SYSTEMS APPROACH TO THE MARKETING ASPECTS OF HIGHER EDUCATION

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
GURRAMKONDA M. NAIDU

1969

This is to certify that the

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ABSTRACT

SYSTEMS APPROACH TO THE MARKETING ASPECTS OF HIGHER EDUCATION

By

Gurramkonda M. Naidu

The topic of this research is the marketing of graduate education. The study aims at determining the factors that influence the choice of a university (selective demand for the product, education). The specific problem dealt with is the identification of variables that make the "educational product package" more acceptable to students at different levels (Doctoral, Masters and Seniors) of higher education.

The study was structured around two groups of variables: i) Individual characteristics such as academic, demographic and socio-economic characteristics and the perceptions of the university variables, ii) Environmental variables such as competitor's actions as independent variables. Educational buying behavior (acceptance or rejection of an educational product package) at an institution is treated as the dependent variable.

Using Michigan State University as a data base this study focused on finding the relationships between educational purchase behavior (selective demand for education) and a set of independent variables. The issues considered in the investigation are:

i) Finding the similarities and dissimilarities between those who accepted MSU's educational product package, shows, and those who rejected MSU's educational product package, no-shows.

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ii) The above descriptive knowledge has been utilized to predict whether an applicant with certain characteristics would be a show or a no-show.

iii) The final focus is on identification of control variables which could be manipulated by the administrator so as to achieve certain desired results.

The descriptive analysis revealed that there are dissimilarities between shows and no-shows with respect to academic characteristics, perceptions of the MSU variables, and the demographic and economic characteristics of the individual. The above descriptive knowledge has been utilized to gain predictive knowledge of educational buying behavior. Where the prediction has been satisfactory, efforts are made to find control knowledge about certain aspects of the buying behavior.

A probabilistic model that describes the educational buying behavior for each level, aid/no aid category, and for different classes of student incoming quality has been considered. The model also demonstrates how the enrollment and incoming quality of students varies for different administrative policies of financial aid allocation.

On the basis of this research the following general conclusions can be drawn:

1) Financial aid is an important variable in determining a student's acceptance or rejection of an educational product package.

2) Without financial aid the educational product package has less attraction, but at the same time financial aid alone may not attract quality students. This implies a need for a balanced "mix" of the educational product package.

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3) The attractiveness of an educational product package mix may vary from level to level. At higher levels, financial aid and faculty reputation are considered to be more important by the students whereas at the lower levels, general reputation of the university and the location of the campus appeared to be of greater importance in the student's decision to accept or reject a particular (educational) product package.

4) The acceptance or rejection of a particular educational product mix within a level may vary between classes of student quality. The higher the quality student, the greater the number of alternatives (admissions and financial aid offers) he may have at the time of his decision; and the greater the number of alternatives, the lower the chances of accepting a given educational product without financial aid.

5) The models developed demonstrate that for a given financial aid budget, as the amount of financial aid per student increases, the incoming quality of student improves and as the given amount of budget is spread on many students (less per student) the incoming quality decreases.

The above results may help an educational institution to formulate marketing strategies for its products in order to appeal to particular segments (levels of higher education or quality of students within a level) of the student population.

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SYSTEMS APPROACH TO THE MARKETING ASPECTS OF HIGHER EDUCATION

By

Gurramkonda M. Naidu

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Marketing and Transportation Administration

1969

This thesis is dedicated to

THE LORD SREE VENKATESWARA

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I have received advice, constructive criticism and encouragement from various persons in completing this study. I would like to single out the following individuals for their significant contributions that enhanced the completion of my research problem.

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Prameela and Sharmila were a constant source of understanding and cooperation.

I would like to

the above individual

My thanks are a

efficient typing.

I would like to express deep gratitude and sincere thanks to the above individuals.

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CHAPTER I

INTRODUCTION

Statement Of Purpose

This dissertation is concerned with studying the similarities and dissimilarities between those who accept (shows) and those who reject (no-shows) the product package of graduate education offered by Michigan State University (MSU). Using this descriptive knowledge, it is aimed at predicting in the early stages (of application processing) whether MSU's product package would appeal to an applicant with certain given characteristics.

The study is also concerned with identifying the variables that make the product package more appealing for each level (Seniors, Masters and Doctoral) of higher education. With financial aid as a control variable, which may be assumed to be flexible (at least with respect to the amount of aid per student) in the short-run subject to certain constraints (teaching and research commitments), its effect on enrollment is estimated.

The ultimate purpose of this dissertation is to describe the graduate education purchase behavior as a probabilistic model and demonstrate how the enrollment and incoming student quality would interact under different policies of financial aid allocation.

The Probabilistic Model and the Systems Model (Appendix 6) presented in this dissertation would enable one to determine guidelines for administrative decision making in the management of

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Statement Of The Problem

In the Fall of 1967, there were 7444 applications for graduate study at MSU, out of which 4838 were accepted (eligible for admission). Only 2074 of these accepted applicants enrolled, leaving 2764 students as no-shows. Among the no-shows were 680 who had been offered financial aid at Michigan State University. Some of these no-shows are supposed to be better in quality. This poses at least two problems to an institution of higher education:

i) uncertainty in demand for graduate education, and

ii) loss of some quality students who might have received a better graduate education package from elsewhere.

The present research is aimed at studying how students make decisions to buy or not to buy graduate education from an institution. What are the factors that are considered to be most influential in the choice of an educational institution? (Marketing, by definition, focuses on the needs of the consumer as compared to selling, which focuses on the needs of the seller.[1]) Hypothesizing that the consumer's educational purchase behavior is a function of a number of variables (individual characteristics such as ability and intellectual curiosity, socio-economic characteristics of the individual, and environmental variables such as employment opportunities, peer group and societal pressures, etc.), this study is focused on the consumer's choice of a university. More specifically,

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[1] Theodore Levitt (1962). Innovations in Marketing. (New York: McGraw-Hill Book Company, Inc.), p. 55.

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what are the factors that influence the consumer's decision in the choice of a university for graduate education? Why do some people buy graduate education from certain institutions (specifically from MSU) and why do others decide not to buy? What are the similarities and dissimilarities between these buyers and nonbuyers of a graduate educational package? In the present investigation we seek to:

1. Determine similarities and dissimilarities between the buyers and nonbuyers of a graduate education package by level (Doctoral, Masters and Senior) and by aid/no aid category with respect to their image of the institution (measured by the ratings on the university variables), the importance (ranking) of factors that determine the choice of a university and the personal characteristics such as ability, socio-economic and demographic characteristics.
2. On the basis of the above characteristics, predict at the time of application, whether a particular product package (graduate education) from MSU would appeal to the consumer.
3. Identify the important variables that are considered to be influential in determining the purchase of the graduate education package from MSU at different levels (Senior, Masters and Doctoral) of higher education.
4. Describe the graduate education purchase behavior by a Probabilistic Model and predict the enrollment and incoming student quality (as measured by entrance GPA) for different policies of financial aid allocation.

Besides the above mentioned issues, the hypotheses relating to different aspects of the graduate education purchase behavior are tested at the appropriate places of discussion in Chapters III through VI.

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Nature Of The Education Industry

Basically, education is a service industry. As Swanson, et al, pointed out:

"... An institution of higher learning ... is created by society or some segment of society to perform certain services, with either all or some of these services being common to all such institutions. Different institutions and their creators may have widely different goals or purposes in mind which they hope will be achieved by performance of these services. These differing goals may affect the decision as to which of the services are to be performed and the manner in which they are to be carried out, but they do not affect the classification of the services themselves. All of the educational activities of an institution of higher learning are directed towards the carrying out of one or more of these services."[2]

Swanson conceived that there are "five services or service functions being carried on by institutions of higher learning. The first three are direct educational functions and are ends in themselves:

1. Instruction
2. Research
3. Service to the public
4. Service to the academic community and
5. General support"

For practical purposes, we can consider instruction, research and consulting (advisory) services to the public, government and foundations, etc. as the three major distinguishable service functions of the education industry. In the present study, unless otherwise mentioned, the education industry and the educational system refer to higher education.

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[2] John E. Swanson, Wesley Arden, and Homer E. Still, Jr. (1966). Financial Analysis of Current Operations of Colleges and Universities. (Ann Arbor, Institute of Public Administration, Univer- of Michigan), p. 9.

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Inputs and Outputs of the Educational System:

Inputs: The education industry could be considered an input-output system. It accepts into the system a raw material--the partially educated student--and transforms it into a developed product--a student whose educational level has been raised through time and various other "factors of production" employed by the university. The other factors of production that are empolyed by the university for accomplishing the transformation include various kinds of manpower, material and supplies, acquired services, equipment (including books, instruction materials, etc.) and building. Each of these broad categories could further be subdivided into finer classifications.

