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Scholastic Achievement: Its Determinants and Effects in the Education Industry

I. INTRODUCTION

Economists traditionally look upon scholastic achievement, for a given level of educational attainment, as a quality factor that differentiates a person's productive capacity in the labor market. The competitive economic system rewards such quality differentials by high wage rates or salaries. This effect of scholastic achievement upon economic activity has been verified in the literature, most recently in an article by Hansen, Weisbrod, and Scanlon.[1] Research that established the positive relationship between the level of educational attainment and level of earnings have generally acknowledged the importance of scholastic achievement as a determininant of the level of earnings, although most efforts have

NOTE: This paper is an outgrowth of a joint research effort carried out with Ernest Bartell, congregation of Holy Cross; Arthur Corazzini; Henry Grabowski; John Keith; and Alvin Klevorick for the State of Massachusetts' Board of Higher Education. The author wishes to thank all the gentlemen, especially Arthur Corazzini and Henry Grabowski, for numerous suggestions and helpful comments. Naturally, the remaining errors belong to the author. The author also wishes to thank the State of Massachusetts for granting the funds which made this research possible.

not been able to isolate its quantitative impact with any great degree of precision.[2]

This study focuses upon a different role that scholastic achievement plays—the role it plays within the education industry. In our educational system, scholastic achievement may be a vital factor that clears the path to higher levels of educational attainment. This may be especially important when a student reaches the high school plateau in his educational career and decides to pursue a college education. In fact, a number of institutions of higher learning have admission requirements directly related to the level of scholastic achievement of potential students. This paper presents a model that describes the role that scholastic achievement plays in securing a space in an institution of higher learning, and the model is empirically tested using sample data on 1969 high-school seniors in the Boston Metropolitan Area. The analysis considers not only the actual enrollment rates for these high-school seniors but also relationships between aspirations and plans and scholastic achievement of the students. Once these relationships are established, the determinants of scholastic achievement are discussed, and this permits us to discuss the policy issue of how scholastic achievement may be influenced to ensure "the quality of educational opportunity."

Although some research[3] has considered the relationship between scholastic achievement and college enrollment rates, it has generally been within the context of a demand model for higher education. In such analysis scholastic achievement is treated as a "taste" factor which represents the notion that intellectually capable individuals seek academic fulfillment and correspondingly desire to pursue higher levels of educational attainment. However, scholastic achievement may represent a form of nonmarket rationing that is used by some suppliers of educational services as a mechanism that brings demand and supply factors into equilibrium. Indeed, it is well known that some institutions of higher learning maintain stringent admission standards based on estimates of student potential (generally measured by scores on the Scholastic Aptitude Test [SAT]) and academic background. The analysis that follows takes into account the supply side characteristics of this market and attempts to isolate the magnitude of the nonmarket rationing that takes place in the market-clearing process.

A public policy issue then presents itself. If education is a vehicle of social mobility and a tool that enables the general populace to pull itself up by the bootstraps, and if nonmarket rationing exists, to ensure "the equality of educational opportunity" all segments of society ought to have equal access to scholastic achievement insofar as it is not an inherited trait. Thus, a model of scholastic achievement is presented and

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In the next section the determinants of aspirations, plans and actual enrollment in colleges are theoretically and empirically analyzed. Section III discusses the nonmarket rationing that takes place through the use of admission standards. A model of scholastic achievement is presented in Section IV, and the final section considers the implications of the analyses and policy issues. A 1969 survey of 4,000 high school seniors in the Boston Standard Metropolitan Statistical Area (SMSA) and a follow-up study in the next year provide sufficient data to test the hypotheses presented.[4]

II. DECISIONS GOVERNING ENROLLMENT IN HIGHER EDUCATION

When a high school graduate enters college, it may appear that he is simply taking another step in a long series of steps up the educational ladder. However, several barriers have to be overcome by a student before he actually enrolls in college. Indeed, tuition charges, opportunity costs, and admission requirements, to mention a few factors, divert some students with a high school diploma who desire to pursue a higher education. In fact, the original study of the Boston SMSA high school seniors in 1969 indicated that high school seniors do not pursue a college education in a random fashion and that their decision to attend or not attend an institution of higher learning is complex. Certain behavioral patterns emerged from the study that indicated that family income, tuition charges, scores on scholastic aptitude tests, and labor-market conditions acted as deterrents to more education. Furthermore, academic requirements used by some institutions of higher learning in allocating their available spaces among potential students act as a rationing device.

Although some deterrents and rationing devices exert their influence at a particular moment in time (e.g., when a high school student receives notice of acceptance or rejection at a college during the spring of his senior year), others reflect influences that encompass a number of years if not the entire lifetime of the student. The very nature of rationing is such that it should be considered a long-run phenomenon. It is not unreasonable to assume that nearly all parents have some desire for their newborns to attend college, but many potential collegiates are gradually excluded along the way.

Some of the determinants of enrollment may exert their influence at a particular moment in time, or may have a cumulative effect over time, or may be a combination of the two. For example, family income is a determinant of the decision to attend college and one which reflects a whole set of environmental factors that are not limited to one particular year or segment of the student's career. Such income has a cumulative effect during the preschool and formal-school years of a student. Conceptually, this cumulative effect is much different than the financial effect of family income representing the amount of family resources available to the high school graduate for his higher educational pursuits. The former effect may influence the student's desire to attend college and may prepare him for academic accomplishment in his educational career. The financial aspect of the family income variable plays a definite role when the student is gathering together resources to meet the cost of attending college.

Thus, the process by which a student decides to attend college is undoubtedly sequential or a step process. Educational decisions are made at various time during the elementary and secondary school years of the student. An early decision concerning higher education may deny the student the opportunity to make other decisions later in his educational career. For example, a decision on the part of a high school student to drop out of school before graduation generally precludes a later decision to attend college. A sequence of these decisions may be made throughout the student's high school career, e.g. when he chooses his educational track or decides not to drop out of school or studies diligently to get good grades. Accordingly, we conceptualize the decisions to attend college to be a sequential decision process. The sequence of decisions may begin in the preschool environment where parents may or may not provide the atmosphere which is conducive to academic achievement and, in the final analysis, to enrollment at an institution of higher learning. The choice of grade school and high school may also be instrumental in the final decision to attend college. Surely, parental encouragement and the home environment during grade school and high school have a positive influence upon the likely success of a student pursuing a higher education.

Data which would make possible empirical investigation of each of these decision junctures are not available for the Boston Metropolitan Area. Therefore, in the analysis that follows, two stages in the decision process are isolated and the determinants of those decisions are analyzed and evaluated. The final "either-or" decision that is made after high school graduation and immediately before enrollment is also discussed and its determinants are statistically evaluated. Of particular interest in

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this study are the relative impacts of the home, school, and community determinants upon the aspirations, plans, and actual enrollment. In the second stage, actual enrollment is analyzed as dependent upon these same home, school, and community factors. As the final "either-or" decision draws near for the potential college student, certain environmental factors may play a more dominant role and the nature of the rationing taking place is clarified. In this section of the paper, the levels of aspirations, plans, and actual enrollment are explained by a number of community, home, and school influences. In the next section, the amount of rationing taking place, the difference between the number pursuing college at one stage of the decision process and the number of students at another stage, is isolated and empirically identified.

Methodology

The focus here is upon those factors which have an impact upon the levels of students' aspirations toward college, their plans for attending, and their actual enrollment rates. If the student employs rational investment criteria, these higher education decisions are based upon a comparison of the present value of the benefits of pursuing a higher education (discounted at an appropriate rate) and the discounted present values of the direct and opportunity costs of doing so. For the Boston Metropolitan Area, the factors that influence these decisions must capture the distinctive characteristics of the communities within the Boston Standard Metropolitan Statistical Area (SMSA). One such factor is the home environment and its empirical counterpart in this study is family income,[5] which represents the economic well-being of the student's family. This factor has several diverse impacts upon the decision variables, and although it is not possible to separate out all of these impacts empirically, it is worth our while to mention these aspects here. First of all, as has been previously stated, family income represents a source of financial aid to the potential college student, for it is from this source of funds that tuition, board, and room fees may be paid. If family income is high, a priori one would expect this student to be in a better position to obtain financial support than a student whose family income is lower. Secondly, family income may also be an indication of the general lifestyle of the student and thus it provides resources for goods and services that may incline the student to higher education. Furthermore, a family with a high income may provide stimulus-response-reinforcement activities in the home, even in the preschool years, that help the student achieve scholastically at a high rate in school and to be inclined toward

scholastic endeavors. To be specific, certain activities such as reading in the home may reinforce the student's school experience, the natural outgrowth of this being the pursuit of more education rather than less.

Another home factor that has a real impact upon these decisions is family size. This variable has a financial aspect along with environmental implications. Financially, family size represents the number of persons among whom education funds may be spread. A student from a smaller family is more likely to command education resources of the family than a student from a large family, since a large family must allocate its scarce educational resources over a large number of individuals. Outside the realm of direct financial considerations associated with higher education, small family size may provide an incentive and motivation to attend college to the student because he has closer contact with his parents and easier access to them. Again, this variable may have a differential impact upon the decisions, depending upon whether the decision is actual attendance or aspiration. For the empirical analysis that follows, the family size and income variables are kept separate since they conceptually have different impacts upon the decision. Although it is possible to combine these two variables into one, namely, income per family member, they are separated for the analysis to isolate their differential impacts.

