

SOME THEORETICAL CONSIDERATIONS OF STUDENT BEHAVIOR IN CURRICULUM CHOICE

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1. Introduction

The fields of study that colleges and universities offer have been subject to change as the outside world of work so requires over time. This process of change, however, often lags behind because the bureaucracy in university administration responds slowly and because the link between the college curricula and the world of work after graduation is not yet clearly understood.

This paper presents a theoretical framework for an economic model of curriculum choice which, it is hoped, will lead to a detailed empirical investigation of the relation between the educational sector and the labor market. In our framework the concept of curricula is defined more broadly. A curriculum is measured in terms of the course bundles which incorporate student ability. The admission policy constraint is included in order to reflect the degree of concentration in each field of study.

The model also deals with student preferences over course work and the parental desires of a college diploma for their children's well-being. The fundamental difference between our model and the conventional human capital model is that the activity of schooling per se directly enters the utility function.

The paper includes the three applications of the model: (1) An explanation of students' switching of majors; (2) the problem of changes in tastes; and (3) the phenomenon of grade inflation. As a step toward the empirical implementation of the model, expected monetary returns to curricula are discussed in the Appendix.

2. The Model

2.1 Broad Definition of Curricula

Consider the hypothetical situation in which a college freshman is faced with an

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“either-or” decision of curriculum choice in college. We are defining curricula broadly to exclude a distinction between closely related disciplines. For example, economics and political science are treated as the members of the “social science” curricula. Similarly, electrical engineering and mechanical engineering, for instance, are not distinguished.

This can be justified in part by examining the starting salaries. The United States Department of Commerce 1970 Census Survey provides partial evidence of the economic comparability of these disciplines. Another justification comes from the student's responses to the interviews. Students are well aware of the substitutability among closely related disciplines. For example, an accounting student said, “If I find that I don't like the accountant's job when I get out in the world of work, I could always switch into a financial or managerial job without much difficulty.”

Therefore we do not expect the broad definitions of curricula to pose a serious problem in our analysis. Of course we are well aware that different disciplines attract students with different characteristics. However, potential differences between groups with a more detailed classification of curricula are not likely to be statistically significant.

2. 2 Measurement of Course Bundles

A student faces the choice between alternative bundles of courses. We assume that student preferences do not change for the purpose of analysis. A student selecting a given bundle (degree program) has to conform to a set of explicit rules governing that particular bundle. These rules involve certain university-wide and departmental course requirements that must be fulfilled. Also, a minimum overall grade point average (GPA) must be achieved in order to graduate.

This means that a given bundle of courses contain requirements and electives and that the majority of “core” courses determines the student's degree (e. g., degree in engineering, sociology, etc.) upon graduation.

The economic theory of choice stresses not only preference but also the constraints which limit the set of feasible alternatives available. One notable constraint is the student's ability. A student who wants to be a lawyer may not be able to go on to a law school without a sufficiently high GPA.

This innate ability (including aptitude) is related to another constraint of university admission policy. The school may limit admission to those whose GPAs are below a cut-off figure, or simply accept a fixed number of students on a first come-first served basis. In the latter case a student may be rejected without regard to GPA. Notice

that we are talking about the departmental or curricula admissions since we deal only with the students who are already in college.

A third constraint is student time. A student has a limited amount of time for course assignments, reading, etc.

We propose that the course bundle be measured as the number of courses taken at passing grades. Or we could interpret this measurement as the weighted average of the number of courses taken in the field, with weights being the degree of difficulty in course work.

We do not use the mere number of courses as the unit of measurement because we want to take the ability constraint into account. A more able student is expected to have a larger number of courses at passing grades for a given time, other things being equal.

The time constraint is implicitly incorporated in our measurement. There exists a limit to the number of courses taken with passing grades, holding student ability constant. The substitution between study and leisure time is also implicitly included here in the sense that more leisure time reduces the number of courses taken with passing grades, given ability.

Let us consider a hypothetical student with the choice between two fields of study such as humanities (H) and sciences (S). This is illustrated by Figure 1.

Suppose the student spends all of his time on the course bundle "Science." Then he could have gotten the OA amount of science courses at passing grade and none in humanities courses. Similarly, if the student devotes all of his study time

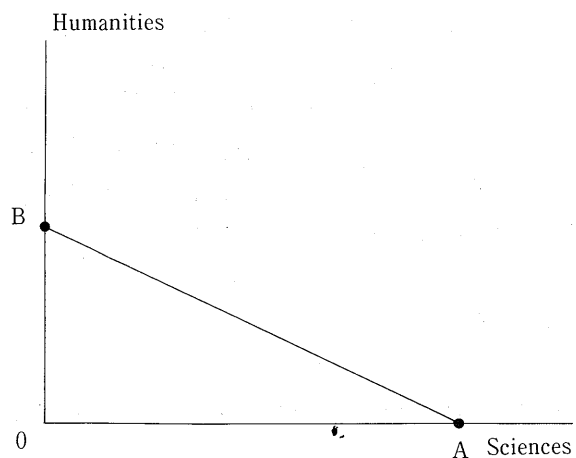


Figure 1

available to the "Humanities" courses, the result will be point B, the maximum amount of humanities courses and no science courses.