Outputs: Through the interaction between students and teachers in the environment of the education industry, the learning process is accomplished and inputs are transformed into outputs. A striking feature of higher education is that it is generally produced in association with a host of other "services" such as contract research for corporations, governments and foundations. The importance of these services varies with the institution. In some, research is viewed as central and instruction as a by-product. In others, instruction is the major concern and research is tolerated only as an extracurricular activity of faculty. It is usually difficult to find an institution of higher learning where these activities are not mixed to some degree.

Some Problems in Measuring the Quality of Inputs:

Tools for measuring the input factors qualitatively with precision do not now exist. In this study, entrance Grade Point age GPA is

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Average (GPA) is used to measure the quality of inputs.

<u>Some of the Typical Problems of the Education Industry</u>:

1. One of the typical problems of the education industry and, for that matter, any industry is the estimation of future demands (short-run and long-run) for its products, as well as finding the relationships between demand and various environmental factors. Such a knowledge is necessary for future planning an instantaneous adjustments to the changes in the environment that may affect the demand for the product.
2. Recruitment (selection) of students is a problem of utmost importance in fulfilling the goals of an educational institution. It is the interaction of two important inputs, students and faculty, that determines the outgoing product-quality. Therefore, to attract good students the industry should know the factors that influence their decisions in the choice of an institution.

The above problems come under the purview of marketing.

<u>Basically a Marketing Problem</u>:

In a recent article, "Broadening the Marketing Concept", Philip Kotler and Sidney J. Levy point out: "It is the author's contention that marketing is a pervasive societal activity that goes considerably beyond the selling of toothpaste, soap and steel ... student recruitment by colleges reminds us that higher education is marketed; ... yet these areas of marketing are typically ignored by the student of marketing".[3] Kotler's and Levy's statements are

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[3] Philip Kotler and Sidney J. Levy (1969): "Broadening The Concept of Marketing". <u>Journal of Marketing</u>, Vol. 33 No. 1, January 1969, p. 10.

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true in the sense that the education industry, which is one of the largest and the most important service industries of this country, has not been studied by the marketing specialists so far. It is a marketing problem and a virgin area with high prospects for extremely fruitful research.

Consumers of Education: A product or service is demanded by the consumers whenever it benefits or satisfies certain needs of the consumer. The benefits of education have several dimesions:

i) Individual purchasers directly enjoy consumption of education mainly intended for self actualization and intrinsic satisfaction. In this sense, it is a consumer good.

ii) It adds to the productivity of its recipients, thereby increasing the total income of the nation. In this sense, it is an investment good for the individual and the nation.

iii) It directly contributes to the social benefits of the nation. A healthy democratic system may need a more educated population. Further, it is easier to bring changes and reforms in the people as demanded by situations or circumstances. In this sense, it is a public investment.

Demand for Education: The demand for education is defined as "the demand for authorization to attend a specific educational institution on a given level and for certain subject matter."[4] Micro economic theory assumes that the demand for goods is determined by three factors--preference, income and price--and these factors operate independently. We may discuss each of these factors briefly:

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[4] Hector Correa (1963): Economics of Human Resources, North Holland Publishing Co., Amsterdam, p. 56.

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Preference: Consumer preference, the factors that influence the consumer's behavior, may be defined in terms of intellectual capacity, vocational aspiration, parental influences and other motivational and environmental conditions.

Income: A linear relationship between demand for secondary education and per capita income is revealed by data from 48 countries.[5] Short-run variations in income, however, influence enrollment very little. In the 1930 depression in America when per capita income was down by 25 percent, the demand for secondary school education never dropped more than 1 percent.[6] Whether the same sort of relationships hold good for higher education is not known.

Price: From the consumer's point of view, the price of education includes both the income lost during the years dedicated to education and the cost of tuition, books and supplies. A study by R.N. Cooper which included all college students (both graduate and undergraduate) in Vermont shows that reduction in price brings an increase in the demand for education, which is the basis for educational subsidies as a means of increasing demand.[7]

Quality and Demand for Education: C.R. Pace and A. McFee studied how the persons demanding education evaluated the quality of the educational institutions. "In answer to a question about what aspects of a college made it 'best', parents of National Merit

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5 Hector Correa (1963). Ibid, p. 82.

6 Hector Correa (1963). Ibid, p. 82.

7 R.N. Cooper (1960). "Pricing and Student Body". Review of Economics and Statistics, Supplement, August 1960, No. 2 Part 2, pp. 29-39.

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Scholars listed quality of faculty, scholastic standards, curriculum, reputation and facilities." They point out in the same article, "in actual choice of college, financial and practical factors were of substantial influence, academic factors playing a more moderate, secondary role."[8]

Supply of Education: The supply of education may be defined as "the supply of time available in educational institutions, such as schools, colleges and universities,"[9] varying with the availability of teachers, and of building space, equipment and other physical facilities.

Marketing Aspects Of Higher Education:

Marketing delivers a standard of living[10] and education plays a key role in performing this function. Whether it is an individual, a business organization or an educational institution, buying and selling are invariably most important for survival and growth. In the sense that education is a "consumer good" as well as an "investment good," the education industry must sell itself selectively to people who have the ability and aptitude to consume its product as well as invest in those from whom the net benefits for the society are high. The social welfare part has to be taken into account, as the price paid for the good is only 20 to 30 percent of the actual cost of the good.[11]

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[8] Robert C. Pace and Anne McFee (1960). "The College Environment," Review of Educational Research, Vol. 30, No. 4, October 1960, p. 315.

[9] Hector Correa (1963). Op. cit., p. 91.

[10] Paul Mazur (1960): "Marketing: A Maturing Discipline", Proceedings Of The Winter Conference Of The American Marketing Association, December 1960, p. 10.

[11] Seymour E. Harris (1962): Higher Education: Resources and Finance. (New York: McGraw-Hill Book Co., Inc.), pp. 131-132.

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Market for Education: The market for education is peculiar. As price (tuition) steadily rises, purchases increase; rising population, increasing incomes, changing attitudes towards higher education, and improvement in product partly explain the increasing demand.[12] A study covering both graduate and undergraduate populations by R.H. Ostheimer, however, concludes that raising tuition by 25 percent would result in a decline in enrollment by 5 percent. But this in 1952 was a static analysis and excludes from consideration rising income and changes in the pattern of spending.[13] Secondly, tuition is only a small part of the total cost to the student of going to college. Finally, as tuition has risen, student aid has increased much more, which may offset the effect by encouraging the most deserving students.[14]

A study by M. Friedman and S. Kuznets indicated that, as income from a profession increases, the number of graduates in that field also increases.[15]

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[12] Seymour E. Harris (1962). Ibid., pp. 130-133.

[13] R.H. Ostheimer (1952). Student-charges And Financing Higher Education: A Study for the Commission on Financing Higher Education, Washington, D.C., p. 72.

[14] Seymour E. Harris (1962). Op. cit., p. 142.

[15] M. Friedman and S. Kuznets (1945). "Income From Independent Professional Practices". National Bureau of Economic Research, New York, Publication No. 45.

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Thus we can summarize the education industry as follows:

Service Function

	Inputs		Outputs	Consumers (market)
Education Industry	Students Faculty Administrators Staff	Education (Instruction)	Developed Manpower	Individual consumers buying for consumption (intrinsic satisfaction) and investment (extrinsic satisfaction)
	Land Buildings Equipment Library and other physical facilities	Research	Innovations	Individual consumers buying for investment - Organizations, foundations and governments.
			Research Papers	Private individuals doing independent research.
		Consulting Services	Books	
			Service to the Society	Public Government Industry Foundations

The present study is concerned with the marketing aspects of the instructional function of education, since it is beyond the scope of a single study to consider all products--research and services.

Strategies For Marketing Education

Every educational institution employs some sort of marketing strategy in its recruitment of students, faculty and administrative personnel. We shall briefly discuss the product, pricing and promotional strategies of marketing as they apply to the education industry.

Product: The results of graduate education are broadly of two types: i) Developed manpower and ii) research and services including the diffused benefits to the society. Its products differ in value and the institutions compete in the effort to turn out educated manpower of the greatest value. How to improve this product both in quality and quantity, as with any other, is a marketing problem revolving such factors

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about such factors as the quality of incoming students, quality of faculty, method of instruction and effectiveness of curricula. In this industry, moreover, the qualities of the two main inputs--teachers and students--are interdependent: the quality of the faculty partly depends on the quality of incoming students[16] which in turn reflects the quality of faculty. Many other variables that influence the quality of incoming students--financial aids, tuition, school reputation, curricula, etc.--must be interrelated in similar ways. This study in part seeks to identify and measure such relationships among these variables.

Price: The pricing of educational services differs greatly from the pricing of industrial goods since the educational institution seeks to maximize the advancement of knowledge and to meet certain needs of society. The price of education from the consumer's point of view includes tuition, supplies and books, income foregone while acquiring education, less the subsidy, if any, he may receive while attending an institution. Tuition typically constitutes only 20 to 30 percent of the actual cost of education. These costs are not uniform for all levels and curricula. For example, tuition covers only about 7 percent of the actual cost of public health curricula whereas in the case of law, tuition covers about 66 percent of the actual costs.[17] Further, the tuition in the prestige institutions

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[16] Elwin F. Cammack (1964). Faculty Mobility and Productivity and Achievement at Michigan State University, MSU's Office of Institutional Research. East Lansing. Unpublished manuscript.