A community variable, per cent nonwhite, represents those characteristics which are not caught by the other influences upon the decision variables and additional factors that pertain to minority groups. These particular factors may be economic or racial discrimination or traits particular to a racial group. The school influences are captured in the aggregate by current expenditures per pupil in average daily attendance and pupil-teacher ratios. Quality aspects of a particular school are represented by teacher experience (the mean number of years the teachers currently teaching in the system have spent in that system and the mean number of years the teachers currently teaching in a system have spent in public school teaching) and the educational attainment of the teachers (the mean highest level of education attained by teachers in a particular school system).

Another variable that has a vitally important impact upon the higher education decision is the Scholastic Aptitude Test (SAT) score of the student. Not only is that score an indication of the student's aptitude toward academic achievement and aptitude for furthering his education, but it is also a criterion for entry into a number of institutions of higher learning. It is common knowledge that SAT scores have high predictive power concerning success in college, and furthermore they are used as a rationing device by colleges to allocate their number of available spaces.

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To relate the decision variables to their explanatory variables, regression analysis is employed. There are several different relations which are plausible, both from the standpoint of the variables to be included and the nature of the functional form to be used. A linear functional form with a limited number of independent variables will be considered here. The relationship between the decision variable and its determinants may be derived from an underlying relation pertaining to the individual student.

Consider the following relation between a student's higher education decision and his other characteristics

$$D_{ij} = a_1 + a_2 N_{ij} + a_3 F_{ij} + a_4 Y_{ij} + a_5 E_j + U_{ij} \tag{1}$$

where D_{ij} is the particular decision variable of the ith student in the jth school. The output variable is not a continuous variable but a 0-1 binary variable which takes on the value 1 when a certain condition is met, such as planning to attend an institution of higher learning, and 0 otherwise.

N_{ij} = a binary variable assigned the value 1 if the ith student in the jth school is nonwhite and 0 otherwise;
F_{ij} = the family size of the ith student in the jth school;
Y_{ij} = the family income of the ith student in the jth school;
E_j = the current expenditures per pupil in the jth school; and
U_{ij} = a randomly distributed error term.

Equation 1 relates each student decision to his own personal and environmental situation. Since the data are at the school level, a similar relation is derived for each school. Accordingly, for the jth school, equation 1 is summed over its n senior students, and dividing by n the following relation results

$$\frac{1}{n}\sum_{i=1}^{n} D_{ij} = a_1 + a_2 \frac{1}{n}\sum_{i=1}^{n} N_{ij} + a_3 \frac{1}{n}\sum_{i=1}^{n} F_{ij} + a_4 \frac{1}{n}\sum_{i=1}^{n} Y_{ij} + a_5 \frac{1}{n}\sum_{i=1}^{n} E_j + \frac{1}{n}\sum_{i=1}^{n} U_{ij} \tag{2}$$

For the binary decision variables and the nonwhite variable, the sum of all positive entries divided by the total number of students becomes the percentage of students in the school population satisfying this particular condition. Thus, equation 2 may be rewritten as a relation between mean values and percentage variables in the following manner

$$\bar{D}_j = a_1 + a_2 \bar{N}_j + a_3 \bar{F}_j + a_4 \bar{Y}_j + a_5 \bar{E}_j + \bar{U}_j \tag{3}$$

where a bar over a variable denotes a mean or percentage over the jth

school. Equation 3 is in such a form that multiple regression analysis may be applied and the forty-seven schools in the Boston SMSA provide the empirical base.[6]

Since the means are calculated over schools whose senior classes vary significantly in size, a weighting procedure based on the size of each school's population is employed to obtain efficient estimators. This procedure involves weighting by the square root of each school's senior population and is described in standard statistical sources.[7]

Several decision variables are available, and chosen were those to represent distinct stages in the decision process. The first variable concerns the aspirations of the students toward higher education, the second concerns their plans as of April 1969, and the third their actual choice in September 1969. Variants of the three are used and the total number of decision variables comes to seven (7). Aspirations are considered at two levels: those aspiring to four-or-more years of college and those aspiring to two-or-more years of college. Plans are broken down as to whether they were definite or probable. Finally, the actual decision to attend is considered for those attending four-year institutions and for those attending two-or-four-year institutions. Also falling into this latter category is a decision variable which represents those deciding not to attend college and entering the labor force. On a priori grounds, the independent variables should have the reverse effect on "working only" as it has upon actual enrollment.[8] Thus, we have chosen seven decision variables which include the following: (1) per cent aspiring to four-or-more years of college; (2) per cent aspiring to two-or-more years of college; (3) per cent definitely planning to attend college; (4) per cent definitely or probably planning to attend college; (5) per cent attending college; (6) per cent attending universities and four-year colleges; and (7) per cent working.

Since there is no "one" particular specification of the decision that has overwhelming a priori appeal, several different specifications are made to isolate different types of determinants of the higher education decision. The first approach was theoretically stated above, the second considers the same home and community variables plus disaggregated school variables, and the third approach introduces a measure of scholastic ability or achievement together with the home and community variables.

In Table 1, regression results are presented for the seven decision variables when per cent nonwhite, family size, family income, and an aggregate measure of the school resources available to the student are included, representing home, school, and community influences. As expected, mean family income has a positive effect upon these decisions with one exception—the "working only" variable where the opposite

TABLE 1 Family, Environmental, and School Influences upon Higher Education Decisions

Dependent Variable (D_j)	a_1 Constant	a_2 Per Cent Nonwhite	a_3 Family Size	a_4 Mean Family Income	a_5 Expenditures per Pupil	$\bar{R}^2$

TABLE 1 Family, Environmental, and School Influences upon Higher Education Decisions

Dependent Variable (D_j)	a_1 Constant	a_2 Per Cent Nonwhite	a_3 Family Size	a_4 Mean Family Income	a_5 Expenditures per Pupil	$\bar{R}^2$
D_1 (% aspiring to 4+ years)	−6.11	.502[b]	−4.309	.0114[b]	.0057	.686
		(.21)	(4.19)	(.002)	(.007)	
D_2 (% aspiring to 2+ years)	22.0	.397[a]	−5.222[c]	.009[b]	.0056	.721
		(.19)	(3.80)	(.002)	(.006)	
D_3 (% definitely planning)	−7.584	.23	−4.66	.0123[b]	.0022	.675
		(.21)	(4.29)	(.002)	(.007)	
D_4 (% definitely or probably planning)	36.14	.42[a]	−4.087	.007[b]	.004	.765
		(.18)	(3.60)	(.002)	(.006)	
D_5 (% actually attending college)	13.0	.101	−7.805[a]	.0096[b]	.0131[a]	.709
		(.20)	(4.01)	(.002)	(.006)	
D_6 (% attending universities and 4-year colleges)	−8.46	.229	−1.33	.0063[a]	.0222[a]	.431
		(.26)	(5.25)	(.003)	(.0099)	
D_7 (% working)	60.5	−.272[c]	5.286[c]	−.0071[b]	−.0087[c]	.411
		(.20)	(4.0)	(.002)	(.006)	

NOTE: Numbers in parentheses indicate standard error of regression coefficient. $\bar{R}^2$ is the coefficient of determination, adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

reaction to family income would be anticipated. Family income was highly significant statistically in all the decision equations. The size of the family income coefficients are very similar for those aspiring to four-or-more years of college, the students definitely planning to attend, and the per cent actually attending, college. The impact of family income is less on those aspiring to two-or-more years and those definitely or probably planning, and this would indicate that the obstacles, financial and other, perceived by the aspirant and planner are less when several different levels of college are available and choices are not limited to four-year institutions. The family size variable works in the direction expected a priori and indicates that size of family acts as a deterrent to higher education either as a financial consideration or as a home environment factor. Although this variable is not statistically significant in all cases, it exhibits substantial stability with regard to sign and magnitude. Of special interest here is the large impact of this variable upon the attendance decision. This may be one indication that in the final stages of the decision-making process, this variable becomes more and more influential and exerts a larger impact. Family size, because of its obvious affect upon family resources, may be a relatively latent factor until the funds for higher education are actually needed.

The nonwhite variable is significant in three of the seven decision equations, and it generally has a positive impact upon the decisions. It is statistically significant in the aspirations and planning equations, and this may be an indication that the nonwhite group perceives higher education as "a vehicle to social mobility" and is in pursuit of it. It is interesting to speculate why the nonwhite variable becomes statistically insignificant as the final higher education decision is approached. Perhaps, that group attempts to keep all of its options open, and it is only at the final juncture of the decision process that financial and other constraints interfere with their desire to attend college.

The impact of the school environment upon the decision variables is demonstrated by the size of the coefficient of current expenditures per pupil. This aggregate measure of the school resources available to the student is not statistically significant for either aspirations or planning, but it does have a positive and a statistically significant impact upon the per cent attending colleges and the per cent attending universities and four-year colleges. This result seems to indicate that indeed the school does play an integral part in influencing its students' college attendance, and this influence has its greatest impact in the final selection process. Furthermore, this school influence has its largest impact upon the per cent attending universities and four-year colleges.

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years in system and education of teachers, yielded mediocre results which are presented in Table 2. The home and community variables performed in a fashion similar to the results presented in Table 1, while "mean years in system" was statistically significant and had a positive impact upon the actual decision to attend college. This result coincides with our a priori notion that teacher experience exerts a positive influence upon the decision variables. The education-of-teacher variable was deleted from the results because it was never statistically significant, which is not surprising due to the minimal amount of variation exhibited by that particular variable.