A point on the line AB indicates the way the student allocates his or her time in each field of study. We can interpret this line as a sort of production frontier indicating the student's ability to produce academic performance.

A non-constant rate of course substitution or the practice of distributing grades according to the normal distribution would imply a more concave production possibilities curve. However, for simplicity we assume a straight line, and this does not affect our general conclusions that follow.

2.3 The Admission Policy Constraint

The admission policy enters our model in two different ways.

On the one hand, university-wide rules preclude the dashed line parts of the production frontier as illustrated in Figure 2 as BD or AC. University requires that a certain fraction of the entire hours of work toward a degree must come from general education or "breadth" requirements.

On the other hand, each department requires that the student should satisfy all the major course requirements in his or her degree program. The student who achieves the specified amount of courses in science will get a "Science" degree and the one who satisfies the specified number of humanities courses will obtain a "Humanities" degree.

Thus no one will try to be on the mid-range, say, the dashed line segment EF of the production frontier AB in Figure 2. The student who has half of the required science courses and half of the required humanities courses will receive neither a "Science" degree nor "Humanities" degree.

If we extend this argument to the everywhere-dense feasible set (i. e., the area bounded by the production frontier line AB and the two axes), it will result in a newly defined feasible set illustrated as the shaded area in Figure 2.

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2.4 Discrete Choice of Fields of Study

This discussion of the feasible set as shown in Figure 2 brings out a unique feature of curriculum choice. On the one hand, this is partially a marginal choice in the sense that there exists a fair amount of variation within the degree requirement that the

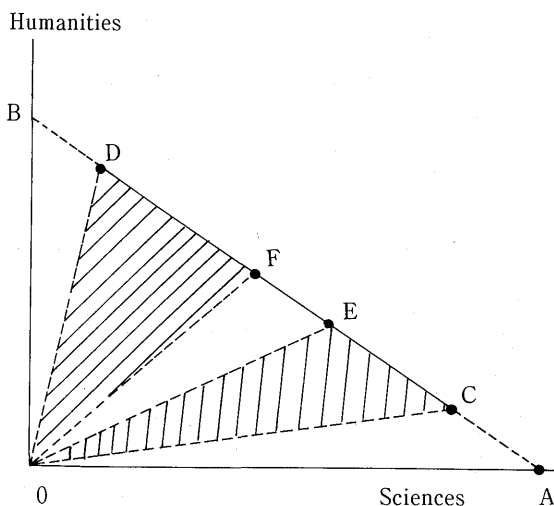


Figure 2

student can combine varying amounts of different types of courses.

On the other hand, this is partially a discrete choice characterized by dichotomous, categorical and unordered decision. This is a choice between one field of study (or one full-time occupation provided there exists a one-to-one correspondence between a curriculum and an occupation) and another. Even if he is making a marginal choice internally, it looks as an "either-or" decision to the eyes of the third party.

It is also a long-run choice in the sense that the student may commit himself to a life-long occupation.

2.5 The Student's Relative Aptitudes and Ability

The relative magnitudes of OA and OB indicate the student's relative aptitudes toward fields of study, holding ability constant. In Figure 3, student 1 has a relatively greater aptitude in Science. Student 2 has a comparative advantage in Humanities over Science.

The differential ability among students, given their relative aptitudes, can be indicated by a parallel shift of the production possibilities lines. For example, as shown in Figure 4, student 4 has an absolute advantage over student 3 while both have the same relative advantage toward Science and Humanities. For a given study time available student 4 can achieve a greater number of courses at passing grades.