[17] Seymour E. Harris (1962). Op. cit., p. 103.

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like Harvard may be triple the average tuition in the country, although the average amount of subsidy per student as well as the percentage of students receiving subsidies (financial aids) may be correspondingly higher than the national average.[18] Because of these market imperfections, pricing of education is a complex problem. Some people[19] suggest that pricing education at residual cost leads to a better allocation of resources. Assessing the residual costs is by no means a less complex problem since the same problems of measurement as well as estimation of short-run and long-run effects are equally difficult to assess with reasonable accuracy.

Discriminatory Price: Education is a multi-price system because some students pay full tuition, some pay part tuition and some no tuition; still others receive various subsidies.

Financial Aid as a Means of Reducing Price to the Consumer and Increasing Demand: Financial aids are of two kinds:

i) Scholarships, fellowships and tuition scholarships and grants, which are usually granted to exceptionally able and financially needy students to enable them to continue their education. Such financial aids normally do not demand a student's time in return for the aid he receives.

ii) Teaching and research assistantships are usually offered to exceptionally promising graduate students as a subsidy to reduce the price of education. Both the institution and the graduate

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18 Seymour E. Harris (1962). Ibid. Chapter 16.

19 Andre Danire (1964). Higher Education in American Economy. (New York: Random House, Inc.).

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student profit from this relationship (in contrast with type (i) financial aids): the student receives financial aid which helps him to maintain himself, and the department receives services which save faculty time for other purposes. Financial aids can be used for the following purposes:

i) To stimulate demand for education

ii) To attract quality students to institutions of higher learning

iii) To divert students into areas where there seems to be a great deficiency of manpower.

Ideally, from the consumer's point of view, education would cost nothing when financial aid is equal to tuition plus supplies plus income foregone. The main problem is deciding which pricing strategy will generate the maximum demand from quality students.

Loans: Most types of loans are to be paid back and are only meant to reduce family financial burdens and the need for employment while at college.

Promotion: Promotion seeks to increase the demand for goods and thereby increase the total revenue of the firm. It begins with identifying the potential market, and then influencing or persuading that part of the population to buy the product. Building an institutional image to capture certain market segments needs continuous manipulation of the marketing variables. The 'on going' institutional image attracts better students as well as better faculty and this directly helps to turn out quality products. With good product image, the recipients of education get the best price for the education acquired and this in turn contributes to statement of

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the betterment of the institutional image. Different institutions start building their images through different strategies: some do it through regular promotional methods such as suitable communications, timing of admissions and financial aid offers, individual attention to the consumers, etc.; some do it by collecting renowned faculty; and some even do it by building a strong football team!

Method of Study: A survey design is employed to answer various issues raised in this dissertation. Using the 1967-68 MSU records, random samples are drawn from the buyers (shows) and nonbuyers (no-shows) of graduate education from MSU to study the similarities and dissimilarities and to model the graduate education purchase behavior. The details of the sampling procedure adopted are presented in Chapter III.

Limitations of the Study: The process under investigation is extremely complex. The very nature of its complexity makes it still more desirable to study the selection of an institution for graduate study. The main problems encountered in situations of this type are:

1. Lack of validated and standardized instruments to measure the variables influencing the selection of an institution for graduate education.
2. Estimation of the main effects or interactions of certain elements of the phenomenon is extremely complex. Institutional rigidities, high costs, interaction of other components of the economy with the educational system and interference of too much noise contribute to the infeasibility of an experimental design in the present inquiry.

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[21] Philip K

3. When a survey design is employed to estimate the effects and interactions of the elements on an inferential basis, some sort of non-response to the questionnaire is inevitable and this may partly contribute to the limitations of the study.
4. Whenever a researcher considers a small segment of the population and tries to generalize about the whole population on the basis of the evidence provided by his sample, there is likely to be some error. The magnitude of error, of course, depends on how representative his sample is from the subpopulation and how different the subpopulation is from the remaining segment of the population. As most of the findings based on the sample from MSU student population are in agreement with the findings of similar studies based on the sample from the whole United States student population, there seem to be valid reasons for supporting the generality.
5. In a study dealing with a real world, complex phenomenon, use of approximations or crude estimates to arrive at certain conclusions are inevitable. Instead of listing such situations here, they are indicated in appropriate places.

Some Possible Contributions of the Study:

A statement by Kotler and Levy: "... Student recruitment by colleges reminds us that higher education is marketed ... Yet these areas of marketing are typically ignored by the student of marketing"[20] indicates at least two things:

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20 Philip Kotler and Sidney J. Levy (1969). Op. cit., p. 10.

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i) the scope for the expansion of the marketing concept to the higher education industry, and

ii) absence of a study that focused on the education industry from marketing point of view.

The present study, started about two years before the publication of Kotler and Levy's article, is probably a first attempt to study the education industry analytically from a marketing point of view.

Institutions of higher education select their graduate students through a screening process. There is a wide variation in the degree of graduate student selectivity among the types of institutions of higher education. The graduate enrollment of a college is limited to the group of students who select the particular institution. The student's selection of an institution represents "a buyer's market" in the education industry. The knowledge of variables which influence the consumer's decision on the choice of a university would be advantageous to the administrator for resource allocation and better management of the educational institution. Lack of knowledge on the factors that influence the primary and selective demand for education has resulted in confusion and uncertainty in planning and control of the educational services.

The descriptive knowledge of the similarities and dissimilarities between the buyers and nonbuyers of education (from an educational institution) with respect to their image of the institution, subjective judgment of the importance of factors that determine their choice of university and the individual's characteristics such as academic ability, socio-economic and demographic characteristics, provide a basis for predicting the

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educational purchase behavior. Concluding that financial aid is one of the most influential variables that may be manipulated by the administrator, subject to certain constraints, a probabilistic model of educational purchase behavior is developed. This opens new avenues for future research and provides a basis for rational decision making in the allocation of scarce resources. The models demonstrate the interaction between the amount of financial aid and the student incoming quality as well as the enrollments. Most administrators believe that the lower the student incoming quality, the higher the risk of poor performance of failure. The method of student selection that would minimize the institution's risk or maximize incoming quality, or maximize the enrollments subject to certain minimum specified standards etc. could be simulated (using the developed models) and the desired policy whose expected outcomes are consistent with the goals of the organization may be selected.

Another contribution of this study could be the finding that there are differences in product package "mix" that are considered "attractive" at each level (Doctoral, Masters and Senior) of higher education. Independent and fragmented research efforts on different levels of higher education arrived at different and inconclusive findings as to the factors that influence the consumer's choice of an educational institution. This study clearly demonstrates the relative importance of various factors that make the product package more acceptable at different levels of higher education. In this sense, it validates some of the earlier findings and ties them together with a common thread.

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Organization: The second chapter reviews the published literature on the determinants of the primary and selective demands for education. As indicated earlier, there has been no study of the educational process from the marketing point of view. Most of the literature covered are contributions from the systems engineers, operations researchers, economists and behavioral scientists. The third chapter deals with the research design, sampling procedure adopted, and a brief introduction to the development of instruments (Appendix 3). This chapter also includes a brief mention of the various statistical techniques used in the analysis. The fourth chapter is a descriptive statistical analysis that enables one to find the similarities and dissimilarities between the buyers (shows) and nonbuyers (no-shows) of graduate education at MSU. The fifth chapter is devoted to the classification of consumers as shows and no-shows using some techniques of multivariate analysis. The sixth chapter is devoted to developing a probabilistic model to predict the graduate educational buying behavior. The probabilistic model utilizes conditional and Bayesian probabilities to predict the buying behavior of a consumer with given academic characteristics (entrance GPA). The model can predict the probability that a student with a given GPA would attend MSU under different policies of financial aid allocation. Finally the model demonstrates the interaction between the amount of financial aid and student incoming quality (as measured by entrance GPA) and the total enrollment. The final chapter is devoted to a summary of the conclusions and some implications to the task of developing realistic models of graduate education buying behavior. The presentation concludes with some recommendations for future studies.

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CHAPTER II

REVIEW OF THE LITERATURE

Introduction

While referring to the market behavior for industrial products, Jerome Herniter and Ronald Howard pointed out, "the behavior of the market is the composite behavior of many individual consumers. As a result, the market is a complex probabilistic system that is complicated in its interactions and difficult to observe. Yet, if there is to be any progress in controlling the market process as a whole, we have no alternative but to attempt to analyze it as its most fundamental level - the activities of the individual consumer."[1] Though the observation is made in the context of industrial goods, it is equally relevant here as education is a service industry.

Purchase of Education As A Two-Stage Decision Process

In elaborating the approach taken by the behavioral scientists, one may consider the student education purchase behavior as a two-stage decision process. First of all, who are the people that demand education (attend institutions of higher education)? What are their characteristics and why do they demand education? Secondly, why do they choose a particular institution. Representing this schematically:

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[1] Jerome D. Herniter and Ronald A. Howard, "Probabilistic Consumer Models", unpublished paper (not dated).