Since one of the admissions requirements to four-year colleges and universities is performance of a certain level on SAT exams, and since those scores represent in some cases the interest of the student in an academic career, a combination of verbal and math scores was introduced into the decision equations along with the family and community environment variables. This specification of the decision equation yielded the best results of the empirical analyses and the per cent of the variation explained by this specification was substantial—in the neighborhood of 80 per cent in most cases. These results are presented in Table 3. In that table, taken in its entirety, all the variables are significant at least at the 5 per cent level except for two variables which are statistically significant at the 10 per cent level. Per cent nonwhite has a positive influence upon the decision variables (except working) and the size of its coefficient remains close to .5 in all cases except the actual attendance equation. The family size variable exhibits its usual negative impact upon the decision variables, and family income shows a strong and positive influence. The coefficient of the SAT variable is positive and statistically significant at the 1 per cent level in each equation. It is worth noting that this variable has its greatest impact upon the decision variables that represent the final stages of the whole process. Furthermore, its greatest impact is upon the per cent who attend universities and four-year colleges, confirming the well-known fact that admission requirements to these institutions of higher learning are most stringent.

In conclusion, the family, the school, and scholastic achievement play significant roles not only in the actual enrollment rates but also in the aspirations and plans of high school students for their pursuit of higher education. In fact, these variables also have an influence, in the opposite direction, upon the decision to enter the labor market (per cent working) instead of pursuing more education. The latter result reinforces the results obtained for the decision variables pertaining to higher education itself.

TABLE 2 Family, Environmental, and Disaggregated School Influences upon Higher Education Decisions

Dependent Variable (D_j)	Constant	Per Cent Nonwhite	Family Size	Mean Family Income	Pupil-Teacher Ratio	Mean Years in System	$\bar{R}^2$
D_1 (% aspiring to 4+ years)	−24.6	.343[c]	−3.557	.014[b]	−.257	1.135[c]	.689
		(.21)	(4.24)	(.003)	(.76)	(.81)	
D_2 (% aspiring to 2+ years)	20.06	.267[c]	−4.933	.0105[b]	−.430	.719	.718
		(.20)	(3.89)	(.003)	(.70)	(.75)	
D_3 (% definitely planning)	−7.93	.171	−4.50	.0129[b]	−.224	.346	.668
		(.22)	(4.41)	(.003)	(.79)	(.84)	
D_4 (% definitely or probably planning)	27.86	.302[a]	−3.616	.0086[b]	−.304	.788	.765
		(.18)	(3.66)	(.002)	(.66)	(.70)	
D_5 (% actually attending college)	−.761	−.164	−7.214[a]	.0133[b]	−.595	1.457[a]	.704
		(.21)	(4.11)	(.003)	(.74)	(.79)	
D_6 (% attending universities and 4-year colleges)	−13.42	.255	−2.295	.0108	−.493	1.023	.365
		(.28)	(5.60)	(.004)	(1.01)	(1.08)	
D_7 (% working)	51.63	−.119	5.346[c]	−.0084[b]	.632	−.585	.391
		(.21)	(4.14)	(.003)	(.74)	(.80)	

NOTE: Numbers in parentheses indicate standard error of regression coefficient. $\bar{R}^2$ is the coefficient of determination, adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

TABLE 3 Family, Environmental, and Aptitude Influences upon Higher Education Decisions

Dependent Variable (D_j)	a_1 Constant	a_2 Per Cent Nonwhite	a_3 Family Size	a_4 Mean Family Income	a_5 Mean Verbal-Math SAT	$\bar{R}^2$

	(.21)	(4.14)	(.003)	(.74)	(.80)

NOTE: Numbers in parentheses indicate standard error of regression coefficient. $\bar{R}^2$ is the coefficient of determination, adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

TABLE 3 Family, Environmental, and Aptitude Influences upon Higher Education Decisions

Dependent Variable (D_j)	a_1 Constant	a_2 Per Cent Nonwhite	a_3 Family Size	a_4 Mean Family Income	a_5 Mean Verbal-Math SAT	$\bar{R}^2$
D_1 (% aspiring to 4+ years)	−74.238	.687[b]	−7.435[a]	.0086[b]	.213[b]	.792
		(.17)	(3.45)	(.002)	(.05)	
D_2 (% aspiring to 2+ years)	−27.911	.521[b]	−7.589[a]	.0071[b]	.157[b]	.780
		(.17)	(3.42)	(.002)	(.05)	
D_3 (% definitely planning)	−56.545	.379[a]	−6.809[a]	.0099[b]	.153[b]	.730
		(.19)	(3.95)	(.002)	(.05)	
D_4 (% definitely or probably planning)	−9.621	.542[b]	−6.204[a]	.0051[b]	.143[b]	.813
		(.16)	(3.25)	(.002)	(.04)	
D_5 (% actually attending college)	−54.122	.223[c]	−11.277[b]	.0078[b]	.212[b]	.791
		(.17)	(3.44)	(.002)	(.045)	
D_6 (% attending universities and 4-year colleges)	−97.66	.679[b]	−6.956[c]	.0046[a]	.286[b]	.595
		(.22)	(4.45)	(.002)	(.06)	
D_7 (% working)	120.655	−.405[a]	8.240[a]	−.005[b]	−.189[b]	.565
		(.17)	(3.48)	(.002)	(.046)	

NOTE: Numbers in parentheses indicate standard error of regression coefficient. $\bar{R}^2$ is the coefficient of determination, adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

III. MARKET AND NONMARKET RATIONING IN THE HIGHER EDUCATION DECISION

The empirical investigation in the previous section was directed toward the question of why potential college students cease the pursuit of higher education at certain junctures in their educational careers. The decision analysis indicated that the school, the family environment, and scholastic achievement not only influence the final decision to enter college but also a high school student's desire, in the first instance, to investigate and entertain the idea of pursuing a higher education. Thus, within the total framework of finding a place at colleges or universities, the high school students who finally pursue the opportunity are in no sense a random sample of the entire student population. The students who move along the path toward higher education encounter several crossroads at which decisions to attend institutions of higher learning are encountered. Some of these individual decisions in the sequential decision-making process are: (1) initial aspirations to acquire a higher education; (2) search efforts, such as taking the Scholastic Aptitude Test, to meet academic requirements; (3) actual plans concerning enrollment; (4) choice of type of institution of higher learning; and (5) the final step of actually enrolling and becoming a college student. Although previous analysis explained the level of aspirations and plans and enrollment, a far more crucial question remains unanswered. Why do some high school students who aspire or plan to pursue higher education end up not attending? Rephrasing the question in terms of the current study: What has happened in the relatively short period of time between aspirations and enrollment or between plans and enrollment that would prohibit some high school students from attending a college or university? Undoubtedly, a number of factors could become apparent to the potential higher education student that would interfere with his aspirations or plans. These factors can be conveniently broken into three categories: (1) financial ability to attend an institution; (2) scholastic ability to attend; and (3) other nonmarket characteristics that would act as a barrier to enrollment.

The interval between aspirations or plans and the actual enrollment in an institution of higher learning allows for a limited number of factors to interfere or divert the potential student away from the college campus. On the financial side, the economic situation of the family is important and may emerge as a major constraint as the final decision approaches. The family unit has a limited amount of resources to spend on education compared to other economic commodities, and the size of the family budget and the size of the family itself are primary determinants of the financial ability of the family to support the education of one of its members. Capital market imperfections and lack of work opportunities

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Scholastic achievement is another factor that will play a role in the decision that is made in the time interval between the senior year in high school and enrollment at college the following autumn. This factor may discourage the potential student from certain institutions because he is not "academically qualified." The student may be bumped from a space at four-year institution because he lacks academic credentials, and thus he may have to settle at a level below his original aspirations. Since junior and community colleges do not have academic requirements besides the high school degree, scholastic achievement need not bump a potential student out of his pursuit for higher education, although even in this situation, poor scholastic achievement may discourage the student because the likelihood of success may seem quite low to him. Nevertheless, scholastic achievement, which is sometimes looked upon as a student's taste for education, surely enters into his decision process between aspirations and enrollment. It is likely to interfere with the realization of aspirations, and it is doubtful that a high schooler's taste for higher education changes over such a short period of time. Rationing of spaces by institutions of higher learning, on the basis of scholastic achievement, is a likely candidate for the influence of scholastic achievement during the interval between aspirations and enrollment.

Finally, nonmarket characteristics besides scholastic achievement may play a role in the decision. Community attitudes and racial characteristics may be important in this regard.