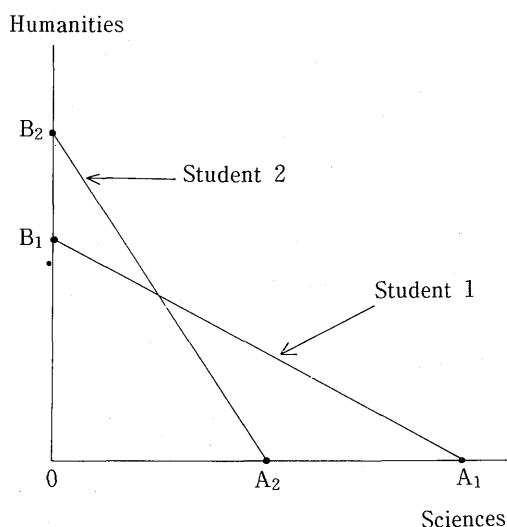


Figure 3 : Comparative Advantage in Curricula

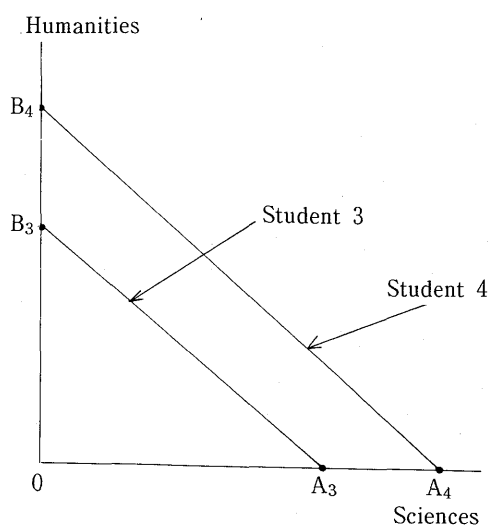


Figure 4 : Absolute Advantage in Curricula

2. 6 Preferences

We assume that a student has an ordinal utility function which is twice differentiable. It is also assumed that the student's utility function does not change during the period of analysis for four-year college life. In other words, his indifference curves retain their shape for the entire college life.

It is quite conceivable and often observed that a student switches his or her major to another during a freshman or sophomore year. We interpret this phenomenon that the student discovered his or her optimal major rather than that the student's preference ordering changed in a fundamental way.

The fundamental difference between our model and the conventional human capital model is that the activity of schooling per se directly enters the utility function. It should be realized that in this model the number of courses taken at passing grades is not exogenous but depends, at least in part, on the resources allocated to its production.

The college diploma is demanded by "consumers." "Consumers" here consist of both students and their parents. Parents usually give financial aid to help their children obtain a college diploma because parents view college education as increasing their children's well-being.

Students benefit from their parental financial and moral help, and make the parents happy upon completion of college education. In this sense students and parents are both benefactors and beneficiaries.

Children's well-being is a normal good, as is parents' satisfaction. Therefore a college diploma is a desirable consumer commodity. A college diploma from a certain school in a specified area of study provides a specific amount of satisfaction (i. e., prestige and power) in addition to the average amount of prestige and power the average college can give. For instance, for a given individual a political science diploma from Harvard gives a higher utility than a political science diploma from a small state college. We can include these aspects of schooling as a part of "nonmonetary return to college education."

An investment motive for acquiring human capital is well studied in the literature. The standard discounted values of lifetime earnings for different occupations enter the student's preference function. We will discuss in the Appendix how these present values of earnings by occupation are perceived by the student.

2. 7 Optimal Choice of Major

Given his or her field of study, a student perceives the expected future monetary

returns, the quality of the working environment, leisure time, etc.; that is, both pecuniary and nonpecuniary returns, job-related and non-job related; and current consumption benefits are perceived.

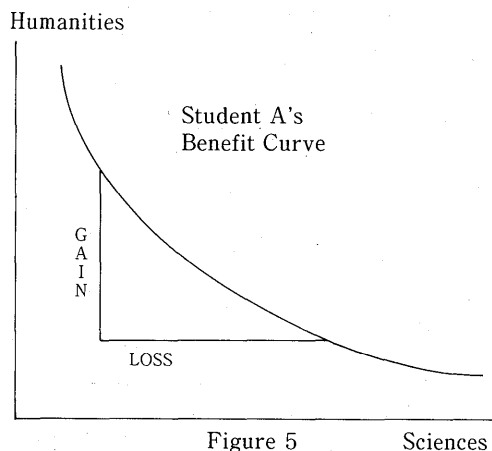


Figure 5

There are some aspects of education that clearly affect utility positively. We term these aspects as "current consumption benefits of college education." A limited list of the examples includes a relatively easy daily life, a larger chance of dating, an easy access to good athletic facilities, greater cultural exposure, including youth culture.

The future pecuniary and nonpecuniary and current benefits of college education to a particular student A determine the shape and location of his or her benefits curve as illustrated in Figure 5.

The reason why this curve looks convex is that there exists a trade-off. Student A has to give up some benefits from one curriculum in order to gain some extra benefits from the other curriculum. Since the gain equals the loss, the slope of curve

$$= \frac{\text{Amount of H Benefits Gained}}{\text{Amount of S Benefits Lost}} = \frac{\text{Marginal Utility of H Benefits}}{\text{Marginal Utility of S Benefits}}$$

For example, given ability, student A can have more free time or study topics of greater interest if he switches to philosophy from engineering while he faces much less monetary returns as being a philosopher after he gets out of school. Or student A may gain a white-collar job in nice surroundings but he or she may lose some money wages.

A student's indifference map provides a representation of the student's tastes for the various benefits. To illustrate how a student's preference map reflects his or her tastes for educational benefits, consider the various preference maps in Figure 6.