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	Stage I	Stage II
Eligible Student Population	Buy Education	Choice of an Institution
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Explain	Who Why	Who Where Why
Type of Demand	Primary Demand	Selective Demand

Figure 2.1: The Student's Decision Process On Primary And Selective Demand For Education.

The question "why" in both Stages I and II could best be explained on an inferential basis. This point will be discussed in greater detail in Chapter VI.

Under the above classification, the focus of the present study is on the second stage decision process, i.e., identify factors that influence students' choice of a university and on the basis of that, predict attendance, total enrollment in a given category or level and incoming student quality. Knowledge of this nature is of utmost importance in marketing the educational services of an institution of higher education.

Variables Influencing the First Stage Decision Process:

The literature pertinent to the influential factors of stage 1 may be briefly discussed since stage 2 is not entirely independent of stage 1. Seymour Harris argues that investment in higher education by an individual or a society is normally the best one could make in terms of long-run benefits (incremental income) due to the

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investment.[2] Friedman and Kuznets' study indicated that the demand for education in a given specialization depends upon the income received from it.[3] Because of lack of data their study was confined to medicine and dentistry. The conclusion was arrived at by analyzing the data for the years 1930 to 1950 and finding a high coefficient of rank correlation between the number of graduates in a profession and average earnings in that profession. The possibility of lagged relationships between the changes in professional income and in the number of persons obtaining professional degree in a given specialization could be of great interest, but lack of sufficient and accurate data did not enable them to arrive at conclusive results. Edward McDill and James Coleman made an attempt to study the family and peer group influences on college plans of high school graduates.[4] On the basis of their sample from ten Illinois high schools, they conclude that although in the freshman year the parent's education was the prime factor in college planning, by the senior year, the prestige of peer groups was recognized as more significant. A similar study was also made by Joseph Katz to examine the effect of societal pressures on the process of higher education.[5] He concludes that the pressure of the day is to attend college no matter what the costs are! The above two studies indicate that peer groups and societal pressures do influence educational purchase behavior.

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[2] Seymour E. Harris (1962). Op cit., Chapter 10.

[3] Milton Friedman and S. Kuznets (1945). Op cit.

[4] Edward L. McDill and Coleman, James (1965). "Family and Peer Influences in College Plans of High School Students". Sociology of Education, Winter 1965, Vol. 38, No. 2.

[5] Katz, Joseph (1966). "Societal Expectations and Influences". The College and the Student, ed. L. Dennis and J. Kauffman, (Washington: American Council on Education).

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The question "why" people attend college (buy education) has been analyzed by Iffert on the basis of a national sample survey of students in twenty institutions. He concludes that better paying job and "compelling interest in a particular field" are the two main reasons for going to college. His analysis also indicates that women rank "academic" reasons over "occupational", whereas men list "occupational" goals over "academic."[6] The evidence of sex differences are reported not only with respect to the main reason for attending the college but also with respect to who attends the university. This is supported by the studies made by Charles Grigg as well as George Cropper and Robert Fitzpatrick. Grigg found that the family is an important factor in the decision to go to college, and sex is the most influential factor affecting both plans and attendance in graduate or professional school.[7] Cropper and Fitzpatrick in a survey based on 3581 students from 35 colleges and universities concluded that academic ability, sex and socio-economic status of the family are the most important factors influencing the advanced educational plans. They point out in the same study that the influence of socio-economic status fails to hold good for women.[8] Vincent M. Murphy and James P. Voil asked a sample of freshman to rate 25 reasons according to the amount of importance (4 point scale)

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[6] Robert E. Iffert (1958). "Retention and Withdrawal of College Students", U.S. Department of Health, Education and Welfare, Bulletin No. 1, p. 27.

[7] Charles M. Grigg (1965). Graduate-Education. (New York: Center for Applied Research in Education).

[8] Cropper, George L. and Fitzpatrick, Robert (1959). "Who Goes To Graduate School? A Study of the Decision to Enter Graduate Training". (Pittsburgh: American Institute for Research.)

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for attending college.[9] They conclude that students go to college for different reasons and not necessarily all of them place the same value on reasons why they go to college. Their sample of 338 freshmen consisted of 196 arts students, 64 business students and 78 science students, and the analysis indicated that even though all of them go to college to get a better job and more knowledge, these three groups differ with respect to other reasons for going to college. The art student said that he goes to attain civic leadership, while the business student goes to college to attain social competence. Thus, the reasons for going to college are not necessarily always the same.

Although most of the above studies deal with undergraduate educational purchase behavior, the behavioral scientists have shown that the demand for education is a function of several variables such as economic rewards, peer group and societal pressures, socio-economic and demographic factors, intellectual and academic interests and various other motivational factors. By no means are the above classifications mutually exclusive and collectively exhaustive. The above descriptive studies present fragmented evidence of the influence of various individual and environmental factors on the demand for education. To generate a theory (model) or theories of education, one needs an integrated effort rather than an approach taken by the six blind men in determining the shape (Iconic model) of an elephant.

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9 Vincent M. Murphy and James P. Voil (1965). "Motivational Patterns of College Freshman". Catholic Educational Review, Vol. LXIII, no. 1, January 1965, pp. 1-6.

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Variables Influencing the Second Stage Decision Process: Identification of the variables that influence the second stage decision process is more relevant to the study, but the available research is very limited. A study by Pace and McFee identified the variables that influence the student's choice of a university according to the amount of influence as: quality of faculty, scholastic standards, curriculum, reputation, financial aids and facilities. But they point out in the same study that "in actual choice of college, financial and practical factors were of substantial influence, academic factors playing a more moderate, secondary role".[10] Their study was based on a survey of parents of National Merit Scholars and the findings reflect the opinion of parents of that small segment of student population.

Two more studies--John L. Holland[11], J.L. Holland and R.C. Nichols[12], both based on National Merit Finalists--conclude that the selection of college is determined by an assortment of complex variables, and different types of colleges are selected by different types of students with characteristic patterns of academic ability, vocational goals, educational values, personalities and family backgrounds, and parental images of the "best" and ideal college.

A study by the Carnegie Corporation[13] of New York on the student's choice of an institution of higher education concludes

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10 Robert C. Pace and Anne McFee (1960). Op cit., p. 315.

11 Holland, J.L. (1959). "Determinants of College Choice". College and University, Vd. 35, No. 1, Fall 1959, pp. 11-28.

12 Holland, J.L. and Nichols, R.C. (1964). "Expressions of a Theory of Vocational Choice". Personnel and Guidance Journal, Vol. XLIII, No. 3, November 1964, pp. 235-242.

13 Carnegie Corporation (1966). "The Invisible Thread: A University's Reputation". Carnegie Corporation of New York Quarterly, Vol. XIV, No. 1, January 1966, pp. 1-4.

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that the choice is heavily influenced by the institutional images presented to the prospective students. The Center for the Study of Higher Education of the University of California at Berkeley supported by a Carnegie grant concludes on the basis of a series of studies on freshmen that curriculum, academic standards and reputation, freedom for students, small size, cost, location and good physical facilities are the six most important factors that influence the student's choice of an educational institution.[14] A group at the University of California believes that the institutional image is an "intangible but potent force" in influencing the student's choice of a college or university. The article goes one step further and states: "A bright and serious student may be attracted to a place with a name for serious scholarship: by attending it he helps validate that reputation."[15] Alexander W. Astin[16] made a number of extensive studies (supported by NSF, Ford Foundation and Carnegie Foundation) on how the National Merit Scholars make their choice of an institution of higher education, and his findings are:

a) Selection depends on the perception of the institution by the student.

b) The favorable image and high "popularity" of the institution attracts able students.

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14 Carnegie Corporation (1966). Ibid, p. 1.

15 Carnegie Corporation (1966). Ibid, p. 1.

16 Alexander W. Astin (1965). "College preferences of very able students". College and the University, Vol. 40, No. 3, Spring 1965, pp. 282-297.

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Education

Most of the studies are focused on high school students entering college (undergraduates) rather than at upper levels of higher education. However, a study by Leonard B. Beach was on graduate student population, and he concludes that financial assistance is the most influential factor in the selection of a graduate school.[17]

Review of the literature on the second stage decision process indicates that there are not many studies focussed on graduate studies. While analyzing the results of the study most of the reviewed literature will be referred to in order to assess the overall general agreement of results.

Before concluding this chapter, the position of the present mission may be made clear. The literature gave evidence that the existing studies on higher education are either fragmented or inadequate. For that matter, some of the behavioral scientists while trying to find the relation of a variable (say, peer group influences) on demand for education, totally ignored the influence of other variables. A similar approach is taken when another behavioral scientist is trying to demonstrate the influence of the ongoing image of the institution in the choice of a college/university. In this study an attempt is being made to focus simultaneously on most of the variables that influence student's choice of a university.

