between test scores and performance in college and the even more limited evidence on the relationship between test scores and academic training on the one hand and occupational productivity or performance on the other. The extent to which answers to the latter questions are important depends in part simply on the magnitude of the effect of SAT scores on student and college decisions. The recent emphasis on test scores may have tended to exaggerate their influence on schooling opportunities relative to the influence of other determinants, in particular school performance itself, and may have misdirected attention to school decisions and away from student choices.

While the importance of test scores has been a major focus of public concern, the influence on college choice of increased earnings attributable to college education has been the focus of much of economic research on the subject.[2] Exceptions are formal discrete choice models of college selection.[3] Whatever the focus of the economic research, it

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1. Substantial discussion has been sparked by the recent Nader report on the Educational Testing Service (Nairn and Associates [1980]), Slack and Porter [1980], and the response to the former (ETS [1980]).

2. Recent examples are Willis and Rosen [1979] and Dresch and Waldenberg [1978].

3. Radner and Miller [1975], Kohn, Manski, and Mundel [1976], Manski and Wise [1978], and Fuller, Manski, and Wise [1980].

has emphasized college attendance versus non-attendance without considering the several separate decisions that determine attendance. There are at least three: the student's decision of whether to apply and if so, to which schools, and the colleges' admission decisions. Our goal is to present empirical evidence on the relative influence of test scores and other individual characteristics on each of these post-secondary school preferences and opportunities.

Human capital literature for the most part emphasizes individual optimal education decisions, investment in education until the marginal benefits--in large part in terms of increased future earnings--are just offset by the marginal cost of another unit of education. In this context, test scores may be thought of as providing individuals and schools with information that will help them to make choices that are closer to the optimum than would be possible without this information. Individuals are presumably aided in determining how much they can get out of additional education--what the gains from additional education will be--and which schools will provide for them the most advantageous education. Test scores presumably help colleges to select the students who will benefit most from the education they provide.[1]

The approach of this paper, however, is to ask to what extent test scores constrain individual choice and thereby limit educational opportunities. Do test scores limit human capital investment decisions and if so, how substantial is the constraint? How important are test scores

1. In a different context, Rothschild [1979] discusses ways in which employment tests may increase national output by permitting more efficient allocation of resources.

in screening students among colleges of various qualities and does the screening operate by way of college application decisions made by individuals or through college admission decisions?

The findings of this paper provide only part of the evidence that would be useful in judging the role of test scores in the determination of individual choice and opportunity. A closely related question is the extent to which test scores help to determine the likelihood that a given student will succeed in a particular college, the likelihood of graduation for example. Another relevant question is the extent to which college quality, given initial student attributes, affects later opportunities as measured, for example, by earnings. If tests constrain college opportunities, then the importance to the individual of the constraint may depend in part on its effect on his opportunities after graduation. Both of these topics are subjects of related papers and will be discussed briefly in the concluding section of this paper. The subject of this paper seems to be a logical precursor to either of these.

We began our research with a focus on the determinants of college admissions, but we realized quickly that to obtain a comprehensive picture of the importance of students' prior school performance and test scores, it was necessary to consider the student application and quality of school choices in conjunction with college admissions decisions. Thus we have developed a model that yields joint estimates of the determinants of all three decisions. In a technical sense, the model incorporates two discrete choices with a continuous outcome. The continuous outcome is the <u>average</u> SAT score of students at the school to which a student applies; it is our measure of school "quality."[1] In addition to individual SAT scores, we have emphasized the influence of high school class rank, non-academic achievement in high school, family background, and local labor market conditions on student decisions to apply for college admission. A primary goal of our analysis has been to compare the relative importance of these characteristics in determining individual and college decisions.

We have based our estimates on data obtained from the National Longitudinal Study of the High School Class of 1972. During the spring of 1972, approximately 23,000 high school seniors were surveyed. The data collected included information on each student's family background, high school performance, and a host of other student characteristics. The students also took a battery of six aptitude tests assembled by the Educational Testing Service (ETS). Three Follow-Up surveys were used to obtain information on post-secondary school and work decisions as well as other related data. We have based our estimates on a random sample of approximately 5,000 of the total sample and have used data from the initial survey and the first follow-up survey.

We find that the importance of both measured academic aptitude and past school performance is reflected much more in student than in college decisions. Test scores in themselves do not in general, through college admissions policies, narrowly pigeonhole persons to a very limited set of post-secondary school opportunities. Test scores and high school class

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1. We are well aware that a comprehensive measure of college quality is almost impossible to define because there are so many determinants of it and because it is a subjective attribute that depends on individual judgment and preferences. Nonetheless, we will sometimes use it as shorthand for the measure that we have.

rank are roughly of equal importance in the determination of both student application and college admission decisions. Our results pertain to schools on average; individual colleges and universities of course may have different admissions policies.

The higher the local wage rate, the less likely are high school graduates to go to college, although the effect is small. The local unemployment rate is not significantly related to college application. Thus apparently our findings weakly support the presumption that there is some interaction between local labor market opportunities and the continuation of schooling; poorer labor market prospects induce more persons to attend school.

Black youth are much more likely than white youth to apply to a college, given high school class rank, test scores, and family background. If affirmative action measures have influenced college attendance, our results indicate that their effects may have been on student application decisions more than on college admission decisions.

The model we have used is described in Section I. The data are explained in Section II. The results are presented in Section III. Concluding remarks are contained in Section IV.

I. The Model

We want to describe how individual attributes are related to the likelihood of college admissions. Presumably college admission decisions depend on the college's academic standards and on the individual attributes of the applicant being considered. Of course any given college considers only students who apply to it. Our approach is intended to integrate the student application decision with the college admission decision, with the particular goal of obtaining consistent estimates of admission probability parameters. We will motivate our statistical model by first considering a simple and standard random choice interpretation of it. The statistical model will then be set forth in a succinct form.

Standard economic reasoning prescribes that whether a given individual finds it worthwhile to go to college depends on the opportunities available to him if he were not to have a college education, as well as the costs of a college education and the opportunities that would be available with a college degree. The opportunities may be defined by monetary reward as well as other occupational and social characteristics. The costs of a college education may include the effort or discomfort associated (by some) with college attendance, as well as foregone earnings. The opportunities available to an individual without college, the relationship between college and subsequent opportunities, and the cost of college incurred by the individual are all likely to depend on individual attributes. For example, persons with high academic aptitude may gain more from college than persons with lower aptitude. The cost of college to an individual--relative to the gains--is likely also to depend on the wealth of his parents.[1] The socioeconomic background of an individual may in general influence his schooling decisions. Opportunities without a college degree will be determined in part by the local labor market conditions faced by the individual.