Student B needs several extra courses of humanities to compensate for the loss of a single course of science, whereas student C needs less than one extra course of humanities to compensate for the loss of a single course of sciences. Thus in this sense humanities courses are less important, relative to science courses, to student B than to student C.

Student D regards humanities courses as useless. Student E regards science courses as a nuisance or disutility since he is willing to reduce the amount of humanities courses he consumes in order to get rid of some science courses.

Let us superimpose Figure 5 on Figure 2 as shown in Figure 7. We could interpret a given point in the indifference curve represents marginal benefits. Student

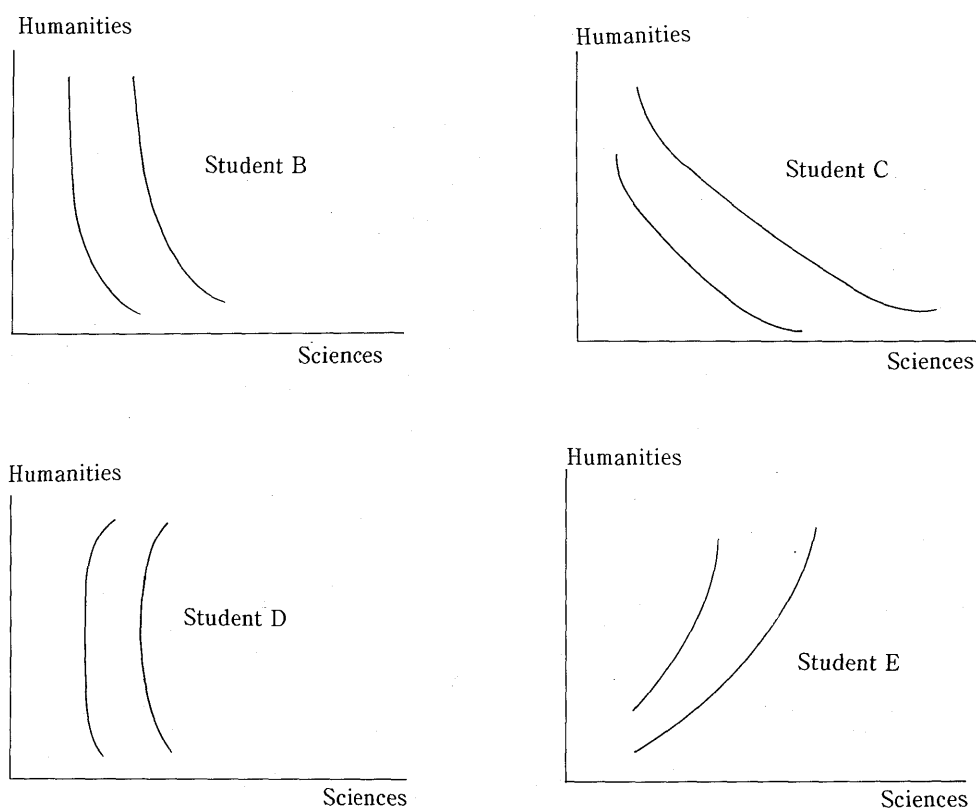


Figure 6. Preference Maps of Various Students

A will make his or her curriculum choice so that student A can equate his marginal benefits and his marginal costs. In other words, student A's equilibrium choice will be that which equates his or her rate of technical substitution in academic performance production with his or her marginal rate of substitution of the benefits of the two curricula.

Point M is an optimal or equilibrium point for this student A. Student A will take O_s amount of science courses and O_h amount of humanities courses both at passing grades. As a result student A will graduate with a humanities degree.

2.8 Switching of Majors

We argue that a student switches his or her major not because the student "suddenly" realizes that certain curricula are more profitable than others but because he or she recognizes through some course work where his or her comparative advantage lies.

Those students who perceived their comparative advantages correctly at the entry of college do not have to change majors. The switching of majors is quite consistent with the framework of ordinary consumer demand theory of utility maximization.

The student's preference map is assumed to remain fixed throughout the analysis. This means that the student already knows quite a lot about his or her tastes for monetary and nonmonetary returns and current consumption benefits when he enters the university as a freshman, and that these tastes remain unchanged until this student graduates with a degree.