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[17] Leonard B. Beach (1965). "The Graduate Student". Graduate Education Today, ed. Everett Walters. (Washington, American Council on Education.)

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CHAPTER III

RESEARCH METHODOLOGY

Methodology is usually defined as a body of methods, procedures, concepts, rules, etc. employed in studying a phenomenon that is of interest to the researcher. In this chapter, the research methodology, design as well as some of the limitations of the results are discussed.

Introduction To The Data Base

One of the main aims of the study is to identify the variables that influence the student's decision either to 'buy' or 'not buy' education from Michigan State University. To identify the variables in an unbiased manner requires the knowledge of various characteristics of the two populations--the population that bought education from MSU ("buyers" or "shows") and the population that did not buy education from MSU ("non-buyers" or "no-shows"). Such knowledge will aid in finding the similarities and differences between the two populations and finally may help to formulate strategies to allocate financial aids in an optimum way to achieve certain predetermined goals. Regarding which characteristics would one like to find the similarities and dissimilarities? What is the rationale for the choice of these variables and how are they measured? The answers to the above questions necessitate the discussion of the relevant variables and the method of their measurement.

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Variables That Determine Educational Buying Behavior

The existing literature (Chapter II) indicates that three broad groups of variables--academic characteristics of the student (consumer of education), his perception of the university variables and his demographic and economic characteristics--determine his behavior in buying education. A brief mention of the relevant literature provides a sufficient rationale for the inclusion of these three broad groups of variables in the explanation of educational buying behavior.

Academic characteristics

Various studies indicate that demand for education depends on academic characteristics such as aptitude, intellectual curiosity, I.Q. of the individual consumer.[1] Unfortunately, the aptitude and I.Q. scores for most of the student population are not available, but highly correlated to them is the student's grade point average (GPA) which unlike the aptitude and I.Q. scores is not standardized. Since the GPA is a characteristic that educational institutions consider in granting the admission and financial aid to the students, it is an important measure of academic ability. Closely related to the GPA are the number of admissions and the number of financial aid offers received by a student. A student's educational purchase behavior is obviously influenced by the number of alternatives at his/her disposal at the time of decision. Variables of this nature are included under the group of academic characteristics.

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[1] Robert E. Iffert (1958). Op cit. and Vincent M. Murphy and James Voil (1965). Op cit.

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Perception of University Variables

A study by the Carnegie Corporation of New York concluded that the choice of an institution of higher education is very much influenced by the institutional images presented to the prospective students.[2] Alexander Astin[3] made a number of extensive studies and also came to the conclusion that

i) Selection of an educational institution depends on the perception of the institution by the student.

ii) The favorable ongoing image and high popularity of the institution attracts able students.

From this it is evident that the image of the institution as perceived by the prospective customers (students) has a great deal of influence on the choice of an institution. Boulding's distinction between knowledge and image is most relevant at this point: "Knowledge has an implication of validity and truth"[4] whereas image is what is believed to be true. Boulding's proposition that behavior depends on image has been validated by the above two studies. The concept of image has been extensively applied to various marketing problems by Remus A. Harris[5], Pierre Martineau[6], Bardin H. Nelson[7] and others. Though the concept of image provides partial

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[2] Carnegie Corporation (1966). Op cit.

[3] Alexander W. Astin (1965). Op cit.

[4] Kenneth E. Boulding (1956): <u>The Image</u>. (Ann Arobr: University of Michigan Press), p. 5.

[5] Remus A. Harris (1958): How Creativity in Marketing can Develop the Image that Counts: The Consumer Demand Image. <u>Advertising Age</u>, Vol. 29, No. 29, July 21, 1958, pp. 61-66.

[6] Pierre Martineau (1960): "The Corporate Personality" in Lee H. Briston Jr., ed. <u>Developing the Corporate Image</u>.

[7] Bardin H. Nelson (1962): "Seven Principles of Image Formation". <u>Journal of Marketing</u>, Vol. 26, No. 1, pp. 67-71.

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answers in explaining human behavior, there is no instrument which directly measures the "image." The indirect methods of measuring these images are discussed later in this chapter under the subtitle "Instrument."

Economic and Demographic Characteristics

Various studies [8] indicated that economic and demographic characteristics of an individual have perceptable influence on the educational buying behavior. Independent studies by Iffert[9], Friedman and Kuznets[10] indicated that the demand for education is influenced by the anticipated future stream of income in a given field of specialization. The studies by Cooper[11] and Beach[12] indicate that the price of education in terms of subsidy or financial aid influences the demand for education. The knowledge provided by the above studies justifies the inclusion of socio-economic and demographic variables in the explanation of educational buying behavior. Having included the relevant variables, the next task of the researcher is to find the instruments that measure these variables.

Development Of Instruments (Questionnaires)

There are no readily available instruments to measure the phenomenon under investigation. Thus an instrument has to be

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[8] George L. Cropper and Robert Fitzpatrick (1959). Op cit., Katz, Joseph (1966). Op cit. and Charles M. Grigg (1965). Op cit.

[9] Robert E. Iffert (1958). Op cit.

[10] Milton Friedman and S. Kuznets. Op cit.

[11] R.N. Cooper (1960). Op cit.

[12] Leonard B. Beach (1965). Op cit.

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developed to measure the variables that influence the educational buying behavior.

The academic characteristics as indicated earlier are measured by the entrance GPA and the number of admissions a student received at the time of his decision to 'buy' or 'not buy' a particular educational product package from MSU. The existing methods of measuring images are by attitude scales and direct or indirect methods of interviewing. In this study the image of the university (MSU) as perceived by individual consumers of education is measured by attitude scales (Appendix 3, Questions 16, 40 and 17, 41 for buyers and nonbuyers, respectively). The information on socio-economic and demographic characteristics is also collected through the questionnaires (3.1 and 3.2 for shows and no-shows of education, respectively) presented in the Appendix 3. Most of the information collected under the three broad groups of variables is common to both buyers and nonbuyers of education. However, it was necessary to develop separate instruments for the two groups since some of the questions, as well as the way they were to be posed, were different. Further, it may be noted that the grouping of the variables into three broad categories is arbitrary and their order of presentation in the questionnaire follows certain rules of questionnaire construction rather than grouping of similar questions in one place. The questionnaires include related information which could be used for cross checking and further research.

The questionnaires were designed to transfer all the data in coded form to IBM cards and magnetic tapes. Whenever possible, items common to both the questionnaires were assigned the same um numbers.

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column numbers. The numbers within the parentheses (please refer to the questionnaires in Appendix 3) to the right of boxes indicate the IBM card column number and the numerical code, respectively. Each subject required two cards. Columns 1 to 4 in both the cards were used for identification number and in column 80, "1" or "2" was punched to indicate whether it was card 1 or 2, respectively.

Pilot Study for Testing the Instruments

A pilot study was conducted to test and validate the instruments in the winter 1968. Some of the suggestions from the respondents as well as experts on questionnaire construction imporved the instruments quite significantly. The information provided by the pilot study on the percentage response in different levels, categories and colleges was utilized in determining the respective sample sizes for the final study. For example, the percentage response in Engineering was better than that of other colleges, and the percentage response was higher from those who are receiving financial aid than from those who are not. In this way the pilot study, besides improving the questionnaires, helped to determine the sample size in different colleges, levels and aid/no aid categories.

Need for Sampling: There are at least two reasons why sample survey was preferred to complete enumeration (census) in this study.

i) The constraints on costs, time and manpower resources did not permit complete enumeration.

ii) Experience all over the globe indicates that a well planned sample survey is a better method of estimating the characteristics of a population than complete en

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Because of the above two reasons, a sampling procedure was adopted to estimate the characteristics of the two populations--buyers (shows) and nonbuyers (no-shows)--which is the initial step for analyzing the similarities and dissimilarities between them. The following paragraphs describe the populations and the sampling plans used in this study. Throughout the study, the words "buyers" and "nonbuyers" are used interchangeably for "shows" and "no-shows", respectively.

Description of Populations And The Sampling Plans

Population of No-Shows

As mentioned earlier, the population of no-shows consists of those who were granted admission to Michigan State University for graduate study in Fall 1967 but did not choose to attend a graduate school or went to some other university. There were 7444 applicants for graduate study in Fall of 1967, out of which 4838 were accepted (eligible for admission). Only 2074 of these accepted applicants enrolled, leaving 2764 students as no-shows. Among the no-shows were 680 who had been offered financial aid at Michigan State University.

Sampling of No-Shows

The sample frame from the no-shows was obtained by acquiring the list of all persons belonging to the population of no-shows from Michigan State University's Graduate Admissions Office where all

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13 Mahalanobis, P.C. (1950): "Why Statistics?" Presidential Address, Indian Science Congress, 37th Session, Poona. Sankhyā Vol. 10, pp. 195-228.

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applications for each term, accepted as well as rejected, are filed alphabetically. The director of Admissions permitted use of these records. The lack of flexibility as well as nonavailability of these records on tape or punched cards required adoption of a systematic sampling procedure. Though this procedure results in selection of units proportional to the starting alphabet, there is no reason to believe that the characteristics to be measured in this study are associated with the starting alphabet; hence, the procedure adopted is a valid one.