Methodology

A more stringent test of the decision processes concerning higher education is now undertaken. This is accomplished by considering two levels in the decision process, say "those aspiring to 4+ years of college" and "the number actually attending college." Our interest converges upon the difference between the levels, i.e.

$$R^1_{ij} \equiv D^1_{ij} - D^5_{ij} \tag{4}$$

where D_{ij} is the particular decision variable of the ith student in the jth school, and R_{ij} is the ith student in the jth school who does not realize his aspirations or plans. Each of these variables are 0-1 binary, variables which take on the value 1 when a certain condition is met and 0 otherwise. In this case, D^5_{ij} takes on a 1 if his aspirations are realized and he enters college, and a 0 if he does not. Since the data are at the school level, a similar relation is derived for each school. Accordingly,

for the jth school, equation 4 is summed over its n senior students who aspired to 4+ years of college, and dividing by n the following relation results

$$(5) \qquad \frac{1}{n}\sum_{i=1}^{n} R^1_{ij} \equiv \left| \frac{1}{n}\sum_{i=1}^{n} D^1_{ij} - \frac{1}{n}\sum_{i=1}^{n} D^5_{ij} \right|$$

For the binary decision variables, the sum of all positive entries divided by the total number of students who aspired to attend college becomes the percentage of students in the appropriate school population satisfying this particular condition. Thus equation 5 may be rewritten in the following manner

$$(6) \qquad \bar{R}^1_j = 1 - \bar{D}^5_j$$

where the bar over a variable denotes a percentage over the jth school. Equation 6 is thus interpreted simply as the per cent of high school seniors rationed in the decision process and is one minus the per cent of students actually attending college. The R variable is the concern of the analysis and will be determined by the variables elaborated in the previous section. Using an analysis similar to that developed in the previous section, it is possible to relate the R variable (the rationing that takes place) to average family income, average family size, per cent nonwhite and average SAT scores in the following manner

$$(7) \qquad \bar{R}^1_j = b_1 + b_2\bar{N}_j + b_3\bar{F}_j + b_4\bar{Y}_j + b_5\overline{SAT}_j + \bar{U}_j$$

where $\bar{N}_j$, $\bar{F}_j$, $\bar{Y}_j$, $\overline{SAT}_j$, and $\bar{U}_j$ are per cent nonwhite, average family size, average family income, average SAT score, and an average statistical error term respectively. Again, since the means are calculated over schools whose senior classes vary significantly in size, a weighting procedure based on the applicable number in each school's population is employed to obtain efficient estimators.

Several rationing variables qualify for this type of empirical analysis, and three different rationing variables were developed, two for the rationing of aspirations and a third for the rationing of plans. The first concerns the rationing that takes place between the aspirations to attain four-or-more years of college that were prevalent in April 1969 and the enrollment in September 1969. The second applies to the aspirations to attain two-or-more years, and the third applies to plans for college made in the spring of 1969. Thus, the three rationing variables are the following: (1) per cent of 4+ year aspirants who were rationed (i.e., the rationed aspirants to 4+ years divided by aspirants to 4+ years); (2) per cent of 2+ year aspirants who did not enroll; and (3) per cent of plans (probable plus definite) to attend college that were diverted. These

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The Statistical Results

There is no "one" particular specification of the rationing process that has overwhelming a priori appeal, and three different specifications are made to isolate different types of determinants of the rationing variables. The first approach is exploratory and includes only home and community determinants. The second approach adds the school environment to the first, and the third approach introduces a measure of scholastic achievement along with the home and community variables.

In Table 4, the preliminary results are presented, and the per cent nonwhite variable is the only one that is consistently significant. The variable had a positive impact on rationing, indicating that the nonwhite group has certain characteristics besides family size and income which make it susceptible to being diverted from the fulfillment of its aspirations and plans for higher education. This result may be due to the particular specification of the equation, since the impact of school is excluded. It is common knowledge that the nonwhite students generally receive fewer educational resources in terms of expenditures per pupil than their white counterparts. Furthermore, nonwhite students do not perform as well as white students on scholastic achievement tests. The third approach introduces scholastic achievement directly into the analysis, and the discussion of the nonwhite variable is appropriately postponed until the results of that approach are evaluated.

The results of Table 4 also indicate that a larger family size is associated with more rationing and fewer high school students pursuing higher education. The result was expected on a priori grounds. Although this variable had the expected sign, it was not statistically significant. The family income variable is statistically significant for the rationed plans group, and the result indicates that the lack of finances enters the picture and acts as a deterrent to higher education. The family income variable was not statistically significant for the other two approaches.

The school influences are added to the previous specification of the rationing equations, and the empirical results of this are presented in Table 5. The nonwhite variable is again highly significant with a positive impact upon rationing for all three approaches. The family size variable has the right sign, but it is not statistically significant. Family income has a statistically significant negative impact upon the rationed plans group, and it was not significant for the other groups. Expenditures per pupil

TABLE 4 Preliminary Regression Results of Higher Education Rationing

Dependent Variable (R_j)	b_1 Constant	b_2 Per Cent Nonwhite	b_3 Family Size	b_4 Family Income	$\bar{R}^2$
R_1 (Rationed aspirants to 4+ years/aspirants)	−29.85	.685[b]	6.646	.0008	.103
	(32.36)	(.26)	(5.44)	(.003)	[2.325]
R_2 (Rationed aspirants to 2+ years/aspirants)	19.98	.431[a]	5.03	−.0038[c]	.141
	(29.27)	(.244)	(4.98)	(.0026)	[2.89]
R_3 (Rationed plans/plans)	38.41[c]	.418[a]	6.15[c]	−.0065[b]	.312
	(27.58)	(.227)	(4.69)	(.0024)	[6.22]

NOTE: Numbers in parentheses indicate standard error of regression coefficient. Numbers in brackets are F statistics. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom.

[a] Statistical significance at 5% level using t statistic.

[b] Statistical significance at 1% level using t statistic.

[c] Statistical significance at 10% level using t statistic.

TABLE 5 Family
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Dependent Variable (R_j)	b_1 Consta
R_1	−28.62
	(32.43)
R_2	21.09
	(29.17)
R_3	40.21
	(27.0)

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TABLE 5 Family, Environmental, and School Influences upon Higher Education Rationing

Dependent Variable (R_j)	b_1 Constant	b_2 Per Cent Nonwhite	b_3 Family Size	b_4 Family Income	b_5 Expenditures per Pupil	$\bar{R}^2$
R_1	−28.62	.741[b]	5.834	.0022	−.009	.101
	(32.43)	(.27)	(5.515)	(.0032)	(.01)	[2.03]
R_2	21.09	.496[a]	4.12	−.0022	−.01	.148
	(29.17)	(.25)	(5.03)	(.0029)	(.009)	[2.60]
R_3	40.21[c]	.506[b]	4.91	−.0043[a]	−.015[a]	.342
	(27.0)	(.228)	(4.64)	(.0027)	(.0087)	[5.78]

NOTE: Numbers in parentheses indicate standard error of regression coefficient. Numbers in brackets are F statistics. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

added to the realization of plans and exhibits a significant coefficient. The rationed plans group yielded three significant variables and a coefficient of variation of 34.2 per cent.

In Table 6, the empirical results are presented for the impact of home, community, and scholastic achievement variables upon the ra-

TABLE 6 Family, Environmental, and Aptitude Influences upon Higher Education Rationing

Dependent Variable (R_j)	b_1 Constant	b_2 Per Cent Nonwhite	b_3 Family Size	b_4 Family Income	b_5 Mean SAT	$\bar{R}^2$
R_1	−22.804	.664[a]	7.031	.0012	−.022	.084
	(40.15)	(.276)	(5.64)	(.003)	(.073)	[1.84]
R_2	55.64[c]	.319[c]	6.69[c]	−.002	−.111[a]	.177
	(35.7)	(.248)	(4.98)	(.003)	(.007)	[2.97]
R_3	80.06[b]	.281	8.08[a]	−.0044[a]	−.130[b]	.365
	(33.02)	(.227)	(4.6)	(.0025)	(.061)	[6.28]

NOTE: Numbers in parentheses indicate standard error of regression coefficient. Numbers in brackets are F statistics. R^2 is the coefficient of determination, adjusted for degrees of freedom.
[a] Statistical significance at 5% level using t statistic.
[b] Statistical significance at 1% level using t statistic.
[c] Statistical significance at 10% level using t statistic.

tioning variables. Since this specification of the rationing model has the most appeal, with its inclusion of mean SAT scores, more explicit attention will be given to the results. The determinants of 4+ year rationing explain a small 8.4 per cent of the variation, and only one variable is statistically significant, the per cent nonwhite. This result indicates that, after adjustment for family characteristics and scholastic achievement, the nonwhite community gets rationed disproportionately in their pursuit of higher education. The results of the 2–4 year rationing equation indicate that scholastic achievement is a significant factor and that rationing occurs on the basis of academic requirements at institutions of higher learning. Exactly how this rationing due to academic standards takes place is not readily apparent, although a "bumping down" phenomenon might be expected. That is, the very best schools with their high standards turn away or bump down a large number of students who then pursue their higher education at a lower-quality institution; a continuation of the bumping down through all levels of higher education finally leads to some individuals being "bumped out." The other variables had the expected signs on the coefficients, and per cent nonwhite and family size were statistically significant at the 10 per cent level.

The final rationing equation for the plans to attend college yielded the best overall results. The determinants explained 36.5 per cent of the variation in the rationing variable and most of the independent variables were statistically significant. The per cent nonwhite variable had the expected sign although it was not significant. The family size acted as a deterrent to the realization of plans for college, whereas family income and scholastic achievement acted as impetuses to the actualization of plans. The latter three variables were all statistically significant.

Thus, even under the stringent specification of the rationing process, several factors play key roles and can be identified as having significant impacts upon the rationing that takes place in the higher education decision process.

IV. DETERMINANTS OF SCHOLASTIC ACHIEVEMENT

An obvious implication of the previous analysis is that scholastic achievement, as measured by SAT scores, is instrumental in determining the success of a student in his pursuit of a higher education. Low SAT scores can act to frustrate student expectations with respect to college attendance. Not only is scholastic achievement an influential factor in the decision process at the aspirations, plans, and enrollment

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junctures but it is also a significant determinant of the rationing that takes place between the decision junctures. From the point of view of public policy that seeks to guarantee "the equality of educational opportunity," the fact that scholastic achievement is a primary determinant of students' decision to attend college presents the following policy problem: Is it possible to mould scholastic achievement and make it equally accessible to all segments of society? This section sets forth to identify and empirically estimate the extent to which home, community, and school factors influence performance on the Scholastic Aptitude Test. School variables are most susceptible to public policy, while the home and community environment sometimes cannot be affected in such a straightforward fashion. Thus, an attempt will be made to measure the separate influence of each of these factors.