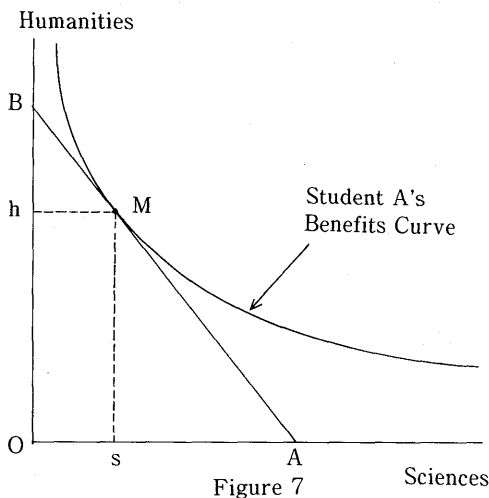


Figure 7

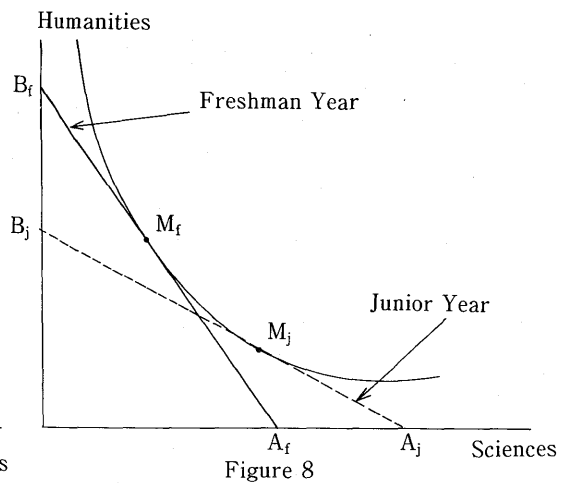


Figure 8

Here we are talking about the student's expectations. Perceptions of the future pecuniary and nonpecuniary and current benefits of college education is nothing but the embodiment of expectations about college education. The student may be able to assess more objectively whether those expectations were too high or too low or materialized several years after college graduation when he experiences the world of work.

However, while in college, it is not unreasonable to assume that the student's expectations (or perceptions) about the pecuniary and nonpecuniary returns and present consumption benefits remain for the most part unchanged.

On the other hand, it is quite conceivable that the student gradually acquires

more information about his or her aptitude. High school experience may define broad areas of aptitude, but the range of curriculum choices is greatly limited. Therefore it is unlikely that an incoming freshman will be fully aware of the attainable set in the absence of experience. Gradually, however, the information regarding personal aptitude will unfold to the student. This information will force the student to switch in the direction of the curriculum in which he or she has the highest comparative advantage if he or she is to maximize the grade point average.

The student behavior of curriculum switching can be illustrated in Figure 8. We have drawn two constraints (academic performance production frontiers). The slope of freshman year's frontier indicates that the student thought he or she has a comparative advantage in courses of humanities. The student was therefore going to choose course bundle M_f which contains relatively more of courses in humanities.

However, the student realizes after one year's course experience that his or her real comparative advantage lies in courses of sciences. Therefore the student will switch and choose course bundle M_j which includes relatively more of science courses. Now the student can maximize his or her GPA by concentrating on the field in which he or she has the higher relative aptitude. The student is a utility-maximizer.

The fact that the student would be worse off can be seen as follows. This case is illustrated in Figure 9.

As we mentioned before, the student must fulfill the course requirements imposed by departmental degree programs. The departmental degree requirement which includes the specified minimum GPA can be represented by the line OR which is a linear combination of vectors of OS and OH : $OR = aOS + aOH$ where $0 \leq a \leq 1$.

Note that if the student were to choose the course bundle M_f while the "true" frontier is indeed B_jA_j , the student would reach a point such as M'_f where both the GPA and the level of satisfaction would be lower. This is because the course bundle M'_f is on a lower indifference curve.

Notice that those students who confirmed that their assessment of their relative aptitudes at their freshman year proved right will remain in the same curriculum throughout the college years.

2.9 Market Discrimination

Employers often say that they are looking for someone with "good, general education" (implying a solid liberal arts background). But they may actually hire vocation-oriented students in engineering, accounting, computer science, etc.