The number of units to be included in the sample was decided on practical considerations (budget and time constraints) rather than some other quantitative considerations such as optimum sample size to minimize variance or cost subject to the desired level of accuracy, or some other sample size allocation procedures such as "proportional allocation" or "Neyman's allocation." The reasons for this are that there was no idea at the initial stage about cost and variance functions, and above all there is no single characteristic with respect to which optimization is sought. To estimate the characteristics of the population of no-shows with a sample of about 10 percent, it was felt reasonable to mail questionnaires to about 20 percent of the population (expecting 50 percent response). Therefore, a systematic random sample with 1/5 as the sampling fraction was used in selecting a random sample from the population of no-shows. The procedure consisted of drawing a number at random (using the random number tables) from 1 to 5, say I and then including all units numbered I, I + 5, I + 10 +... etc., till the required number of units were selected. This resulted in a

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resulted in a total sample of 451 units.[14] Because of the cost and time considerations, 35 selected foreign students were dropped from the sample. The details are presented under column (2) of Table 3.1.

From each selected application, relevant information such as name, address, department to which applied, level of admission sought, present level, name of the educational institution most recently attended, current G.P.A. (grade point average), were recorded. Later these data were transferred onto the punched cards as per the card design index presented in Appendix 2. As a general and representative sample of no-shows, this was fine. However, there was a desire to study in greater detail the segment of no-shows who had offers of financial aid from Michigan State University (supposedly better in quality than the remaining segment of no-shows). Thus the first systematic sample was supplemented with a second restricted systematic sample. The sampling frame of this segment of the no-shows population was secured through the list obtained from the Graduate Dean's office from every department. The cost constraints did not permit use of as large a sample size as might be necessary to compare the shows and no-shows by level, category (aid/no aid) and by every college. To make an in-depth study and arrive at valid conclusions it was decided to spread the sample size dividing the

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[14] If the figures supplied were correct and the files were complete, the sampling procedure should have resulted in a sample of about 552 units. No explanation was offered by the director of admissions on this inconsistency. The author, who had personally gone through the files, attributes the major part of the disparity to incompleteness of files.

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no-shows into four strata--those no-shows who applied to the College of Business, College of Engineering, College of Social Sciences, and all other colleges. Systematic random samples with varying sample fraction was drawn from each stratum so as to get a desired number of responses. The details of sample size distribution are presented in column (3) of Table 3.1.

Table 3.1: Allocation of Sample Size in Systematic Samples I and II by College for the No-Shows of Fall 1967.

College	Systematic Sample I Source: Administrative Office	Systematic Sample II Students Admitted with aid. Source: Department Records	Total
(1)	(2)	(3)	(4)
Business	63	64	127
Engineering	10	53	63
Social Sciences	49	160	209
Other Colleges	236	44	280
Total	358*	321	679

* Total sample = 451, less foreign students (35), less undelivered returns (28), less overlaps between the samples (30) = 358.

Note: The distribution of the population of no-shows by level, college and aid/no aid category were unknown. This explains why Table 3.1 is not as detailed as Table 3.2.

Population of Shows

The population of shows includes seniors, Masters and Doctoral candidates on campus during the year 1967-68. The segment of shows comparable with no-shows is obviously graduate students (Masters and Doctoral). Seniors were included in the study to learn their intentions of buying graduate education from MSU so that in a later study the relationship between "intended show" nd did sho

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and "did show" might be analyzed. Further, the inclusion of seniors served the purpose of having an undergraduate representation in identifying the control variables in higher education. Speaking of no-shows at senior level is meaningless, since the number of accepted transfer students not showing is negligible.

Sampling of Shows

The sampling frame (lists of all units in the population) was secured from the University Registrar's Office. This was in the form of punched cards and contained all relevant information such as name, student number, local address, phone number, and level, by college and by aid/no aid category. One of the aims of the study, as indicated in Chapter I, is to compare the similarities and dissimilarities between shows and no-shows as well as between levels (Doctoral, Masters and Senior), categories (Aid/No Aid) and by colleges (four strata). Therefore, the total sample size determined by the budget constraints was allocated according to level, financial aid category and college as shown in Table 3.2 below.

Table 3.2: Total Enrollment (N) and the Allocation of Sample Sizes (n) by Level, College and Aid/No Aid Category for the Shows (Spring 1968).

N = Population Size In A Strata

n = Sample Size In A Strata

College	Seniors				Masters				Doctoral			
	Aid		No Aid		Aid		No Aid		Aid		No Aid	
	N	n	N	n	N	n	N	n	N	n	N	n
Business	108	50	883	55	312	50	334	50	176	55	79	50
Engineering	106	40	292	45	39	39	77	45	105	50	44	40
Social Science	250	55	1264	60	249	55	169	50	277	60	107	55
Others	839	60	3464	65	973	60	1818	60	1528	85	762	35
Total	1303	205	5903	225	1573	204	2398	205	2086	250	992	180
Sample sizes			403				409			430		

Total Sample = 1269

Allocation of sample size was based on practical considerations (budget and time constraints and the percentage non-response estimated from the pilot study) in order to obtain a large enough response from each segment of the population for meaningful comparisons. Because of this, the sampling fraction (n/N = fraction of the population included in the sample) varied among levels, categories and colleges. As a result, some of the segments are measured with greater accuracy than others. The sampling units within each level, category (aid/no aid) and college were then selected by the computer at the University Data Processing Center. This was done by arranging sampling units by student number and then choosing a random number from random number tables and selecting the required number of units starting with the first number that ended with the chosen random digit. The procedure was repeated (of course, every time with a new random number) till the required number of units (Table 3.2) in each level, category and college were selected.

Mailing The Questionnaires To The Random Sample Of Shows And No-Shows

The final questionnaires, along with a letter from the Director of the Systems Science Program were mailed to the selected students during the middle of Spring 1968. Fifteen days later, a follow-up letter was sent to the no-shows and a phone call was made to each of the shows. The letters that accompanied the questionnaires and the follow-up letter (for no-shows) are presented in Appendix 3.

Response to the Questionnaire:

The responses from the no-shows and shows are presented in Tables 3.3 and 3.4 respectively.

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Table 3.3: Response to the Questionnaire from the No-Shows by College.

College	Response: Identified College	Didn't Identify College	Overall percentage response
Business	57		
Engineering	38		
Social Sciences	96	63	59%
Other Colleges	145		
Total	336	63	399*

* Doesn't include two of the questionnaires filled out by parents and another from a student who has actually enrolled in extension program.

Table 3.4: Total and Percentage Response to the Questionnaire from the Shows by College, Level and Aid/No Aid Category.

Level	Senior			Master			Doctoral		
College	Aid	No Aid	Total	Aid	No Aid	Total	Aid	No Aid	Total
Business	26 (56)	23 (42)	49	22 (44)	42 (80)	64	49 (89)	18 (36)	67
Engineering	38 (95)	22 (49)	60	33 (85)	29 (64)	62	35 (80)	18 (45)	53
Social Sciences	31 (56)	43 (72)	74	34 (76)	30 (60)	72	41 (68)	25 (45)	66
Other Colleges	42 (70)	32 (49)	74	34 (57)	30 (50)	64	79 (93)	25 (71)	104
Total	137 (67)	120 (53)	257	131 (64)	131 (64)	262	204 (82)	86 (48)	290

Note: Figures within the parentheses indicate percentage response. Overall percentage response from the Shows: 63%

The arrival of the duly filled questionnaires followed approximately an exponential distribution. As the questionnaires arrived at the Systems Science Office (at MSU), the responses were checked for certain consistencies. The population under study being a well educated one, the inconsistencies in responses were quite negligible.

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The analysis will be discussed in the following chapters but it may be appropriate to mention the variety of techniques used in the analysis of this study.

Techniques Of Analysis

A variety of statistical techniques are employed in the estimation, testing of various hypotheses and making of inferences from the data. The appropriateness of each of these techniques is briefly discussed below.

Chi-Square Test For Equality Of Proportions: In comparing the shows and no-shows on various characteristics, such as the perceptions of university (MSU) variables, ranking of the variables that influence the choice of an institution, academic and demographic characteristics, etc., the chi-square test is used to test the equality of proportions between the two samples. The test criterion enables the researcher to assess whether the differences, if any, in proportions between samples could be attributed to chance (random or nonassignable causes) differences or to "real" (assignable causes) differences. If the computed value of χ_o^2 (chi-square under the null hypothesis) is higher than the table value of χ^2 for certain degrees of freedom and predetermined level of significance, then the null hypothesis of no difference between proportions of the two samples is rejected. Chi-square is also used to test the differences in proportions between aid/no aid categories on various characteristics. In all the above situations, the samples are independent and frequencies are in discrete categories, which justifies the appropriateness of the use of χ^2 statistic.