Methodology

Identifying factors that contribute to the scholastic success of students is within the realm of educational production-function studies.[9] The production function, since it is a mathematical function relating system inputs and outputs, forces the researcher to be very specific with regard to the goal of the educational process, the nature of the inputs and the quantity and quality of the resulting outputs. The empirical results of two previous sections direct our search for an appropriate output variable to SAT, since this measure of scholastic achievement is a primary determinant of the decision to enroll in college. Relating system inputs to mean SAT yields empirical estimates of the significance and impact of such inputs, thus indicating the productivity of the educational process in the area of scholastic achievement.

Several input variables that attempt to capture the separate environmental influences on the student emanating from his home, community, and school are now present. The home environment variable has for its empirical proxy both the income of the student's family and family size. An environmental factor reflecting the community environment is per cent nonwhite. The most obvious candidates for the school inputs are current expenditures per student, empirical variables related to the teacher—experience and educational attainment—and the pupil-teacher ratio. Teacher experience and educational attainment have as empirical counterparts the mean number of years the teachers currently teaching in a system have spent in the system and the mean highest level of education attained by teachers in a particular school system.

The unit of analysis for this empirical test is the school, and multiple regression analysis is employed to isolate those inputs that are statisti-

cally significant determinants of mean SAT and to identify the magnitude of the influences. In a manner similar to that used in the previous sections, the relationship between mean SAT and mean input variables is derived from an underlying relation pertaining to the individual student. Summing over the basic relationship for all seniors in a high school and dividing by this number yields the following

$$\overline{SAT}_j = c_1 + c_2\overline{N}_j + c_3\overline{F}_j + c_4\overline{Y}_j + c_5\overline{E}_j + \overline{U}_j \tag{8}$$

where $\overline{SAT}_j$ is the mean SAT score for the jth school. Since these means are calculated over schools which vary significantly in size, a weighting procedure based upon the size of each senior class is again employed to obtain efficient estimators.

This linear equation has the disadvantage of specifying a constant change in output to a given change in inputs over the entire range of inputs. However, diminishing returns may be an important factor and would eventually set in, especially with regard to family income and current expenditures. Thus the above analysis was expanded for nonlinear regression. Accordingly, it is assumed that each student is operating under the following quadratic form

$$SAT_{ij} = c_1 + c_2 N_{ij} + c_3 F_{ij} + c_4 Y_{ij} + c_5 Y^2_{ij} + c_6 E_{ij} + c_7 E^2_{ij} + U_{ij} \tag{9}$$

Diminishing returns imply that c_5 and c_7 have negative signs. Summing over all the students in a particular school and dividing by those students, the following equation results

$$\overline{SAT}_j = c_1 + c_2\overline{N}_j + c_3\overline{F}_j + c_4\overline{Y}_j + c_5\frac{1}{n}\Sigma Y^2_{ij} + c_6\overline{E}_j + c_7\frac{1}{n}\Sigma E^2_{ij} + \overline{U}_j \tag{10}$$

Using the statistical identity to obtain a measure of average square of family income

$$\frac{1}{n}\Sigma Y^2_{ij} = G^2_Y + \overline{Y}^2 \tag{11}$$

substituting the estimate of G^2_Y for each high school sample and adding it to $\overline{Y}^2$ for an estimate of the average square of family income in equation 10.

The Empirical Results

Three formulations of the scholastic achievement model were empirically tested and the results are presented in Table 7. The first specification of the model included the home and community variables and

TABLE 7 Empirical Determinants of Mean SAT Scores

c_1 Constant	c_2 Per Cent Nonwhite	c_3 Family Size	c_4 Family Income	c_5 Expenditures per Pupil	c_6 Pupil/Teacher	c_7 Teacher Experience	c_8 Teacher Education	c_9 (Family Income)^2	c_{10} (Expenditures per Pupil)^2	$\bar{R}^2$

TABLE 7 Empirical Determinants of Mean SAT Scores

	c_1 Constant	c_2 Per Cent Nonwhite	c_3 Family Size	c_4 Family Income	c_5 Expenditures per Pupil	c_6 Pupil/Teacher	c_7 Teacher Experience	c_8 Teacher Education	c_9 (Family Income)^2	c_{10} (Expenditures per Pupil)^2	$\bar{R}^2$
1.	315.13[b]	−1.402[b]	17.412[c]	.0098[c]	.05[b]						.933
	(63.13)	(.54)	(11.02)	(.006)	(.02)						[129.98]
2.	315.13[a]	−1.312[a]	15.605[c]	.0113		−3.037[c]	1.18	9.676			.927
	(182.84)	(.56)	(11.93)	(.009)		(2.18)	(2.63)	(20.72)			[84.04]
3.	808.57[a]	−1.638[b]	15.861[c]	−.134	.109				9.93×10^{-6}	-26.61×10^{-6}	.934
	(400.34)	(.56)	(11.04)	(.11)	(.09)				(7.5×10^{-6})	(37.31×10^{-6})	[93.86]

NOTE: Numbers in parentheses indicate standard error of regression coefficient. Numbers in brackets are F statistics. $\bar{R}^2$ is the coefficient of determination, adjusted for degrees of freedom.

[a] Statistical significance at 5% level using t statistic.

[b] Statistical significance at 1% level using t statistic.

[c] Statistical significance at 10% level using t statistic.

current expenditures per student, which represents the aggregate educational resources available to the student. The second formulation introduced disaggregated school variables in place of current expenditures per pupil. The final specification is the nonlinear equation with squared family income and squared current expenditures per pupil. All three formulations yielded significant coefficients of variation, adjusted for degrees of freedom, in the neighborhood of .93.

The per cent nonwhite variable was statistically significant in each specification of the model and had a coefficient circa -1.4 in each case. This indicates that a 1 per cent increase in the per cent of a high school being nonwhite yields a decrease of one and four-tenths points on the SAT. This result is not unusual for educational production-function studies and reinforces the notion that the public education system does not provide the same educational services for different racial groups, even if it spends an identical amount of dollars on that group.

Expenditures per pupil is statistically significant in the linear formulation of the model and the elasticity of SAT with respect to expenditures, computed at the means, is .088. This elasticity demonstrates the positive impact of expenditures on SAT but it indicates a relatively inelastic response of the output measure to school inputs. This inelastic response, however, is not atypical or surprising when educational output variables are involved. These outputs are a cumulative function of a long history of past inputs in the student's home and school environment, and tend to be only marginally responsive to current inputs influencing student performance—such as family income flows and current school expenditures. The disaggregated school inputs yielded coefficients with the right direction of impact, although only the pupil-teacher ratio was close to being significant at the 5 per cent level. The negative coefficient of the pupil-teacher ratio demonstrates that manipulation of school inputs, in particular, greater amounts of teacher-pupil contact, does increase the output of the system. Teachers' experience and their educational attainment also produce better scores on SAT.

Family size has a positive impact upon scholastic achievement in all three formulations of the model, although it is not significant at the 5 per cent level in any case. This positive impact runs contrary to the results of most educational production-function studies. The standard result is generally interpreted as follows: when family size is large, the economic resources of the family that can be devoted to educational activities is limited because of the other needs of the family. Thus, small family size allows more time, effort, and resources to be devoted to the educational pursuits of the children. The results obtained here, running contrary to other studies, may possibly be interpreted in terms of externalities that accrue to large families due to the interactions among the members

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which may contribute to educational achievement. For example, one youngster, upon mastering the phonics system, may easily teach a younger brother or sister and free the parents for other educational interactions with their children.

The family income variable is close to statistical significance at the 5 per cent level in the linear formulation of the model and has a positive impact on SAT, as expected a priori. However, that variable is not significant in the other specifications of the model, in fact it has a negative sign in the nonlinear equation. On the whole, the nonlinear model yielded only mediocre empirical results.

The empirical results of the SAT model indicate that scholastic achievement can be influenced by school, home, and community variables. However, increasing scholastic achievement is not at present an easy or inexpensive policy solution because the output of the system is so inelastically related to school expenditures and family income.

V. IMPLICATIONS OF THE ANALYSES AND POLICY CONSIDERATIONS

The nonwhite segment of the Boston SMSA high school seniors in 1969 sought to hold open the possibility of attaining a college education until the last possible moment. With home and school influences held constant, this nonwhite segment portrayed special aspirations and plans to attain a college education. Yet, when the final enrollment tally was complete, the unique desire of this group was not realized. One interpretation of this result is that the nonwhite group places considerable stock in the belief that higher education is a vehicle of social mobility and a way of "pulling themselves up by the bootstraps," and accordingly they desired to keep the higher education option open to themselves as long as possible. However, in the final stage of the decision process, these aspirations were frustrated.

This example of a barrier that confronts high school students who aspire to a college education does not exhaust the list of barriers that they must overcome before enrollment in college takes place. Family income and size, school and community environment, and scholastic achievement influence the individual's education decision. Some of these factors, such as family income and current expenditures per student, are the standard economic forces that play a role in the marketplace. However, scholastic achievement may be considered a nonmarket force if it is used by the suppliers of educational services as a market-clearing mechanism. A rationing model developed in the text

demonstrated that academic requirements were being used by the suppliers of educational services in that manner.