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1. At least if capital markets are imperfect, and if socioeconomic background influences tastes, even if they are not.

Finally, there is a wide variety of schools, and the particular school that an individual prefers is presumed to depend on his characteristics. It is also reasonable to suppose that whether an individual chooses to go to college should depend on the quality of school he would attend, were he to go to college.

One formal way to capture this line of reasoning is the following. Suppose that X represents a vector of personal, family, and local labor market variables. Suppose that associated with an individual's opportunities without a college degree is a value U_0 that depends on X as well as on unmeasured random factors e_0, such that

(1) $$U_0 = Xb_0 + e_0 ,$$

where b_0 is a vector of parameters. Suppose also that if a person were to go to college the quality of the most preferred college would be

(2) $$Q = X\beta_2 + \varepsilon_2 ,$$

where β_2 is a vector of parameters and ε_2 a random term.[1] Finally, suppose that opportunities with a college education (call them U_1) depend on the characteristics X directly, as well as on the quality Q of the college attended, so that

(3) $$U_1 = Xb_1 + Qc_1 + e_1 .$$[2]

1. The effect of X on Q may reflect in part the individual's perception of the probability of admission to a school of quality Q. We will return to this point later.

2. Higher quality schools, for example, may increase future earnings (Solmon [1975], Solmon and Wachtel [1975], Morgan and Duncan [1979]); it may also affect the enjoyment of a person while a student, or the time and effort required to obtain a degree.

For expository purposes, we have shown U_1 as linear in Q, although our statistical specification does not impose this constraint, and indeed other work has shown the relationship to be non-linear.[1] If we substitute for Q, we have

$$(4) \qquad U_1 = X(b_1 + c_1\beta_2) + (c_1\varepsilon_2 + e_1) .$$

Suppose further that an individual would apply to college only if the value associated with an education at the most preferred school is greater than the value associated with opportunities without a college degree. Then the probability of applying to college is given by the probability that U_1 is greater than U_0, or

$$(5) \qquad \Pr[U_1 - U_0 = X(b_1 + c_1\beta_2 - b_0) + (c_1\varepsilon_2 + e_1 - e_0) > 0)]$$

$$= \Pr[A = X\beta_1 + \varepsilon_1 > 0] ,$$

where A, β_1, and ε_1 are defined by the equality, with A representing the value to the individual of opportunities with college, minus the value of opportunities without college.[2] Notice that β_1 is a vector of "reduced form" parameters, each indicating, according to this interpretation, the effect of the associated variable on the difference between the value of opportunities with and without college.

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1. See Fuller, Manski, and Wise [1980].

2. This specification does not explicitly account for the cost of application, which we believe is not a major determinant of application for most students, but may be important for some who are at the margin. Many schools will waive the application fee on request. In any case, the effect of the cost of application is captured in the constant term in our empirical specification.

Equations (2) and (5) together represent demand for college education. This aspect of the model is analogous to the profit maximization discrete-continuous production models proposed by Duncan [1980] and a similar net supply system model discussed by McFadden [1979].

Thus far we have discussed only the choice of individuals and have presumed that a person would apply to a college only if attendance at that school would be more advantageous to the individual than opportunities without college. A much more detailed model of individual choice among schools to which a person has been admitted is presented by Fuller, Manski, and Wise [1980]. Another and also more elaborate approach is followed by Abowd [1977]. We would like in this paper, however, to consider jointly the individual's application decision and college quality decision together with admission decisions made by colleges.

From application material submitted by students, we presume that admissions officers are able to predict academic potential. Suppose that in general the available information includes test scores--which may afford a straightforward means of comparing all applicants--as well as other indicators of academic preparation such as high school grades or high school class rank. Other information, such as recommendations, may also provide evidence of academic potential, although it may entail considerable subjective assessment on the part of admissions officers. Suppose for ease of exposition that given the high school class rank R_i, of person i, and a test score T_i, the academic potential of person i is evaluated by college j as

(6) $$P_{ij} = \alpha_1 T_i + \alpha_2 R_i + e_{ij} ,$$

where e_{ij} is a disturbance term that captures the stochastic nature of subjective assessment. It may reflect attributes known to admissions officers but for which we do not have measures, and it may vary with the school to which the individual applies. The parameters α_1 and α_2 are weights placed by admissions officers on test scores and past school performance. For convenience we shall assume for the time being that they are constant across colleges.

The equation above is very similar to the relationship underlying the extensive literature on the predictive validity of tests. In this literature, P_{ij} would be replaced by a measure of academic performance in college--such as grades--and test scores and high school class rank would be taken as predictors of college performance.[1]

It may be tempting to specify the admissions decision as a function of test scores and class rank and to compare the estimated coefficients on the variables in such an admissions model with the estimated validity coefficients on these measures. But, the academic potential of applicants is not the sole criterion for admission to most colleges. Other student characteristics including non-academic talents may also be valued by schools. Consequently, a more realistic description of the

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1. For the case of a single predictor the validity coefficient is the regression (correlation) coefficient in a normalized model. The validity coefficient with a set of predictor variables is the multiple correlation between P_{ij} and the predictors. A recent survey of over 800 such studies found validity coefficients of 0.52 for high school grades, 0.41 for the SAT, and 0.58 for both predictors combined. See Ford and Campos [1977].

relationship between admissions decisions and student attributes should include a broader range of student characteristics than the indicators of academic ability contained in validity models. The relationship (6) is presumed to indicate only the evaluation by college j of the academic potential of student i.

In addition, while colleges may broadly agree on the academic potential of an applicant with given characteristics, we know that colleges have different admissions criteria. In order to translate the above relationship into a selection rule we recognize that an individual's likelihood of admission to a particular college will depend in part on the qualifications of others who apply to that college.