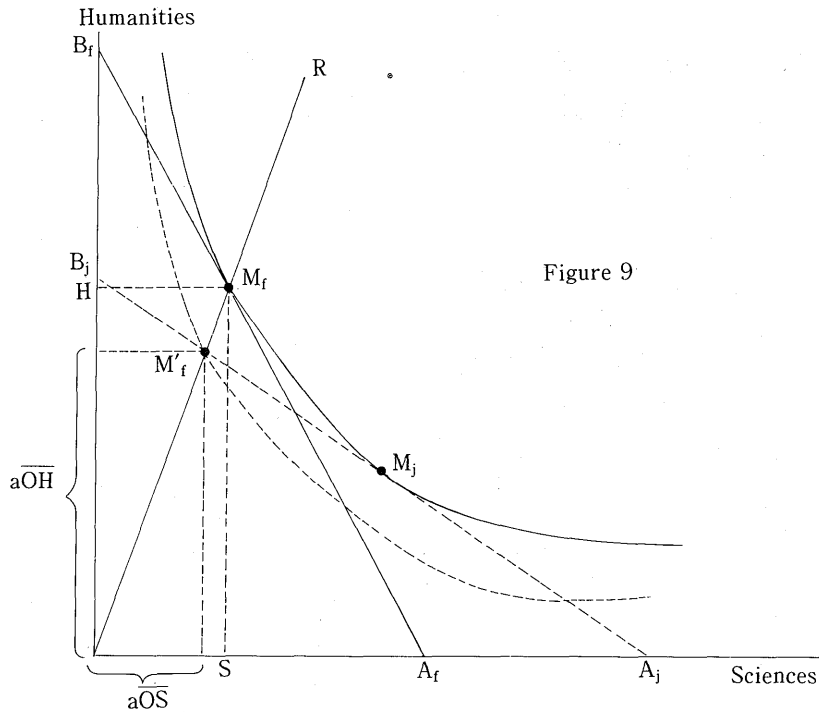


Figure 9

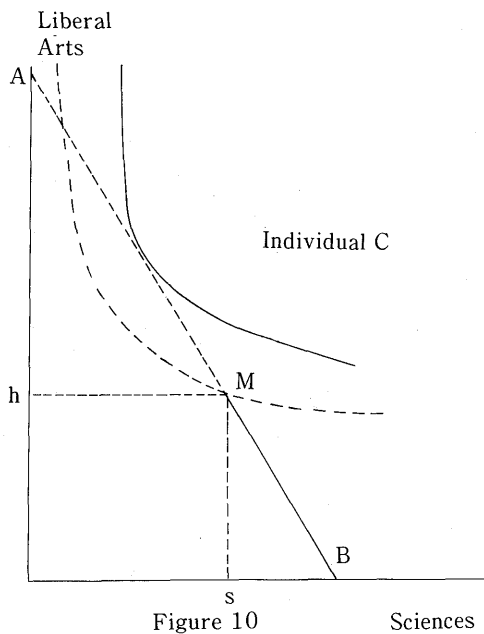


Figure 10

Students, of course, may know this. Let us consider individual C who has a comparative advantage in liberal arts. Market discrimination by employers will render a certain portion of his production frontier practically non-existent (for example, the AM portion shown in Figure 10), and individual C is denied of entry (not by admissions but by psychic pressure) into liberal arts field despite his aptitudes. As a result, individual C's derived benefits from a college education are lower than other-

wise (i. e., the course bundle M in Figure 10 is on a lower benefits curve).

2. 10 Individual Preferences System May Not Remain the Same Even over a Relatively Short Period of Time

The usual demand analysis tends to take it for granted that the preference structure is fixed at least over a given period of time in question; Analytical expediency makes this understandable.

If a prediction is made on the basis of an economic analysis that assumes tastes to be fixed, and if the prediction is confirmed by experience, then the neglect of tastes has been justified. "Hence every successful economic analysis of consumer behavior that neglects changes in tastes is support for the neglect."¹

Even if an economic prediction fails, the economist usually looks for other sources of failure much more often than he looks for changing tastes. Changing tastes can invalidate a prediction, but so too can a mistaken analysis such as the neglect of some other important variable, the improper formation of the theory, inappropriate statistical technique. These causes for prediction failure have been found to be more probable than changing tastes.

It is argued here, however, that in our analysis of curriculum choice changing tastes is a distinct possibility in addition to other probable factors and that its theoretical consequence be explicitly brought about especially when it can yield a prediction.

In the section 2.8 above a switching of majors is explained by the hypothesis that a student recognizes through some course work where his or her comparative advantage lies. This same phenomenon of a curricula switching can also be explained by shifts in individual preferences structure over time.

Consider individual D who has started his curriculum as a science major. He has a comparative advantage in sciences and his choice seemed quite a natural one. But a series of "Enlightenment" events, including a contact with a youth culture on campus, has rather swiftly restructured his preference schedule, and he has become a philosophy major in his junior year of college. It cannot be inferred that he derives a higher satisfaction from his current major because a comparison of two different preference orderings is impossible (Figure 11).

An individual may switch from one curriculum in which he holds a comparative advantage to the other in which he does not; this seemingly irrational behavior turns out to be quite rational if changing tastes is taken into consideration.