The analysis of rationing also confirms the notion that minority groups are frustrated in their plans to enroll in college. In the rationing model, the per cent nonwhite variable was statistically significant, and the direction of its impact indicated that the greater the per cent of the nonwhite student population, the more likely that rationing would occur between springtime of the senior year in high school and fall enrollment in college. Although it has been argued that such a variable may be capturing the inadequate academic backgrounds of nonwhite students, as measured by SAT scores, the inclusion of scholastic achievement in the analysis together with the per cent nonwhite variable yielded identically significant results. Those results indicated that the nonwhite group was rationed disproportionately, explicit consideration of its academic credentials notwithstanding. One implication for policy is that any financial program for higher education should take into explicit account the racial characteristics of the student population that it covers, for one racial segment of the population may have unique characteristics that make it more difficult for that group to attain a college education.

College requirements, specifically certain levels of scholastic achievement, act as a deterrent to enrollment in college. Such requirements act to frustrate aspirations and plans to pursue the Great American Dream. As long as admissions policies are used by institutions of higher learning, rationing vis-à-vis the decision process will continue and a certain proportion of aspirations to attend college will be frustrated.

APPENDIX A

The Boston Metropolitan Area Sample

In the original April 1969 sample, there were fifty-six schools in the Boston Metropolitan Area with adequate educational expenditure data and a sufficient number of returned questionnaires to be used as the basis for empirical analysis. The same fifty-six schools were examined carefully for possible inclusion in the follow-up study. In the original Boston Metropolitan Area (BMA) study, these fifty-six schools accounted for 2,209 questionnaires. The follow-up study yielded a total of 1,450 returns from the original total, 1,082 of which were mail returns and the rest compiled from information gathered in phone interviews. Thus, 65.6 per cent of the original sample were recontacted in the follow-up

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survey, and 49.2 per cent of that original population from the fifty-six schools returned their questionnaires in usable form.

Since the entire population did not respond to the follow-up questionnaire, it seemed likely that some biases existed in the response rates of the various schools. In fact, a simple regression of per cent returns on mean family incomes for the fifty-six schools yielded an R^2 of .227, the regression equation read: % Total Return = 11.9 + .0077 Income, and the income coefficient was significant at the .01 level. Thus, the respondents on the average were from families with higher incomes. This result may be one indication that college students responded in greater proportion than the others in the population. To counteract this possible bias in the response rate, a criterion was established to insure a minimum response rate per school. The following test was established to insure a sufficiently large number of observations within each school. At least twenty returns from each school were necessary for a school to be included in the empirical analysis. If that "absolute-number-criterion" was not met, an alternative criterion could qualify a school for inclusion: a return of over 60 per cent for the school. Although the criterion is substantial, only nine of the fifty-six schools were eliminated because of it. A simple regression of per cent returns on family income for the forty-seven schools yielded the following regression equation: % Total Returns = 30.1 + .00567 Income, with the income coefficient statistically significant at the .01 level. These forty-seven schools yielded an income coefficient .0021 smaller than the income coefficient for the fifty-six schools. This result indicates that the criterion employed above eliminated some of the bias that existed in the returns. Approximately 30 per cent of the bias was deleted through the exclusion of the nine schools.

Of the remaining forty-seven schools in the sample, six were from Boston and forty-one from the surrounding communities. These forty-seven schools provide a substantial degree of variation for empirical analysis, both with regard to the percentage of students aspiring to attend, and actually attending, college, and also with respect to the school, home, and community environments that surround them.

APPENDIX B

Statistical Characteristics of the Boston Metropolitan Area Data

Forty-seven schools in the Boston Metropolitan Area provide the basis for the empirical analysis in this paper. Although there are more high

schools in the BMA, some did not provide the expenditure and other educational information necessary for inclusion in the analysis. In Table B-1 the descriptive statistics for the forty-seven schools included in the sample are presented for the decision, input, and mean SAT variables. For the decision variables, the table shows that 52.4 per cent of the 1969 high school seniors in the Boston Metropolitan Area were attending universities or four-year colleges in the 1969–70 academic year, 10.8 per cent were attending two-year colleges, and 21.9 per cent were working full time. Over 73 per cent of the total number of students aspired to two or more years of college. Table B-1 also presents data concerning the dispersion for the decision, input, and mean Scholastic Aptitude

TABLE B-1 Dispersion of Variables

Variable	Mean	Coefficient of Variation
A. Decision variables		
1. % aspiring to 4 or more years of college	65.66	.213
2. % aspiring to 2 or more years of college	73.17	.166
3. % definitely planning to attend college	65.0	.224
4. % definitely or probably planning to attend college	75.87	.14
5. % attending college	63.24	.229
6. % attending universities and 4-year colleges	52.43	.311
7. % working	21.9	.549
B. Input variables		
1. Family income (dollars)	7,123.70	.114
2. Family size	3.811	.112
3. % nonwhite	3.76	2.039
4. Mean verbal SAT	472.96	.071
5. Mean math SAT	508.11	.078
6. Expenditures/pupil	861.63	.260
7. Pupil/teacher	22.49	.116
8. Mean age of teachers	37.547	.096
9. Mean years in system	7.21	.422
10. Mean years in public school	9.07	.299
11. Teacher education	9.989	.030
C. SAT variable		
Mean SAT: (Verbal + Math)/2	490.53	.071

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Test (SAT) variables. The coefficient of variation, an index of dispersion, is the ratio of the standard deviation to the mean value of a variable. The dispersion of all the variables provides sufficient variation to include them in the analysis. The small dispersion for the mean verbal SAT, mean math SAT, and mean SAT is to be expected, since these scores are drawn from a normal population which has a tendency to cluster close to the population mean.

As in most studies of education, it is necessary to investigate the possibility that the independent variables are "clumped" together and so highly correlated that they exhibit little independent variation. If such a situation exists, it becomes very difficult to discriminate among their effects. Table B-2 presents the matrix of simple correlation coefficients. While the correlations between the school input variables and the environment variables are often statistically significant, they do not seem large enough to present a severe multi-collinearity problem. The most severe multi-collinearity occurs among some of the alternative measures of teacher age and experience. These high correlation coefficients between mean age of teachers, mean number of years in the system, and mean number of years in public education indicate that these variables are substitute measures of teacher experience, and little can be gained by employing more than one of these measures in any statistical analysis. Mean math and mean verbal SAT scores are also highly correlated, and this indicates that either one adequately describes the scholastic aptitude of students. Except for these variables, the independent variables exhibit enough independent variation to be jointly employed in a statistical analysis.

Table B-2 also provides some insights into the structure of these variables for the Boston SMSA. They indicate that school allocations (e.g. high expenditures per pupil and low pupil-teacher ratios) tend to be positively related to those environmental and background influences which contribute to a successful educational experience on the part of students (high family income and small family size). Thus, in the Boston SMSA school allocations tend on balance to reinforce any inequalities arising from the nonschool environment. Another structural feature of the simple correlations is the positive relationship between teacher age and experience and expenditures per pupil. At the same time, these teacher experience variables are negatively related to family income, indicating that the prosperous communities tend to employ younger teachers.

Finally, Table B-2 yields positive correlations between SAT scores and expenditures per pupil and between SAT scores and family income. These relationships are expected a priori and from previous research into the determination of scholastic achievement. However, a word of

TABLE B-2 Simple Correlations of Input Variables

	Family Income	Family Size	Mean Verbal	Mean Math
Family size	−.194			
Mean verbal SAT	.353	.055		
Mean math SAT	.275	.030	.885	
Expenditures/pupil	.314	−.198	.378	.376
Pupil/teacher	−.453	.025	−.275	−.169
Mean age of teachers	−.419	−.175	−.093	−.024
Mean years in system	−.647	−.013	−.291	−.162
Mean years in public education	−.374	−.192	−.118	−.047
Teacher education	.346	−.262	.263	.165
% nonwhite	−.346	.089	−.353	−.282

caution is in order. If SAT scores and family income are used to determine simultaneously the decision variables, it may be difficult to isolate the independent influence of these variables because their inclusion may "muffle" their separate impacts. Indeed, family income is a determinant of SAT, but SAT and family income have, conceptually, separate impacts that may be difficult to isolate in the empirical analysis. The severity of this simultaneous-equation bias may be minimal in this case, but it should be noted.