Thus we suppose that for admission purposes, college j attaches a "generalized" potential to student i--call it V_{ij}--that depends on academic potential P_{ij}, as well as other individual attributes Z_i, so that

$$(7) \qquad V_{ij} = P_{ij} + Z_i\delta = \alpha_1 T_i + \alpha_2 R_i + Z_i\delta + e_{ij} ,$$

where Z_i is a vector of attributes and δ a vector of parameters. We also recognize that higher quality schools ceteris paribus require higher academic quality for admission than lower quality schools.[1]

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1. Of course "quality" itself is indirectly determined by the number of applicants as well as their qualifications. In a strict sense the application decision for each student is not independent of the decisions rendered on other applicants. However, since selection ratios and measured characteristics of enrollees tend to change slowly over time, we have defined college quality without reference to the current applicant pool. In the empirical work that follows we use the average SAT scores of students attending the college in 1972 as a measure of quality. We discuss this in more detail in the next section.

Suppose that the required level of V_{ij} in college j is a function of Q_j and is given by $L_j = \alpha Q_j + u_j$, where u_j is a random term.[1] Further, suppose that colleges are willing to trade off academic potential P against other attributes Z, so that the probability of admission of individual i at college j is given by the probability that V_{ij} exceeds L_j, that is

$$(8) \qquad \Pr[V_{ij} - L_j > 0]$$

$$= \Pr[(\alpha_1 T_i + \alpha_2 R_i + Z_i\delta) - \alpha Q_j + (e_{ij} - u_j) > 0]$$

$$= \Pr[S_i = X\beta_3 - \alpha Q + \varepsilon_{3i} > 0] \ ,$$

where S, X, β_3, and ε_3 are defined by the last equality and the index j has been suppressed.

All of these relationships can be presented succinctly in a model with the following three components:

$$(9) \qquad \begin{aligned} &\text{Application:} && A_i = X_{1i}\beta_1 + \varepsilon_{1i} \ , \\ &\text{College Quality:} && Q_i = X_{2i}\beta_2 + \varepsilon_{2i} \ , \\ &\text{Admission:} && S_i = X_{3i}\beta_3 - Q_i\alpha + \varepsilon_{3i} \ . \end{aligned}$$

The likelihood that individual i applies to some college is assumed to be represented by an unobserved indicator variable A_i, that depends on

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1. This multiplicative specification is a simplification. All that is needed to generate the following results is that L_j be a monotonic increasing function of Q_j. Our empirical specification permits a nonlinear effect.

the personal characteristic X_{1i} and the random term ε_{1i}. The quality of the school that a person applies to is given by the continuous variable Q_i, also assumed to depend on personal characteristics X_{2i} and a random term ε_{2i}. It should be interpreted as the quality of college a person with measured attributes X would select as a first choice, were he to apply to college. The likelihood that a person with characteristics X_{3i} will be admitted to a school of quality Q_i is indicated by the unobserved indicator variable S_i, that depends on the random term ε_{3i}, as well as on X_{3i} and Q_i. The characteristics X_{ji} that enter each equation are distinguished by the number in the subscripts because not all of the elements of X enter each of the equations. It is helpful for interpretation to keep in mind that the random terms capture unmeasured determinants of the relationships. A is assumed to be positively related to college application and to have the property that a person applies to some college if A is large enough--in particular, following the usual normalizing assumption, if $A > 0$. S is assumed to have the property that a person is admitted if $S > 0$.

We will use this same general idea, but we must describe the probabilities of three possible outcomes. To do this, we need to consider the covariances between the disturbance terms, given by the covariance matrix

(10)
$$\Sigma = \begin{bmatrix} 1 & \rho_{12}\sigma & \rho_{13} \\ & \sigma^2 & \rho_{23}\sigma \\ & & 1 \end{bmatrix}$$

The variance of the qualities of schools applied to by persons with given characteristics X, is σ^2. The correlation between unobserved determinants of college application and the quality of school applied to is given by ρ_{12}; the correlation between unobserved determinants of application and unobserved determinants of admissions is given by ρ_{13}; and the correlation between the unobserved determinants of college quality and of admissions is given by ρ_{23}. For identification, the disturbances in both of the dichotomous relationships are taken to have variance 1.

we expect a priori that the unobserved determinants of the applications and college quality decisions, both made by applicants, are likely to be highly correlated; but that the correlations between these two and the admission decisions may be much less. This approach is used of course to correct for "selection bias." If the unmeasured attributes that determine admissions decisions are correlated with the unmeasured attributes that determine the quality of the school that an individual applies to, we cannot obtain consistent estimates of the effects on admissions decisions of measured variables without "correcting for" the correlation between these unmeasured variables. And of course only persons who apply to some school select a school of a given quality. To obtain consistent estimates of the effects of personal characteristics on the quality of school persons apply to, we must also account for the possible correlation between unmeasured determinants of the quality of school and unmeasured determinants of application.

For any individual i, there are three possible outcomes: individual i does not apply to college so that $A_i<0$ and no college quality is observed; individual i applies to a college of quality Q_i and is admitted so that $A_i>0$, quality Q_i is observed, and $S_i>0$; individual i applies to a college of quality Q_i but is not admitted so that $A_i>0$, quality Q_i is observed, and $S_i<0$.

The probabilities of these three outcomes for an individual i are given respectively by:

i) $Pr(A_i<0) = 1-\Phi[X_{1i}\beta_1] = P_{1i}$,

ii) $Pr(A_i>0,\ Q_i \text{ observed},\ S_i>0)$

$$= Pr(A_i>0,\ S_i>0|Q_i)\cdot f(Q_i)$$

$$= Pr(\varepsilon_1<X_{1i}\beta_1,\ \varepsilon_3<X_{3i}\beta_3 + Q_i\alpha|Q_i)\cdot f(Q_i)$$

(11)
$$= \int_{-\infty}^{X_{1i}\beta_1}\int_{-\infty}^{X_{3i}\beta_3+Q_i\alpha} g(\varepsilon_1,\varepsilon_3|Q)d\varepsilon_3\, d\varepsilon_1\cdot f(Q_i)$$

$$= P_{2i}\ ,$$

iii) $Pr(A_i>0,\ Q_i \text{ observed},\ S_i<0)$

$$= Pr(A_i>0,\ S_i<0|Q_i)\cdot f(Q_i)$$

$$= Pr(\varepsilon_1< X_{1i}\beta_i,\ \varepsilon_3>X_{3i}\beta_3 + Q_i\alpha|Q_i)\cdot f(Q_i)$$

$$= \int_{-\infty}^{X_{1i}\beta_1}\int_{X_{3i}\beta_3+Q_i\alpha}^{\infty} g(\varepsilon_1,\ \varepsilon_3|Q)d\varepsilon_3 d\varepsilon_1\cdot f(Q_i)$$

$$= P_{3i}\ ,$$

where Φ is a standard normal distribution function and g is a conditional bivariate normal density function.