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Kendall's Rank Correlation Coefficient, τ (tau) : Kendal's τ is a measure of association between two sets of data when the measurement is at least in ordinal scale. To measure the association or agreement between the ranks assigned (relative importance of factors that determine the choice of a university) by the representatives from any two groups (Doctoral, Masters or Seniors), Kendall's rank correlation coefficient is used. The higher the value of τ, the higher the agreement or association between the rankings of the representatives. τ is subject to tests of significance, which provides a criterion to assess whether the association between rankings of two groups is by chance (random) or due to real similarities.

Discriminant Analysis : The problem of classification of consumers into shows and no-shows on the basis of the configuration of the various characteristics may be done using discriminant analysis. The procedure consists of finding a linear discriminant score for each variable that minimizes within-group variation and maximizes between-group variation. The between-group variation, when all the relevant characteristics are simultaneously taken into account, is measured by the concept known as "Distance" (D^2). The higher the value of D^2 ("Distance"), the greater the dissimilarities between the groups. The greater the dissimilarities between groups, the easier to classify the subjects into either one of the groups to which they may possibly belong. The method of classification involves the use of linear discriminant scores for each variable in computing the likelihood of an individual belonging to either one of the groups and then assigning the individual to the group through the

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for which the likelihood is maximum. The classification is good when the groups are dissimilar with respect to certain characteristics, which enables the researcher to predict the educational purchase behavior (show or no-show).

Probability The probability of educational purchase at MSU, besides other variables, is very much influenced by the academic characteristics of a student as measured by his most recent GPA and the financial aid offered (market-rate, below market-rate and above market-rate) by MSU. Conditional and Bayesian probabilities are used to assess the probability of educational purchase behavior of a student in a given level, under varying policies of financial aid allocation.

Modeling In modeling the educational purchase behavior, three types of models--probabilistic, regression and systems models--are developed. The probabilistic model is presented in Chapter VI and the regression and systems models in Appendices 6.2 and 6.3 respectively. Besides the above mentioned techniques, other appropriate methods of sampling, estimation and inference are extensively used in answering a variety of questions posed at different stages of analysis. Before closing this chapter, some of the limitations of the research methodology may be briefly mentioned.

Some Limitations of Research Methodology

The limitations may be of two types:

i) general limitations (common to all similar types of studies) which were discussed in Chapter I.

ii) specific limitations (specific to the present study) and the possible consequences, which are briefly discussed below:

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1. The bias due to nonresponse is a general limitation to a study based on a sample survey. In situations of this type, the usual procedure adopted is to pursue some of the nonrespondents to obtain a second set of responses and when the differences in the response patterns of the two groups (respondents to first letter and respondents to follow-up letter) are insignificant, then the bias due to nonresponse is assumed to be negligible. In this study, the above procedure could not be adopted as the nonrespondents are not identifiable. Students were assured that they would not be identified by their names, to ensure quality data. (Please refer to Appendix 3 for letters sent to the students.) As most of the findings of this study are in agreement with the findings of similar studies, there appears to be no evidence to doubt the validity of the results based on lack of 100 percent response.

2. The data are collected after the students made their decision either to attend or not attend MSU in the Fall 1967. Post decision data may sometimes be biased. However, the population under observation being a well educated one, the responses are likely to be highly reliable and consistent.

3. The next limitation may be due to non inclusion of foreign students in the no-shows population. Some of the findings of this study may not hold good for the no-shows foreign student population.

4. The fourth limitation could be on the generalization of the findings. The quality of the students, faculty, administrative staff, and educational facilities may vary from institution to institution and, therefore, it may be argued that the results of this study are not generalizable. It may be true that the sample

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of MSU graduate applicants may not be a representative sample of U.S. graduate applicants, but to the author's knowledge there has been no study which sampled from the whole U.S. college student population. This is probably due to the recognition of most researchers that the breadth of coverage necessarily diminishes the depth of findings when the resources are limited and the questions posed are specific. The coincidence of the findings of this study with the findings based on larger segments of U.S. college student population indicates that the models developed here may hold good even though the coefficients or the parameters of the model may differ. In this sense there are not many limitattions for the generalization of the findings of this study.

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CHAPTER IV

SIMILARITIES AND DISSIMILARITIES IN STUDENTS' EDUCATIONAL BUYING BEHAVIOR, THEIR CHARACTERISTICS AND PERCEPTIONS OF SELECTED ENVIRONMENTAL FACTORS

The main aim of a researcher in finding the similarities and differences between two or more groups is to see whether the differences in behavior of these groups could be predicted from the differences in certain characteristics. By the very nature of underlying logic, this can only associate differences in behavior to dissimilarities of certain characteristics between the groups. No doubt this is a weak relationship (only association--no causal relationship) but in the absence of a theory or hypothesis, one of the best avenues open to the researcher is to start with a "hunch" and work towards establishing a stronger relationship between the dependent variable and a set of independent variables, some of which may be manipulated (control variables) by the researcher whereas others, though they exert preceptible influence on the dependent variable, may not be manipulated by the researcher (examples--competitors' actions, government regulation, acts of God, etc.). In the present study, the concern is with finding differences in various characteristics which may partly or wholly explain the differences in the educational purchase behavior of the two groups--shows and no-shows (for MSU). The differences and similarities between the two groups could be viewed from different points.

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The reason for doing this is to build a stronger base for our logic. For example, from a particular point of view, certain comparisons may be confounded, whereas some others might be inflated. The analysis in the following pages presents six types of comparisons that are relevant to the focus of the present study. These are:

1. Comparison of the shows and no-shows who applied for the Master's program at MSU and were granted admission and financial aid.
2. Comparison of the shows and no-shows who applied for the Doctoral program at MSU and were granted admission and financial aid.
3. Comparison of the shows and no-shows who applied for the Master's program at MSU and were granted admission only.
4. Comparison of the shows and no-shows who applied for the Doctoral program at MSU and were granted admission only.
5. Comparison by levels (levels of higher education).
6. Comparison of categories (Aid/No Aid) within a level.

The focus of this chapter, as stated above, is to study descriptively the similarities and dissimilarities between

i) shows and no-shows (analyses 4-1 to 4-4)

ii) levels of higher education (analyses 4-5)

iii) categories (Aid/No Aid) within a level (analyses 4-6).

This descriptive knowledge is a basis for continuation of analysis presented in the following chapters.

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Similarities And Dissimilarities Between Shows And No-Shows Who Were Granted Financial Aid For The Masters Program By MSU In The Fall Of 1967

Making the groups homogeneous with respect to the standard of offering financial aid and comparing them to various characteristics can shed some light on differences in the educational purchase behavior at MSU. The Chi-Square test (test for equality of proportions) has been used to test the differences between shows and no-shows. The comparisons are presented in a convenient way under a broad classification of variables in a summary form in Table 4.1.

Academic Characteristics

The analysis indicates that the two groups differ very significantly (significant at 1% level) with respect to entrance grade point average (GPA), number of admissions and financial aid offers. No-Shows on the average had an entrance GPA of 3.40 as compared to 3.20 for the Shows. The higher number of financial aid offers (2.7 per No-Shows as compared to 0.9 per Show - excluding MSU's offer) obviously gave a better choice among alternatives, which might possibly explain the differences in the educational purchase behavior at MSU. The interrelationships between entrance GPA, number of financial aid offers, and number of admissions will be discussed later.

Perception of University Variables

The behavioral theories[1] demonstrate that the perceptions which are bases for images direct the behavior of individuals.

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[1] Remus A. Harris (1958). Op cit.; Kenneth E. Boulding (1956). Op cit., and Pierre Martineau (1960). Op cit.

Table 4.1: Comparison of Shows and No-Shows - Master's Applicants with MSU's Offer of Financial Aid

GROUP Variables Under Comparison	SHOWS (Max n = 131)	NO SHOWS (Max n = 134)	χ^2
(1)	(2)	(3)	(4)
Ratings of MSU Variables			
1. Curriculum in the major field	4.1 (130)	3.8 (132)	15.421**
2. Faculty reputation in the major field	3.7 (130)	3.6 (132)	6.814
3. General reputation	3.8 (130)	3.7 (132)	2.780
4. Financial aid available	3.8 (127)	3.6 (132)	13.035*
5. Educational facilities	3.6 (130)	3.7 (129)	9.302
6. Location of campus	3.5 (129)	3.2 (131)	10.658*
7. Promptness of information about admission	4.1 (129)	4.2 (132)	1.401
8. Promptness of information about financial aid	3.7 (129)	3.8 (132)	31.562**
9. Individual attention to admission and financial aid	3.5 (130)	3.2 (132)	6.198
Ranking of Variables+			
1. Curriculum in the major field	3.30	3.63	8.092
2. Faculty reputation	2.13	3.19	24.357**
3. General reputation	2.23	1.91	6/109
4. Financial aid available	1.98	2.72	22.602**
5. Educational facilities	1.04	0.97	19.057**
6. Location of campus	1.00	0.67	16.803**
7. Low costs (including tuition)	0.66	0.32	10.666**
Academic Characteristics			
1. Entrance GPA	3.20	3.40	20.350**
2. # of admissions	1.9	4.3	98.581**
3. # of financial offers	0.9	2.7	99.083**
Demographic Characteristics			
1. Sex	80.2% Males	81.3% Males	0.060
2. Marital status	52.7% Single	62.7% Single	4.346*
Economic Characteristics			
1. Average gross annual income of parents	$11,100 (122)	$12,450 (127)	7.829
2. Major source of support			
a) Financial aid	84 (70.0%)	87 (68.0%)	
b) Wife's earnings	17 (14.2%)	22 (17.2%)	
c) Personal savings	3 (2.5%)	4 (3.1%)	
d) Parental assistance	3 (2.5%)	3 (2.3%)	
e) Loan	1 (0.8%)	3 (2.3%)	
f) Other resources	12 (10.0%)	9 (7.0%)	

\+ Ranking on 6 point scale (5-0)-5 Most influential factor,...,0 = Not included in the top five factors

* Differences significant at 5% level

** Differences significant at 1% level

Note: Figures within the parentheses when otherwise not specified indicate the # of responses to the item under consideration.