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2. For example, Gary Becker in his work on rates of return to education assumed that approximately one-third of the earnings differential between high school and college degree holders was attributable to scholastic achievement. See Gary Becker, *Human Capital* (New York: NBER, 1964), pp. 79–90.
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Expenditures per Pupil	Pupil/ Teacher	Mean Age of Teacher	Mean Years in System	Mean Years in Public Education	Teacher Education
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.005	.271	.882			
.205	.141	.938	.886		
.431	−.067	.326	.080	.400	
.099	.048	.397	.498	.341	−.074

5. The 1969 survey of the high school seniors of the Boston SMSA provided information concerning the father's age, occupation, and level of educational attainment. These data were then used to construct a family-income figure by relating those characteristics to income of males 14 years and older, nonwhite and white, for the Northeast Region of the U.S. as shown in U.S. Census of Population, *Occupation by Earnings and Education* (Washington, D.C., 1965), PC (2)-7B, Table 2, pp. 196–219. These data provided two age categories, eight occupational categories, and six education categories to arrive at a proxy for the family-income figure used in the local analysis.
6. See Appendix A for the criteria upon which the selection of the forty-seven schools was made.
7. For example, E. Malinvaud, *Statistical Methods of Econometrics* (Chicago: Rand McNally, 1966), pp. 254–258.
8. The following argument could be put forth: "By definition 'those attending' and 'those not attending' add to the total high school graduates, and this identity dictates that the 'working only' group be influenced in the exact opposite direction as those forces which influence enrollment." However, these two groups do not encompass the entire population, and housewives, persons in the armed forces, those attending noncollege institutions and others are not included in the above division of students between "working only" and those actually attending college.
9. There have been a number of such studies in recent years, one of which is S. Bowles and H. M. Levin, "The Determinants of Scholastic Achievement—An Appraisal of Some Recent Evidence," *Journal of Human Resources* 3 (Spring 1968): 1–24.

2 COMMENTS

Barbara L. Heyns
University of California

It is reassuring to observe the increased interest in educational research and policy shown by economists; it is, however, disheartening to see the degree to which professionals within disciplines maintain departmental specializations and forgo efforts at interdisciplinary research and communication. While economists are surely not alone in this tendency, there is a large body of sociological literature relevant to the concerns of this Conference, and to the issues raised by Dugan.

The present research conceptualizes scholastic achievement as a factor in both the demand and supply of higher education. The demand for higher education, measured by aspirations, plans and college enrollment, is conceived as a "taste" factor, reflecting a propensity to consume schooling. The supply of education, or the admissions policies of colleges and universities, is subject to "nonmarket" rationing, due in part to differential achievement and, perhaps, to discrimination. The approach adopted appeals to me. It is more sophisticated conceptually than traditional economic models.

The institutional constraints are, at least, acknowledged by the inclusion of a concept of rationing. In contrast, achievement is traditionally assumed to reflect either qualitative differences in educational attainment or an output measure in production-functions for schools.

The framework of Dugan's analysis is straightforward. The model presented is generally well reasoned and explicit. In general, my comments are directed toward clarification in light of a rather different body of literature, so perhaps my remarks should be weighed by a different scale. My criticism is divided into three parts, not equally important in my mind; questions of methodology, of substantive interpretation, and of concepts and policies.

The methodological problems should, perhaps, be dealt with first, since they are generally less interesting. The relationships presented by Dugan are calculated from school data, and represent aggregate relationships, not individual differences. Consistently, however, the interpretations offered refer to differences between individuals, and not between schools. A considerable literature exists on the pitfalls of ecological analysis,[1] and the fallacies involved in making inferences to individuals based on correlations among aggregates. The equations provided by Dugan offer, perhaps, an empirical example. The partial regression coefficient for per cent nonwhite in all of the equations examined is positive, except those depicting rationing. The effects are largely insignificant, except for the models which include mean SAT scores. Interpreting these effects as representing differences between racial groups, would force one to conclude that nonwhite

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students were more likely to aspire to, to plan for, and to attend a college or university than whites. There is some support for higher aspirations among nonwhites, however no research I am familiar with has yet demonstrated higher attendence rates, regardless of controls used. The conclusion which is correct, however, is that those schools which had a higher proportion nonwhite sent more pupils to college. Inferring that nonwhites as a group were more likely to enroll is incorrect, and testable only with data disaggregated by race. The conclusion about schools may be somewhat misleading, since many other characteristics of such schools are not known. Aggregated data tend to be more highly correlated than do relationships between individuals; ecological correlations, even when weighted, can be biased estimators of the actual relationships, even to the extent of having the opposite sign. Introducing them into a regression equation tends to increase both the degree of multicollinearity, and the proportion of variance explained.

Equally important, significance levels for coefficients computed from aggregated data depend not on the sample size, but on the degrees of freedom present. Restricting observations to group means substantially reduces both the variance to be explained, and the degrees of freedom. Weighting school means by the size of the within-group sample does not justify imputing a substantially lower standard error based on individual observations. For the Boston Metropolitan Area data, the sample actually consists of 47 schools, not 1,450 individuals.[2]

Such complaints may reflect the quibbling of sociologists, who rarely explain as much as half the variance between individuals. A model such as that presented by Hauser[3] would have been substantially more informative, even at the sacrifice of explanatory power. While the models presented are intriguing, conclusions as well as policy recommendations await a more refined analysis.

Several substantive criticisms also seem in order. It is not surprising that the relationships between school variables such as per pupil expenditures, pupil-teacher ratios, and the age and experience of teachers are not powerful predictive variables; a large number of studies have shown such results.[4] The justification generally offered for their inclusion, despite trivial and erratic coefficients, is that school variables can be more easily manipulated through social policy, than can background factors. Policy recommendations, such as equalizing resources, or altering college admissions are indicative of both the state of the art, and the value judgments of the researcher. If achievement is viewed as the product of schools, and certain characteristics of schools are associated with higher achievement, it is often difficult to consider alternative explanations. Relationships between teacher experience, per pupil expenditure, and academic outcomes are a case in point.[5] Dugan interprets these relationships as demonstrating that schools do "play an integral part in influencing students attending college."

An alternative interpretation could be made. A typical career pattern for many teachers is to accept first positions at relatively disadvantaged schools, with low-achieving pupils, and to transfer to more affluent and desirable districts after acquiring some experience.[6] The association be-

tween teacher experience and achievement could be entirely due to the teaching profession's preference for highly motivated, academically oriented students, rather than teacher experience having an independent effect on achievement. Since years of experience is a prime ingredient in determining salaries, and since 85 per cent of the average school budget is allocated to personnel, inequalities between schools in expenditures may reflect the same pattern. Equalizing school resources would seem to mean either restricting the mobility of teachers, or increasing the staff at disadvantaged schools. While there may be some merit in such policies, the expected impact on achievement, aspirations, or college attendence would be negligible. Such examples serve only to make the point that the educational process is quite complex and subtle, and that there is every reason to believe that models currently available are inadequate for different schools, districts, or groups of pupils.[7]

The pattern of coefficients in different equations is interpreted as representing sequential decisions of students, or stages of educational aspirations. The actual survey included only one follow-up, however, and we are never told how consistent the respondents are in either responses or behavior. The general similarity of models strikes me as being as noteworthy as the slight changes in coefficients in separate equations. I suspect that the dependent variables are quite highly intercorrelated, and that they are measuring similar propensities between schools. One could imagine a perfect correlation between the proportion aspiring to higher education and the proportion attending college between schools, while large numbers of students in every school decide not to continue. The series of equations refers to neither a sequential process, since the same students are involved, nor to individual decision making, insofar as this is inadequately reflected in changing proportions relative to other schools. The degree to which individuals are sorted on the basis of income and race cannot be determined with such data. The changes represent either changes in individual plans, individual misreporting, or differential reliabilities between schools. Research on the aspirations of high school seniors indicates we have much to learn about the formation and change of aspirations.[8] The model of educational rationing presented could also be criticized from this perspective. If the correlation between decision variables is high, one would expect differences in proportions between schools to contain substantial error variance. The precipitous decline in the proportion of variance explained in Tables 4, 5, and 6 could be explained if one assumed much of the difference was error, rather than real changes in either the demand or supply of higher education.

Operationalizing a concept such as rationed admissions on any critieria is extremely difficult. Historically, the expansion of opportunities for higher education has grown as quickly as has the increasing proportions of students completing high school. Continuation rates do not indicate a substantial bottleneck at college admission, nor do trends point to an increased difficulty in enrolling.[9] It is possible that aspirations among high school graduates have increased relative to the supply of higher education but one

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would need a time series of such relationships to reach this conclusion. What is clear from a variety of sources is that aspirations exceed attainment at almost every level of education. In high schools, fewer students are assigned to a college preparatory course than report aspiring to, or planning for, college.[10] It is also true that lower class and nonwhite students are differentially "cooled out"; that is, the gap between aspirations and attainment is inversely related to social class.

Schools are the principal institution for social selection and differentiation, and this necessarily implies rationing at many levels. The paradox would seem to be demanding equality of opportunity from institutions designed to channel students into a highly stratified society. Changing admissions policies alone would not necessarily alter the life changes of many pupils, nor insure a larger degree of upward mobility. The returns to education are by no means equally distributed by class or race. The total amount of schooling is presently more equally distributed than is income, and the trend seems to be toward greater equality. What I find disturbing is the implicit assumption that more accessible educational institutions would provide more equal opportunity.

Sociological models of occupational mobility point to the importance of education as a mediating factor between the status of sons and that of fathers.[11] Duncan has argued that American society allows for a considerable amount of social mobility and that no evidence exists which suggests this is declining. It is also true that a considerable degree of inequality can and does exist simultaneously, and also shows little tendency to change. The latter point is important precisely because policy makers often assume that increasing social mobility will reduce inequality. Education does facilitate individual mobility, at least relative to the importance of parental status. However, the large component of unexplained variance suggests that many factors other than schooling are important.

The substantive conclusions reached by Dugan can be questioned both methodologically and conceptually. The findings discussed seem in general to be consonant with much social science research. Policy considerations, however, depend on the extent to which manipulating factors will produce different outcomes.

The process through which education is rationed can be criticized from many perspectives. If the desired outcome was to promote opportunity, it is quite doubtful that a perfectly competitive market for higher education would do so. The situation in which the only determinant of college admission is the ability to purchase it seems highly unlikely to allow many children from lower-class families entrance.