The log-likelihood function for the total sample of observations is given by

$$L = \sum_{i}^{N_1} \ln P_{1i} + \sum_{i}^{N_2} \ln P_{2i} + \sum_{i}^{N_3} \ln P_{3i} , \tag{12}$$

where the three summations distinguish the groups corresponding to the three possible outcomes. The likelihood function is maximized with respect to the parameters to be estimated: β_1, β_2, β_3, α, σ, ρ_{12}, ρ_{13}, and ρ_{23}.

II. The Data From the National Longitudinal Study of the High School Class of 1972

We have confined our attention to four-year colleges and universities. For example, the probability of application refers to the probability of application to a four year college; some of those who didn't apply to four year schools applied to two year or vocational schools. In addition, the National Longitudinal Study of the High School Class of 1972 asked the respondents to list in order of preference the first three schools to which they had applied. We have based our estimates on the first of those and have checked the results using the second school listed by those who applied to more than one school.[1]

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1. Approximately 63 percent applied to only one school; 21 percent applied to two schools; and only 16 percent to three or more schools. The "most preferred" school is the best apparent indicator of student preferences and admissions decisions based on these applications have been checked with admissions decisions based on applications to the second most preferred school. The results are not noticeably different.

Our analysis is based on several groups of variables. The first group includes variables that describe the individual's academic aptitude and high school performance, as well as non-academic achievements in high school.

The Scholastic Aptitude Test (SAT) score of an individual is thought to have a substantial effect on his post-secondary school preferences and on available alternatives. Although SAT scores are recorded for many students in our sample, not all of them took the SAT test. Many took no college admission test at all, while others took the American College Testing Program (ACT) test. Our method of analysis requires that we have an academic ability measure for all persons in the sample, not only for those who took the SAT test--undoubtedly for most because they planned to apply to some school. For this reason, in some components of the analysis we have used the SAT "equivalent" of the ACT score or an SAT score predicted on the basis of the ETS test scores that are available for each person in our sample.

High school class rank is also presumed to influence both student application and college admission decisions. Any individual's class rank is determined not only by his ability, but by the ability of others in his high school as well. We do not have a definitive measure of high school quality, but have tried to control for it in part by including in our analysis the percent of students from an individual's high school who "go" to two-year and four-year colleges. Finally, we have used two measures of non-academic achievement in high school: leadership in student government and athletic achievement.

The first group of individual characteristics is presumed to affect both the student's application decision and the admission decision of colleges. We believe that measures close to these would be available to most college admissions officers; we believe the only exception is the proportion of students from an applicant's high school who go to college, although in many instances admissions officers may have other implicit or explicit indicators of the quality of high school that an applicant attended. For example, admissions officers may have information on the past performance of students from a particular high school. Admission decisions are also presumed to depend on "quality" of the college in question. Our measure of quality is the average of the SAT scores of students entering the school.[1]

The second group of variables is intended to measure an individual's socioeconomic background and enters the application and college quality equations. It includes family income and parents' education.

Race is also included, with the effect of race allowed to interact with geographic region--South versus Non-South.

The third group includes two measures of local labor market conditions: a local wage rate and a local unemployment rate. These variables enter the application equation.

Finally, the analysis includes an indicator of sex, and an indicator of urban versus rural high school attendance.

The variables are defined as follows:

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1. Solmon [1975] discusses several alternative measures of college quality and expresses a preference for SAT scores over survey measures such as the Gourman ratings. See also Astin and Henson [1977].

SAT: the sum of the verbal and mathematics scores on the Scholastic Aptitude Test if this test was taken, the SAT "equivalent" of the score on the ACT test if it was taken, or, if neither of these was available, a predicted SAT score based on 5 of the 6 ETS tests administered to the National Longitudinal Study sample.

College SAT: the average of the SAT scores of the students in the college to which an individual has applied.

High School Class Rank: the percentile rank of a person in the person's high school, based on course grades.

High School Student Government Leader: one if the person was a leader in high school student government and zero otherwise.

High School Athlete: one if the student was a "leader" in high school athletics and zero otherwise.

Percent of High School Class Going to College: the percent of students from an individual's high school who go to two or four year colleges.

Parents' Income: family income as reported by the youth respondent.

Education of Mother (Father) less than High School: one if the individual's mother (father) had less than a high school education and zero otherwise.

Education of Mother (Father) College Degree or More: One if the individual's mother (father) had a college degree or more education, and zero otherwise. The excluded category is a high school degree but less than a college degree.

Black in the South: one if the person was black and: (1) went to high school in the South (college application and college quality equation) or (2) applied to a college in the South (admissions equation).[1]

Black in the Non-South: defined analogously to Black in the South.

White in the South: defined analogously to Black in the South. The excluded category is White in the Non-South.

Local Wage Rate: average 1972 wage of manufacturing workers in the SMSA of the individual's high school, or if not available, the state average.

Local Unemployment Rate: SMSA 1972 unemployment rate (or state rate where not available).

Male: one if the individual is male and zero if female.

Urban: one if the individual went to high school in an urban area and zero otherwise.

Parents' Income Missing: one if the youth did not report parents' income and zero otherwise.

The means and standard deviations of the variables are shown in Appendix Table 1.

III. The Results

The estimated parameters for each of the three equations, together with (asymptotic) standard errors, are shown in Table 1. The results can be most easily understood by considering the effects of specified changes in the right hand variables. Such effects are presented in Table 2. We will discuss first some of the implications of the results in Table 1 and then turn to Table 2. Finally, we will present simula-

1. South is assumed to include the following states: Alabama, Arkansas, Delaware, Washington, D.C., Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Virginia, West Virginia.

tions based on our estimates.