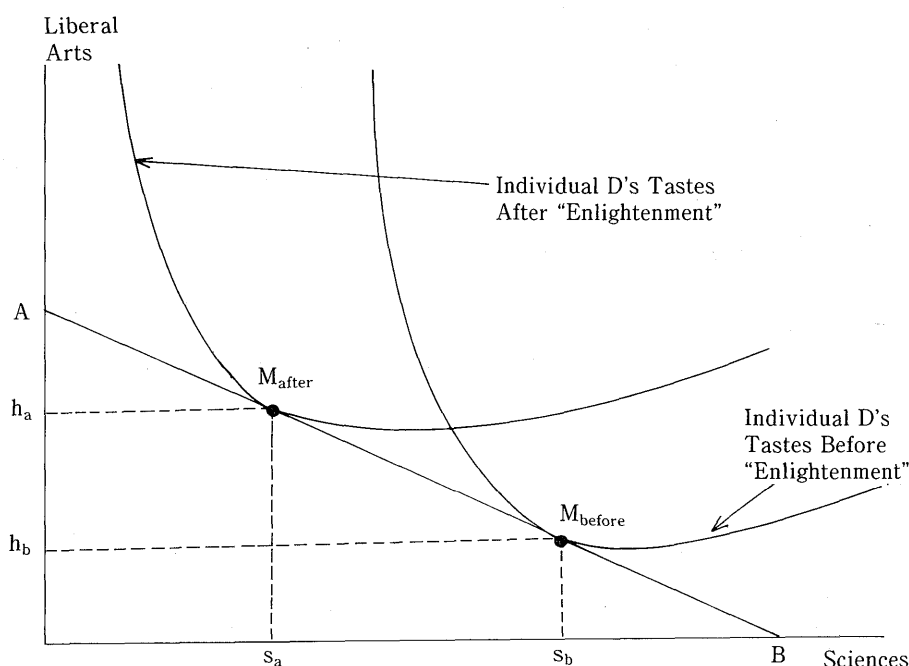


Figure 11

2. 11 Grade Inflation

For persons concerned with college curricula, a recent decline in the enrollment in liberal arts courses is obvious. This gradual decline in enrollment causes a financial squeeze in these liberal arts departments because the university generally allots money according to the student size.

Performance standards can be considered as analogous to prices in terms of resource allocation. Curriculum groups may undertake an adjustment of relative prices (i. e., grades) in the face of serious fiscal difficulties. Competition among departments suggest that in order to maintain budgets and staff, departments may undertake a policy of grade inflation.

This can be illustrated in our analytical framework. Consider individual E who has a comparative advantage in the sciences. He is likely to take, in due time, the O_s sciences and O_h liberal arts courses and to graduate with a B. S. degree in sciences (Figure 12).

As a result of grade inflation in the liberal arts departments, this individual E now perceives his production frontier as $B'A$ instead. Given his preference system, it is now feasible for him to take the $O_s'O_h'$ combination of classes and to graduate eventual-

ly with a humanities degree, enjoying a higher satisfaction from his college program.

Although our analysis can provide a theoretical justification for this possible behavior by curriculum groups, it must await a sufficient amount of data to judge the empirical implications of this particular action on educational resource allocation. But a detailed discussion of this phenomenon is, of course, beyond the scope of the present study.

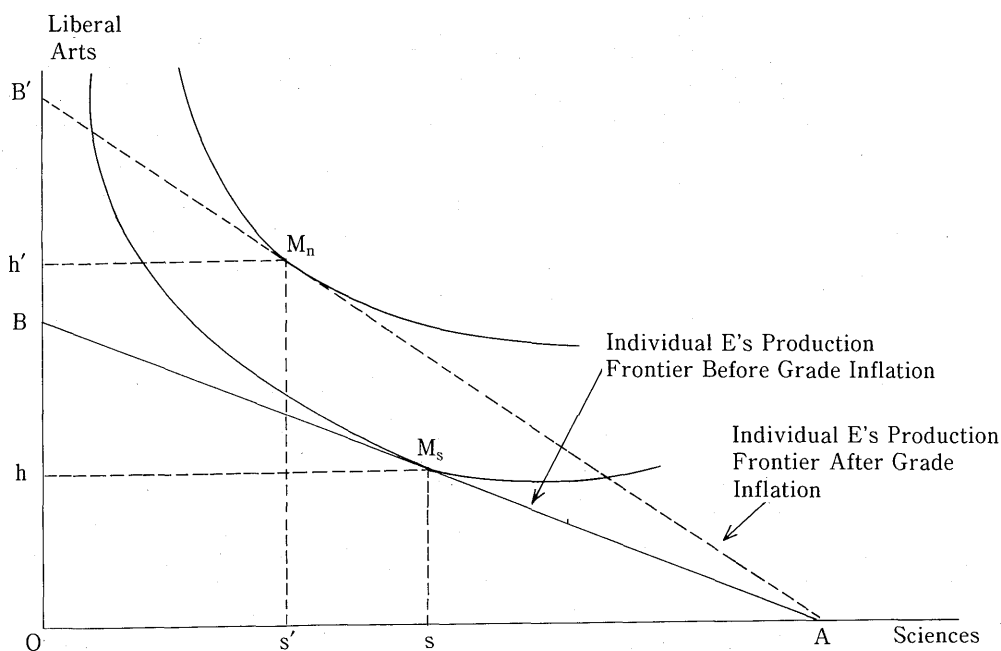


Figure 12

3. Conclusion

An economic model of curriculum choice presents one possibility of analyzing the student rational behavior on selecting a future course in the world of work. Given the institutional constraints (university admission policy, university-wide and departmental course requirements) and the innate ability constraint (represented by whether the student is passable or not in a given course), the student tends to choose the field of study in which he has a comparative advantage. The student's behavior in majors switching is thus viewed as a short-run phenomenon within a longer-run process of discovering his comparative advantage. It can also be a long-run choice in the sense that the student

may commit himself to a life-long occupation.