Equality of opportunity minimally implies that the allocation of scarce resources depends on some individual characteristics rather than, or in addition to, parental wealth. Any such social constraint would involve nonmarket rationing, at least until such time as education is neither a scarce commodity nor a determinant of wealth or status. The critical policy question is how, and to what degree, such rationing will occur. Some consideration of alternatives seems called for.

The question of how selection should operate is fundamental, and resolves itself into the question of what are relevant criteria. As Dugan argues, scholastic achievement has become a principal mechanism for differentiating pupils. In part, this is because it is presumed to measure past achievements, and because it is highly predictive of future academic success. Equally, it seems to differentiate between children of different social class and racial groups. What can well be overlooked, however, is that it does not predict occupational success or income later in life very well, except through the strong relationship to years of schooling.[12]

Although Dugan points to the role of achievement as restricting the options open to certain children, a critique of those criteria would also be relevant. The arguments regarding cultural bias in tests are well made elsewhere. Let us assume that a principal ability measured by such tests is an ability to take tests. This form of interpersonal competition is considerably more prevalent and better rewarded in schools than in the labor market. The diversity of talents and aptitudes required to perform many jobs competently is neither well measured nor part of the curriculum. Potentially, this is a possible explanation for the negligible independent effect of ability. The criticism is not so much that schools are irrelevant to students' futures; but that the bases of selection and recruitment are strictly academic and do not reflect the broad spectrum of human potential. A case could be made for the usefulness of tests to predict *academic* success. It is obviously more efficient to admit students who show more "promise" than students who need special attention. Perhaps higher education should remain academic, rather than relevant, but then surely other channels of upward mobility could be established—with nonscholastic determinants.

The question of the degree of rationing seems to me to depend on the amount of educational subsidies available. If the only criteria for admission were aspirations, it would be equivalent to open enrollment. Such a policy has much to recommend it, except perhaps the costs involved. It is not clear to me whether Dugan would advocate open enrollment or prefers a rationing model based on equal admission rates for different groups of students. What I find lacking in the analysis is an explicit description of policy alternatives, and some feeling for the sociological impact such policies might have.

One final point deserves mention. At a conference entitled "Education as an Industry," one would like to hear discussion of the potential impact economic analyses have on school administrators and educational systems. In *Education and the Cult of Efficiency*,[13] Callahan brilliantly documents the disastrous effects of considering education as an industry during the early twentieth century. "Scientific" management, efficiency, and cost accounting seem more applicable to production systems in which there is certain knowledge of the process; unfortunately, we lack such knowledge entirely when it comes to learning. As a social scientist, one's minimal responsibility would be to admit the state of the art and to try to avoid the most blatant errors of the past.

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Dugan has provided a good framework in which to analyze college-going decisions. His separate analysis of college aspirations, planning for college, and actual college attendance is conceptually far more satisfying than an analysis of a simple go–no-go decision.

To discuss Dugan's application of this framework to the data at hand, it will be useful to divide his findings into two general groups: those that do not have direct relevance to current educational policy debates and those that do. In the first group, I include Dugan's findings that when SAT scores are controlled, the student's propensity to plan for and go to college depends positively on family income and negatively on family size. These findings certainly seem plausible. While we might not like their implications, it seems that no alternative method of college financing, including the Brewster-Zacharias Plan, will change the findings very much.

In the second group, I include two other of Dugan's findings. First, he argues that even when SAT scores are controlled, nonwhite students are disproportionately rationed in their desire to go to college (Table 6 and pp. 77–78). Second, Dugan argues that the SAT scores themselves, an important element in the rationing process, can be raised through additional expenditure in the schools (Table 7, regression 1). Both of these findings may be correct but I believe each will require further exploration before the issues are closed.

I shall begin with the rationing finding. There are something like four variables in which one might be interested when measuring the propensity toward college of a class of seniors:

1. the number of students in the class;
2. the number of students who aspire to go to college;
3. the number of students who are seriously planning to go to college (by which, I mean, they have read catalogues, filled out applications, and so on); and
4. the number of students who actually do go to college the following fall.

If I were to investigate the presence of current discrimination by either the colleges or the college and noncollege sources of financial aid, I would look at the ratio of (4) to (1). I would want to see whether there was a difference in that ratio between white and nonwhite classes when other factors were controlled. Dugan performs such an analysis in regressions D_5 and D_6 of Table 3. He finds no current discrimination of the type I have suggested. When the class is controlled for family size, family income, and SAT scores, Dugan finds that the proportion of nonwhite students has a *positive* impact on the proportion attending all colleges and the proportion attending four-year institutions (though the all-college coefficient is significant only at the 10 per cent level).

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Dugan's conclusion on rationing comes not from the ratio of (4) to (1) but from the ratio of (4) to (3) and especially (4) to (2)—that is, the number of seniors who actually go to college as a proportion of those who were planning to go to college or who aspired to go to college in their senior year of high school (Table 6—all regressions).

Dugan finds that when family background and SAT scores are controlled, a relatively large proportion of nonwhites who want to go to college do not make it. Given the positive relationship between proportion nonwhite and proportion admitted to college noted above, this rationing relationship can be true only if the proportion nonwhite has an even larger positive impact on the proportion who want to go to college. This is in fact what Dugan shows in Table 3, regressions D_1–D_4.

It is here, I think, that caution must enter. Many other studies have shown a similar relationship: that when background factors are controlled, nonwhite children have higher aspiration levels than do white children.[1] For precisely this reason, it is important to find out whether aspiration means the same thing for both groups. Consider asking a high school senior the following two questions:

1. Do you want to go to college?
2. Have you ever seen a college catalogue or written for an admissions application?

If the senior answered yes to the first question but no to the second, I would be suspicious as to how serious his aspirations were. To be sure, intervening problems could exist. Inadequate counselling advice would be an example. But I would have to know more before I considered the failure of such a student to get into college to be a national problem.

In Dugan's data, there is a hint, no more, that something like this may be going on. Consider the regressions in Table 3. The proportion of nonwhite students in a class has a smaller impact on the proportion of students definitely planning to go to college (regression D_3) than it does on the proportion of students aspiring to go to college (regressions D_1 and D_2). These results appear again in Table 6. The impact of rationing on nonwhite students who were planning to go to college (R_3) appears to be substantially weaker than the impact of rationing on nonwhite students who aspired to go to college (R_1). There certainly are interpretations of this aspirations-planning gap which do not rely upon the "unserious aspiration" model I have suggested, but I believe the question needs to be more fully investigated before we know the answer.

Even if Dugan's rationing conclusion is based on unserious aspirations, there are other rationing questions in his data which are worthy of exploration. Dugan shows that when SAT scores are controlled, the proportion of students in a class who attend college is positively related to their mean family income and negatively related to their family size (Table 3, regressions D_5 and D_6). I noted above that when these factors were also held constant, nonwhites were favored, but we can ask whether they were favored enough. For example, we might want a scholarship policy which took explicit recognition of the fact that blacks come, on average, from larger

families with lower incomes than whites. Dugan might then ask whether there is a gap in black-white college attendance when SAT's are controlled but when family size and family income are assumed equal. If there is, then the mechanism producing this gap should be further explored.

In discussing the determinants of college attendance, Dugan shows that SAT scores play an important part in the college attendance process (Table 3, D_5, D_6). This finding leads him to explore the determinants of SAT scores themselves (Section IV). One of his findings is the positive relationship between expenditure per child in the school and the average level of SAT scores of the students. Thus it appears that another way of helping a group of students into college (though as Dugan notes, an extremely costly way) might be to spend more money on schools to boost the students' SAT scores (Table 7, regression 1).

We know from other educational production-function literature that such findings must be interpreted with great caution. Investigators such as Bowles (1970) and Hansheck (1968) have found that when input characteristics are carefully disaggregated—for example, classifying teachers by their verbal ability—some relationship between school inputs and student achievement can be found. However, the majority of studies including many of the pessimistic conclusions about the Elementary and Secondary Education Act (ESEA) Title I compensatory programs offer little hope that simply spending more money in a school will boost the achievement scores of the students.

Again, an alternative model may be operating. Suppose that in Table 7, regression 1, family income is not an adequate control for family background. Suppose rather that even when income is controlled, the parents of certain communities put an exceptionally high premium on their children's education. Suppose they show this concern first by giving their children exceptional attention within the home, and second by voting high school budgets in the (incorrect) belief that the size of expenditures per child has a positive effect on achievement. In such a situation, it may be the home attention that is really causing the high SAT scores but statistically it will appear that expenditure is important.

Here, too, some further exploration seems both warranted and possible. In note 5, Dugan notes that his income figure is constructed data: that originally he had information on father's occupation and father's years of education and that these were transformed into income figures through figures in *Occupation by Earnings and Income.* If my alternative argument is correct, then the original occupation and education data may offer a slightly better control for background than do the derived income figures. Regressions using the original background data may be in order.

As I said at the outset, I believe Dugan has developed a good approach with which to analyze who goes to college and when those who do not go become diverted. I believe, however, that he will have to do more work with the data he has, and perhaps with other data, before the approach can yield policy conclusions in which we have confidence.

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1. See, for example, Coleman et al. (1966) Table 2.43.1 (p. 193) for white and nonwhite responses similar to those in Dugan's data. Despite achievement test and other differences between whites and nonwhites, percentage responses to definitely planning and probably planning to go to college questions are essentially equal.

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