A. Parameter Estimates

The variable "SAT score" is used in the application and college quality equations, as well as in the admissions equation. Although we do not have an unambiguous interpretation of the estimated effect of this measure on application and college quality, we are inclined to interpret the relevant coefficients as measuring the effects of scholastic aptitude or academic preparation. The ambiguity arises because some students apparently decide not to go to college (and thus do not take the SAT) without knowing precisely what their scholastic aptitude is, according to either the ETS battery of tests or according to an SAT score. In addition, some students make decisions on which schools to apply to before they know their SAT scores. On the other hand, it is clear that actual SAT scores influence the ultimate application decision of many students. In short, we do not know precisely what information is available to students when they apply to a given college. Nonetheless, we feel that our loose interpretation is not likely to be far off, because most students receive many other indications of scholastic aptitude or preparation prior to the time that the SAT is taken, indications that are likely to be highly correlated with SAT scores.[1]

The "college SAT" is entered in the admissions equation in a piecewise linear fashion. The breakpoints are at the mean of college SAT and at the mean plus one standard deviation. It can be seen in Table 1 that, given other individual attributes, the probability of admission declines

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1. For example, PSAT scores that are usually obtained during the junior year in high school.

with college SAT and at an increasing rate.[1] The relevant coefficients are -2.0, -3.5, -6.6.

The correlations among the unmeasured determinants (error terms) of the three outcomes are shown at the bottom of Table 1. As expected, the correlation between the unmeasured determinants of the application and the college quality decisions is positive and large, .87. Thus, given our set of measured characteristics, persons who are the most likely to apply to some college are also likely to apply to a college of higher quality than the average. Neither the correlation between the error terms in the applications and admissions equations nor between the unmeasured determinants of college quality and admission are significantly different from zero by standard criteria. The first correlation is .08 and the second -.02. Because these are correlations between unmeasured determinants of individual versus college decisions it is not surprising that they are small. The two individual decisions are on the other hand highly correlated.

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1. If we let college SAT be represented by $\overline{SAT}$ and its mean by μ, and its standard deviation by σ, the specification is precisely described by the three variables:

$$\overline{SAT}_1 = \begin{cases} \overline{SAT} & \text{if } \overline{SAT} \leq \mu \\ \mu & \text{if } \mu < \overline{SAT} \end{cases}$$

$$\overline{SAT}_2 = \begin{cases} 0 & \text{if } \overline{SAT} \leq \mu \\ \overline{SAT} - \mu & \text{if } \mu < \overline{SAT} \leq \mu + \sigma \\ \sigma & \text{if } \mu + \sigma < \overline{SAT} \end{cases}$$

$$\overline{SAT}_3 = \begin{cases} 0 & \text{if } \overline{SAT} \leq \mu + \sigma \\ \overline{SAT} - (\mu + \sigma) & \text{if } \mu + \sigma < \overline{SAT} \end{cases}$$

Most of the parameters are measured with considerable precision, as judged by the standard errors. In the simulations below, however, we have in one or two instances given results based on the estimated parameter even though the parameter estimate was of marginal significance (say with a t-statistic considerably less than 2).

Finally, the numbers at the end of the table indicate that 40 percent of the sample applied to a four-year college and that of those who applied, 89 percent were admitted to the college listed as the first choice. In short, there appears to be a substantial amount of self-selection; most persons apply to schools where they are likely to be admitted. And indeed, a surprisingly small number of schools are even moderately selective.[1] In any case, even these summary numbers suggest that much of the effect of personal characteristics on college attendance outcomes is through individual application and college quality choices rather than through their effect on college admissions decisions.

B. The Effect of Two Standard Deviation Shifts and Category Changes in Variables

To compare the estimated effects on the three outcomes of changes in each of the right-hand variables, it is helpful to consider the effects of "comparable" changes in each of them. Such results are presented in Table 2. An example will help to explain the entries in this table. Consider the effect on the probability of application of

1. See Hartnett and Feldmesser [1980] where this finding is discussed in some detail, as well as findings on the proportion of applicants admitted. The numbers that they cite are consistent with our findings.

a change of 2 standard deviations in a person's SAT score, assuming that none of the other variables is changed. We have assumed that each of the other variables is equal to its sample mean. Then we have evaluated the probability of application for a person with an SAT score one standard deviation above the mean of students in our sample, and the probability with an SAT score one standard deviation below the mean. The table entry of .35 is the first probability minus the second. The entry of 120 in the second column means that a person with an SAT score two standard deviations (about 350 points) higher than the score of a second person with the same (mean) values for other variables will on average apply to a school with average SAT scores 120 points higher than the second person. The same difference in SAT score would change the individual's probability of admission by .12, other things equal. For non-continuous variables, the comparison pertains to the change associated with the specified change in category. For example, evaluating other variables at their means, the probability that children of parents who are both college graduates will apply to some college is .29 higher than the probability for children of parents with less than high school education. To evaluate the results in Table 2, it is useful to keep in mind that the portion of the sample who applied to a college was .40 and the overall admission rate was .89; the standard deviation of college quality (SAT) is 124.

The estimates for admission are based only on the admission parameter estimates. To obtain, for example, the probability that an individual X will in fact be admitted to a school, we must consider the probability of application and the expected quality of college applied to, as well as the probability of admission. The results in Table 2 pertain to the effect on the probability of admission of a change in a given variable, should a person with the mean X value for other variables be considered for application.

The most important determinant of college choice and admission is scholastic preparation as reflected in the SAT score and high school class rank measures; but other personal characteristics are also important. Scholastic preparation and other variables are most important in determining whether or not to go to college at all and the quality of college to apply to, rather than in the determination of admissions. We will present below more evidence on this.

The influences of SAT score and class rank are of comparable orders of magnitude in each of the equations, although the SAT score has a somewhat greater effect than class rank in both the application and college quality equations. (The relevant magnitudes are shown in more detail in the simulations below.)

The single most important determinant of college admission, by these measures, is the college quality itself. Colleges with better students necessarily have more selective admissions policies on average. In the terminology of the admissions model described on page 11, they require higher academic potential. This is not apparently a student body size effect, because student body size is not statistically significant when added to the admissions equation.[1]

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1. Applicants to the better schools are more likely than applicants to lower quality schools to make several applications to schools of comparable quality. Thus for this reason also, the probability of admission to any particular school should be expected to decline on average with increasing school quality.

Student government leadership in high school and athletic achievement are also positively related to the probability of college application and to the quality of school to which persons apply. These measures have estimated effects on the probability of application about one-half as large as the estimated effect of a two-standard deviation (50 percentile point) change in class rank. Their effect on college quality is also about one-half as large as a two-standard deviation shift in class rank. Both of these non-academic measures of achievement appear to be less important, relative to other variables, in college admissions decisions than in student college application and college quality decisions.