Behind the student's selection of course bundles through the process outlined above lies the perceived value of a diploma. This perceived value of a diploma can be measured indirectly by expected pecuniary and nonpecuniary returns (wages, nice working environment, leisure time, etc.) in relation to a life-long occupation. Irrespective of a particular manner in which the student reaches his decision (for example, he eyes on the earnings differentials among alternative occupations), monetary rewards considerations can be modified by nonmonetary factors.

Changes in individual preferences system and the practice of "grade inflation" also modify the optimal choice of major by the student. Although the present analysis provides a theoretical justification for the possible behavior by students, it must await sufficient data to judge the empirical implications of a particular studental action on educational resource allocation.

FOOTNOTE

- 1 An interesting account of tastes in economic analysis can be found in George J. Stigler, The Theory of Price, Third edition, the Macmillan Company, New York, 1966, pp. 38-41.

Appendix: EXPECTED MONETARY RETURNS TO CURRICULA

Expected monetary returns is an ingredient of the student's utility function. We assume that the student translates a curriculum into a broad group of occupations when estimating the expected monetary returns to his or her curriculum. If this is the case, the student is looking at the present values of lifetime earnings for different occupations.

We assumed before that the student entered the university with a preconceived notion about future monetary returns to curricula. That preconceived notion must be determined empirically. The following three assumptions can be suggested.

Assumption: The student has a "reservation wage" which is the minimum acceptable future monetary return. This reservation price varies between individual students.

Other things being equal, the differential monetary returns among curricula do not affect the shape of the student's preference map so long as the starting salaries exceed the reservation prices: that is, if

$$(\text{Starting Salary in Occupation } i) - (\text{Reservation Price for any Occupation}) > 0.$$

Assumption: The student is concerned with the absolute differentials of the discounted values of monetary returns among different occupations:

$$(\text{Present Value of Occupation } i) - (\text{Present Value of Occupation } j).$$

Assumption: The student is concerned with the relative differentials of the discounted values of monetary returns among different occupations:

(Present Value of Occupation i)/(Present Value of Occupation j).

One way of achieving the dichotomous as opposed to multiple choices might be as follows: Among all the alternatives open a choice is made between two options; having dismissed one of these as the less desirable of the two, he can proceed to compare the other to a third alternative. Proceeding step by step in this way, he can reduce the number of eligible alternatives to two.

As to the specific ways the student pairs up the two occupations for comparison, the following two assumptions can be considered.

Assumption: The student compares the two 'representative' occupations from the two broadly defined occupational groups. He behaves this way because he is not certain about which specific occupation he would actually have in his prime of his working life. Therefore he tends not to be concerned with detailed salary differences among occupations within the same broad group.

For example, the student is aware of the basic salary differences between the medical and the engineering professions. Of much less concern, however, how much monetary rewards differ between an optometrist vs. a veterinarian or a chemical engineer vs. an aeronautical engineer. The relevant information to the student is the fact that physicians and engineers earned on the average approximately \$19,000 and \$13,000, respectively, say, in 1970.

Assumption: The student has already dismissed many of the broadly defined occupational groups. Thus his specific curriculum is chosen with an eye on the earnings differentials among alternatives within the same broad group.

According to this assumption, a student has ruled out, based on nonmonetary considerations, other occupational groups except, say, business profession. The earnings differentials among accountant (\$10,677), financial manager (\$11,742), sales manager (\$9,508-\$14,526), sales representative (\$9,585-\$11,124), etc., are the sole concern. (The figures in the parentheses are median earnings of the occupation in 1970).

Notice that the students' expectations may be disappointed. Relative earnings in different occupations may change with the passing of time, so that at any particular time one will find individuals in occupations they would not have chosen had they foreseen correctly the trend of relative earnings. This analysis only establishes a tendency in determining which choice will maximize individuals' satisfaction.¹

Also notice that the discussion in this section deals only with monetary return to curricula. Nonpecuniary returns and present consumption component as well as monetary returns also help determine the shape and the location of the preference curve, and thus the major a student is likely to select. Therefore monetary returns must be interpreted as a part of the entire preference framework in the analysis. This means that monetary reward considerations can be modified by nonmonetary factors in curriculum selection.

FOOTNOTE

- 1 For an economic analysis of occupational choice see Tibor Scitovsky, Welfare and Competition, Irwin, 1971 revised edition, pp. 97-99.