Parents' education, by these measures, has effects on college application and college quality that in order of magnitude are more or less comparable to the effects of class rank. The effect of a two-standard deviation shift in parents' income is only about one-half as large as the effect of the described change in parents' education. The effect of the change in parents' income is about the same as the effect of the high school student leader and athlete effects.

Black high school graduates with given characteristics are considerably more likely to apply to four-year colleges than white high school graduates with the same characteristics.[1] Their probability of application to a four-year school is about .45 (absolute value) higher in both the North and the South than the probability for whites in the North. Blacks may in general be more likely to apply to college than whites of comparable ability and background because of relatively greater returns to college education. The

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1. Comparable results on post-secondary school attendance are presented in Meyer and Wise [1979].

result may also be a reflection in part of increased awareness of and encouragement associated with government affirmative action policies. It may also be that black colleges in the South attract some black students who would not attend college if they lived in other regions of the country and would go to non-black schools if they were to go to college. In other regions, particularly in the West, blacks may be more likely also to go to junior colleges.

This latter observation is consistent with the observation that black students in the South on average apply to considerably lower quality schools than white students in the South, the difference in average college SAT is 81 points (the standard deviation of average college SAT is 124). On the other hand, blacks in the non-South apply on average to schools with average SAT scores about 58 points higher than the school applied to by whites. Our estimates indicate that black students in both the North and the South are apparently a bit more likely to be admitted than white students, holding other variables constant, but in neither region is the estimated effect significantly different from zero by standard criteria. In general, if affirmative action has affected student college outcomes, its effect has apparently been reflected more in student decisions than in decisions of colleges.

Finally, we see that local labor market conditions have only small estimated effects on college attendance and only the wage effect is significant and of the expected sign; where the wage rate is high, persons are less likely to go to college. The importance of these variables is swamped by the influence of measures of academic ability and preparation and by the effects of family background. Of course academic ability should

Table 1. Parameter Estimates (and Asymptotic Standard Errors), by Equation.

Variable	Probability of Application	College Quality (SAT)[a]	Probability of Admission
SAT Score (÷1000)	2.423 (0.150)	0.303 (0.018)	1.471 (0.636)
High School Class Rank (÷100)	1.431 (0.100)	0.147 (0.013)	1.155 (0.269)
High School Student Leader	0.337 (0.077)	0.028 (0.009)	0.241 (0.173)
High School Athlete	0.333 (0.066)	0.038 (0.008)	0.182 (0.130)
Proportion of High School Class Going to College	0.811 (0.120)	0.105 (0.015)	-0.385 (0.315)
College SAT, 1 (÷1000)	--	--	-1.968 (2.006)
College SAT, 2 (÷1000)	--	--	-3.525 (1.957)
College SAT, 3 (÷1000)	--	--	-6.632 (1.871)
Parents' Income (÷10,000)	0.266 (0.047)	0.023 (0.006)	--
Education of Mother Less Than High School	-0.041 (0.054)	-0.009 (0.007)	--
Education of Mother College Degree or More	0.226 (0.070)	0.010 (0.008)	--
Education of Father Less Than High School	-0.248 (0.053)	-0.027 (0.007)	--
Education of Father College Degree or More	0.238 (0.061)	0.031 (0.007)	--

Table 1. Parameter Estimates (and Asymptotic Standard Errors), by Equation (continued).

Variable	Probability of Application	College Quality (SAT)[a]	Probability of Admission
Black in the South	1.243 (0.088)	-0.106 (0.009)	-0.055 (0.336)
White in the South	0.034 (0.056)	-0.025 (0.007)	-0.043 (0.115)
Black in the Non-South	1.242 (0.105)	0.058 (0.012)	0.174 (0.200)
Local Wage	-0.078 (0.032)	--	--
Local Unemployment Rate	-0.013 (0.010)	--	--
Male	0.168 (0.044)	0.021 (0.006)	-0.095 (0.095)
Urban High School	0.002 (0.047)	0.009 (0.006)	0.049 (0.097)
Parents' Income Missing	0.254 (0.075)	0.026 (0.010)	--
Constant	-3.738 (0.192)	0.457 (0.021)	1.513 (0.633)
Correlations:		Log Likelihood Value	-1095.9
Application-College Quality	0.868 (0.087)	College Quality Error Variance, $\hat{\sigma}^2$	0.016 (0.001)
Application-Admission	0.078 (0.171)	Total Sample	5001
College Quality-Admission	-0.024 (0.179)	Number of College Applicants	2005
		Number Admitted	1799

a. College SAT divided by 1000.

Table 2. Effects of Standard Deviation and Category Changes in Variables, by Equation.

Variable	Probability of Application	College Quality (SAT)	Probability of Admission
SAT Score 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	.35	120	.12
High School Class Rank, 1 S.D. Above the Mean, Versus 1 S.D. Below the Mean	.29	81	.13
High School Student Leader Versus Not	.13	28	.04
High School Athlete Versus Not	.13	41	.02
Percent of High School Class Going to College, 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	.12	40	-.03
College SAT, 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	--	--	-.15
Parents' Income, 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	.14	32	--
Education of Mother and Father College Degree or More Versus Education of Mother and Father less than High School	.29	78	--

Table 2. Effects of Standard Deviation and Category Changes in Variables, by Equation (continued).

Variable	Probability of Application	College Quality (SAT)	Probability of Admission
Black in the South Versus White in the Non-South	.46	-106	.01
White in the South Versus White in the Non-South	.01	-25	-.01
Black in the Non-South Versus White in the Non-South	.45	58	.03
Local Wage, 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	-.03	--	--
Local Unemployment Rate, 1 S.D. Above the Mean Versus 1 S.D. Below the Mean	-.02	--	--
Male Versus Female	.06	21	.02

reflect in part the gains to be had from college education and this surely reflects in part the reward to college training in the labor market.

C. Additional Simulations

To give a better idea of the relative effects of class rank and SAT scores and their importance in application versus admissions decisions, we have presented a few simulations. Suppose that other variables assume sample mean values, while student SAT and class rank assume the various values shown in Table 3. The table entries represent simulated estimates of application and admission probabilities together with preferred college qualities.

Notice first that estimated admission probabilities are much higher than estimated application probabilities. In particular, persons in the bottom half of their high school classes and with low SAT scores, say 700 or lower, are very unlikely to apply to a four-year college--.03 to .23. Yet if such persons applied to a college of average quality, their likelihood of admission would be very high--between .52 and .82. Even persons with high class rank and SAT scores are considerably less likely to apply to colleges than to be admitted should they apply to the average school. It seems apparent that the greatest impact of SAT scores and class rank is on individual application decisions. The relative impact on college admission is much less.

The effect of SAT scores and class rank on preferred college quality is shown in the bottom part of Table 3. Again, we see substantial differences in average preferred college quality, depending on individual academic performance and aptitude.

In short, students seem to categorize themselves by SAT scores much more than colleges themselves do.

This is not to say that anyone has a relatively high probability of being admitted to any school. To demonstrate this we have calculated admission probabilities at different quality colleges for selected SAT and class rank values. The results are presented in Table 4.

At the lower quality colleges (800 is well below the average) the probability of acceptance is high for all applicants. This is consistent with the findings of Wing and Wallach [1971]. According to their findings almost half of all schools essentially have open admission and don't actively consider SAT scores, although they may require applicants to take the SAT.

On the other hand, it is clear that the probability of admission at the best schools would be low for most students and would be well below a sure thing even for students with the best academic credentials. [Recall that these simulation results assumed that individual attributes, other than SAT score and class rank, are equal to the average over all persons in the sample]. Our results should give a good indication of the expected experience of students at the majority of schools. For schools in the tail of the selectivity distribution, however, our results may be less accurate. For example, at schools with an average SAT of 1400, our prior judgment was that almost no very poor student would be admitted but our simulations suggest probabilities greater than zero, and the simulated probabilities for the best students may be high. Of course the simulations in the tails are based on extrapolations well beyond the central tendency of the data, especially when it is assumed that other determinants of

Table 3. Simulated Application Probabilities, Admission Probabilities and College Qualities, for Selected SAT and Class Rank Values.

SAT	CLASS RANK (Percentile)				
	0	25	50	75	100
	Probability of Application				
500	.03	.06	.11	.19	.30
700	.07	.14	.23	.35	.49
900	.17	.27	.40	.54	.68
1100	.31	.45	.59	.72	.83
1300	.50	.64	.76	.86	.92
	Probability of Admission at Average Quality College				
500	.52	.63	.74	.82	.89
700	.64	.74	.82	.89	.93
900	.74	.82	.89	.93	.96
1100	.83	.89	.94	.96	.98
1300	.89	.94	.96	.98	.99
	College Quality				
500	690	727	764	800	837
700	751	788	824	861	898
900	811	848	885	921	958
1100	872	909	945	982	1019
1300	932	969	1006	1042	1079

Table 4. Simulated Probabilities of Admission at Colleges of Selected Qualities for Selected SAT and Class Rank Values.

SAT	CLASS RANK (Percentile)				
	0	25	50	75	100
			College SAT 800		
500	.69	.78	.86	.91	195
700	.78	.86	.91	.95	.97
900	.86	.91	.95	.97	.98
1100	.92	.95	.97	.99	.99
1300	.95	.98	.99	.99	.99
			College SAT 1100		
500	.41	.53	.64	.74	.83
700	.53	.64	.74	.83	.89
900	.65	.75	.83	.89	.94
1100	.75	.83	.89	.94	.97
1300	.83	.89	.94	.97	.98
			College SAT 1400		
500	.02	.04	.07	.12	.18
700	.04	.07	.12	.19	.27
900	.07	.12	.19	.27	.38
1100	.12	.19	.28	.38	.49
1300	.20	.28	.38	.49	.61

admissions are held constant. In addition, we have not allowed interaction terms--say between SAT and class rank--that might be expected to improve the "fit" of our specification, especially at extreme values of the explanatory variables. Nonetheless, a very small proportion (9 percent) of schools admit fewer than half their applicants according to the findings of other investigators.[1]

For purposes of comparison we have presented in Appendix Table 2 simple binary probit estimates of the admission equation together with the estimates based on the three-equation model. Simulated admissions probabilities based on the probit estimates are very close to those shown in Table 4, although we have not shown them.[2]

To give an idea of the importance of socioeconomic background, as compared to academic aptitude and performance, we have presented a few simulations of application probabilities and school qualities based on selected values of parents' income and education. They are shown in Table 5. Again, the results are based on the assumption that other variables are equal to their respective sample means.

Although both parents' income and education are substantially related to the probability of application and to college quality, their effect on student choices is clearly less than the effect of SAT scores. Surprisingly to us, even persons from high income ($18,000 in 1972 dollars) families

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1. See Hartnett and Feldmesser [1980].

2. This result of course is consistent with the very small correlations between the disturbance term in the admission equation and the disturbance terms in the college application and college quality equations.

Table 5. Simulated Application Probabilities and College Qualities for Selected Values of Parents' Income and Education.

PARENTS' INCOME ($)	PARENTS' EDUCATION	
	Mother and Father Less Than High School	Mother and Father College Degree or More
	Probability of Application	
6,000	.19	.45
9,000	.21	.48
12,000	.24	.52
15,000	.26	.55
18,000	.29	.58
	College SAT	
6,000	765	842
9,000	772	849
12,000	779	856
15,000	786	863
18,000	793	870

and with college-educated parents, with other characteristics equal to the sample average, have only a .58 probability of applying to a four-year college.

IV. Concluding Comments

While SAT scores certainly exclude some persons from some schools, to us they seem not to represent a dominating constraint on the college opportunities of high school graduates.

Although among the measures we have considered SAT scores are surely an important determinant of college admissions decisions in the top 50 percent or so of colleges, and an important determinant of student college application and college quality decisions, other personal attributes are also important. In particular, high school class rank is of comparable importance. In addition, the importance of SAT scores is much more apparent in their influence on student application and college quality decisions than in the admission decisions of colleges. Although persons with low academic ability and past performance are very unlikely to apply to any four-year college, such persons, if they were to apply to a college of average quality say, would have a rather high probability of admission. The probability of admission is much higher than the probability of application.[1]

This suggests strongly to us that low rates of application are not

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1. These results pertain to the marginal student (or a small number of students) should he choose to apply. If all students who don't now apply, were to decide to apply, the result undoubtedly would no longer hold. In this case, at least in the short run, supply constraints would lower admission probabilities.

simply the reflection of expectations of low admission probabilities.[1] As casual observation suggests, person with low scholastic aptitude and past school performance may be likely to find school unenjoyable and to expect that they will not get much out of college education. Indeed, for them a college education may not be a good human capital investment. This is not to say that even the best students can gain admission to any school of their choice; they of course cannot. Nonetheless, the probability of admission at even the more selective schools is apparently higher than some of us might have expected.

To the extent that colleges use SAT scores, it is in the context of all information available to admissions officers. The admissions criteria that would pertain if SAT scores were not available is uncertain. In particular, it is not clear that without the test scores persons who would score low on them would have a greater chance of admission, even at the more selective schools. Nor would it be demonstrably correct to assume that without test scores more minority students, more students from poorer socioeconomic backgrounds, or more individuals from any other group would be admitted to colleges. It may well be, for example, that tests "screen in" more students or encourage more students than they

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1. This is not to say that there is no such effect. Indeed Feldmesser and Hartnett in a personal communication to us have suggested that there is at least strong anecdotal evidence that most people believe that colleges and universities are more selective than in fact they are. On the other hand, of persons in the National Longitudinal Study who were working full-time in October 1972, only 17 percent said they were not continuing education full-time because of poor grades or test scores, while 31 percent said they needed more money to continue schooling, 41 percent that their future plans didn't require schooling, and 38 percent that they wanted to take a break. Persons could have responded affirmatively to more than one possibility.

screen out. Although some students may not apply because they think their scores are too low, others may apply because they discover themselves to be "smarter than they thought."

To the extent that SAT scores do determine student application and college admissions decisions, there are at least two related questions that are the subject of current and future research on our part.

If students self-select themselves to colleges (or not) in part on the basis of SAT scores, and if colleges admit students in part on the basis of these scores, we would like to know if indeed these decisions seem to be in accord with individual experiences in colleges, should they attend. One indication of this would be the relationship between achievement in college and dropout rates on the one hand and individual academic ability and college quality on the other. We are focusing on this question in related research.[1] Note that it is important to consider college dropout decisions, not simply class rank or grades of those who are in college or obtain degrees. It may well be that expected student performance in college accords well with observed student decisions. If this were true, it would provide support for the information value to students of scholastic ability measures.

To the extent that SAT scores prevent students from gaining entry to the college of their choice, we would like to know what the effect of this constraint is on opportunities following college graduation. One measure of the effect of such a constraint on later opportunities is the relation-

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1. See Venti and Wise, "Test Scores and Self-Selection of Higher Education: College Attendance Versus College Completion," Mimeograph, July 1980.

ship between college quality--given pre-college characteristics including test scores--and earnings after college graduation. Although this is by no means a new question, the final follow-up to the National Longitudinal Study of the High School Class of 1972 will provide a unique opportunity to address it.[1] Both of these questions are related to the work on school selection and earnings by Willis and Rosen [1979], although they have approached their work from a somewhat different direction.

Finally, a continuing concern is the relationship between attributes that determine success in college and those that determine job performance. Although not the subject of this paper, it is interesting to note that the kinds of attributes that are evidently important in the determination of individual college application decisions, have also been found to be related to the job success of college graduates, although their relative importance in the two situations may differ (see Wise [1975a, 1975b]).

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1. Evidence on related questions was presented in Wise [1975a and 1975b], Solmon [1975], Solmon and Wachtel [1975], and Morgan and Duncan [1979].

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Appendix Table 1. Variable Means and Standard Deviations for Total Sample and for College Applicants.

Variable	Total Sample		Applicants Only	
	Mean	Standard Deviation	Mean	Standard Deviation
SAT Score	835	198	953	202
High School Class Rank	.550	.276	.691	.237
High School Student Leader	.072	.258	.122	.328
High School Athlete	.103	.303	.149	.356
Percent of High School Class Going to College	.506	.190	.549	.194
College SAT	--	--	1024	124
Parents' Income[a]	11185	5382	12772	5537
Education of Mother less than High School	.264	.441	.165	.371
Education of Mother College Degree or More	.114	.318	.196	.397
Education of Father less than High School	.321	.467	.191	.393
Education of Father College Degree or More	.189	.392	.318	.466
Black in the South (High School)	.062	.240	.063	.244
White in the South (High School)	.213	.410	.200	.400
Black in the Non-South (High School)	.037	.189	.043	.204

Appendix Table 1. Variable Means and Standard Deviations for Total Sample and for College Applicants (continued).

Variable	Total Sample		Applicants Only	
	Mean	Standard Deviation	Mean	Standard Deviation
Black in the South (College)	--	--	.058	.234
White in the South (College)	--	--	.209	.407
Black in the Non-South (College)	--	--	.048	.215
Local Wage	3.930	.592	--	--
Local Unemployment	3.897	1.862	--	--
Male	.490	.499	.508	.500
Urban High School	.251	.433	.262	.440
Total Sample	5001			
Number of College Applicants	2005			
Number Admitted	1799			

a. Calculations exclude observations with missing values.

Appendix Table 2. Admissions Model Parameter Estimates (and Asymptotic Standard Errors) by Method of Estimation.

Variable	Method of Estimation: Probit	Method of Estimation: Joint Estimation of 3 Equations
SAT Score (÷ 1000)	1.518 (0.301)	1.471 (0.636)
High School Class Rank (÷ 100)	1.121 (0.212)	1.155 (0.269)
High School Student Leader	0.214 (0.151)	0.241 (0.173)
High School Athlete	0.194 (0.121)	0.182 (0.130)
Proportion of High School Class Going to College	-0.355 (0.244)	-0.385 (0.315)
College SAT, 1 (÷ 1000)	-2.931 (0.769)	-1.968 (2.006)
College SAT, 2 (÷ 1000)	-4.186 (1.221)	-3.525 (1.957)
College SAT, 3 (÷ 1000)	-6.703 (1.136)	-6.632 (1.871)
Black in the South	-0.228 (0.212)	-0.055 (0.336)
White in the South	-0.070 (0.111	-0.043 (0.115)
Black in the Non-South	0.111 (0.187)	0.174 (0.200)

Appendix Table 2. Admissions Model Parameter Estimates (and Asymptotic Standard Errors) by Method of Estimation (continued).

Variable	Method of Estimation	
	Probit	Joint Estimation of 3 Equations
Male	-0.103 (0.093)	-0.095 (0.095)
Urban High School	0.056 (0.096)	0.049 (0.097)
Constant	2.541 (0.773)	1.513 (0.633)