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Comparing the two groups with respect to their perceptions may enable one to understand the differences in behavior. No-Shows perceived the curriculum in the major field, availability of financial aid at MSU and the location of the campus as significantly lower (Table 4.1) in attractiveness than did the Shows. In the choice of a university, No-Shows gave significantly higher importance to financial aid and faculty reputation, and significantly lower importance to location of campus and low costs than did the Shows.

Demographic and Economic Characteristics

There were no sex differences between the two groups. However, they did differ in marital status. 62.7 percent of the No-Shows were single as compared to 52.7 percent of the Shows belonging to the same category. There seemed to be no evidence that the groups differed with respect to economic characteristics.

Similarities And Dissimilarities Between The Shows And No-Shows Who Were Granted Financial Aid For The Doctoral Programs By MSU In The Fall 1967. (Analysis 4-2)

The summary of analysis is presented in Table 4.2.

Academic Characteristics

There was no evidence that the two groups differed in entrance GPA. However, they did differ in number of financial aid offers and number of admissions received. Excluding MSU's offer, the No-Shows had on the average three offers of financial aid compared to one for that of Shows.

Perception of University Variables

The No-Shows perceived the attractiveness of curriculum in the major field, faculty reputation, availability of financial aid

Table 4.2: Comparison of Shows and No Shows - Doctoral Applicants With MSU's Offer of Financial Aid.

GROUP Variables Under Comparison	SHOWS (Max n = 204)	NO SHOWS (Max n = 75)	x^2
(1)	(2)	(3)	(4)
Ratings of MSU Variables			
1. Curriculum in the major field	4.1 (202)	3.6 (73)	19.442**
2. Faculty reputation in the major field	4.0 (201)	3.6 (72)	11.289*
3. General reputation	3.7 (200)	3.6 (73)	6.921
4. Financial aid available	3.8 (201)	3.3 (73)	23.744**
5. Educational facilities	3.3 (200)	3.6 (71)	9.707*
6. Location of campus	3.4 (200)	3.0 (71)	13.410*
7. Promptness of information about admission	4.1 (202)	4.0 (71)	4.075
8. Promptness of information about financial aid	3.6 (199)	3.5 (72)	11.301*
9. Individual attention to admission and financial aid	3.7 (202)	3.5 (67)	5.297
Ranking of Variables+			
1. Curriculum in the major field	3.33	3.73	3.658
2. Faculty reputation	3.22	3.55	3.833
3. General reputation	2.04	2.22	2.084
4. Financial aid available	2.36	2.96	23.750**
5. Educational facilities	0.88	0.99	6.241
6. Location of campus	1.07	0.53	11.745*
7. Low costs (including tuition)	0.71	0.40	4.951
Academic Characteristics			
1. Entrance GPA	3.45 (200)	3.50 (73)	3.490
2. # of admissions	1.8 (170)	3.6 (74)	51.329**
3. # of financial offers	1.0 (155)	3.0 (74)	78.426**
Demographic Characteristics			
1. Sex	87.3% Males	80.0% Males	2.302
2. Marital status	27.5% Single	42.7% Single	7.450*
Economics Characteristics			
1. Average gross annual income of parents	$9.750	$12,450	8.347
2. Major source of support			
a) Financial aid	133 (66.8%)	61 (83.6%)	
b) Wife's earnings	47 (23.6%)	8 (11.0%)	
c) Personal savings	5 (2.5%)	1 (1.4%)	
d) Parental assistance	0 (0%)	2 (2.7%)	
e) Loan	3 (1.5%)	1 (1.4%)	
f) Other resources	11 (5.5%)	0 (0%)	

+ Ranking on 6 point scale (5-0)-5 Most influential factor,...,0 Not included in the top five factors

* Differences significant at 5% level

** Differences significant at 1% level

Note: Figures within the parentheses when otherwise not specified indicate the # of responses to the item under consideration.

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Rating Scale

1 = very unattractive
2 = unattractive
3 = neither
4 = attractive
5 = very attractive

and location of MSU campus significantly lower than that of the Shows. No-Shows considered financial aid as significantly higher in importance in the choice of a university, whereas the Shows considered the location of campus to be significantly more influential than that of No-Shows.

Demographic and Economic Characteristics

There were no sex differences between the groups but they differed in marital status (more married among the Shows). For 93.6 percent of the No-Shows, financial aid was a major source of support, compared to 66.8 percent for the Shows. For only 11.0 percent of the No-Shows, their wives' earnings were a major source of income as compared to 23.6 percent for the Shows in the same category.

Similarities And Dissimilarities Between The Shows And No-Shows Who Were Offered No Financial Aid For the Master's Program By MSU In The Fall 1967 (Analysis 4-3)

Analyses 1 and 2 were concerned with the examination of the similarities and dissimilarities between the shows and no-shows who were offered financial aid by MSU for the Master's and Doctoral programs respectively. It is also of interest to study the similarities and dissimilarities between the two groups who were granted admission but no financial aid at MSU. The summary of analysis is presented in Table 4.3.

Academic Characteristics

There were no differences in entrance GPA, with each group's average at 3.05. However, differences did exist between the two groups with respect to the number of admissions and the number of financial aid offers. No-Shows had an average of 3.1 admissions

Table 4.3: Comparison of Shows and No Shows - Master's Applicants with no Offer of Financial Aid From MSU.

GROUP Variables Under Comparison	SHOWS (Max n = 131)	NO SHOWS (Max n = 86)	χ^2
(1)	(2)	(3)	(4)
Ratings of MSU Variables			
1. Curriculum in the major field	4.0 (125)	3.8 (84)	5.51
2. Faculty reputation in the major field	3.7 (125)	3.6 (84)	6.81
3. General reputation	3.9 (125)	3.9 (84)	1.68
4. Financial aid available	2.9 (120)	2.3 (82)	47.77**
5. Educational facilities	3.5 (124)	3.8 (83)	10.41*
6. Location of campus	3.9 (126)	3.1 (84)	38.85**
7. Promptness of information about admission	4.2 (127)	3.8 (82)	10.92*
8. Promptness of information about financial aid	3.1 (118)	2.5 (82)	50.28**
9. Individual attention to admission and financial aid	3.3 (124)	3.0 (83)	13.78*
Ranking of Variables+			
1. Curriculum in the major field	3.11	3.44	5.53
2. Faculty reputation	2.20	2.59	4.47
3. General reputation	2.47	2.38	2.05
4. Financial aid available	0.36	2.65	100.15**
5. Educational facilities	0.93	1.02	4.09
6. Location of campus	1.97	0.60	32.55**
7. Low costs (including tuition)	1.28	0.77	9.90*
Academic Characteristics			
1. Entrance GPA	3.05	3.05	1.52
2. # of admissions	1.0 (87)	3.1 (85)	68.50**
3. # of financial offers	0.3 (77)	1.6 (77)	68.78**
Demographic Characteristics			
1. Sex	79.4% Males	77.9% Males	0.07
2. Marital Status	35.9% Single	62.8% Single	16.43**
Economic Characteristics			
1. Average gross annual income of parents	$9,300 (110)	$13,150 (78)	14.95**
2. Major source of support			
a) Financial aid	1 (0.8%)	41 (47.7%)	
b) Wife's earnings	15 (12.1%)	15 (17.4%)	
c) Personal savings	17 (13.7%)	7 (8.1%)	
d) Parental assistance	16 (12.9%)	8 (9.3%)	
e) Loan	5 (4.0%)	3 (3.5%)	
f) Other resources	70 (56.5%)	12 (14.0%)	

\+ Ranking on 6 point scale (5-0)-5 Most influential factor,...,0 Not included in the top five factors

* Differences significant at 5% level

** Differences significant at 1% level

Note: Figures within the parentheses when otherwise not specified indicate the # of responses to the item under consideration.

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as compared to 1.0 for the Shows; No-Shows had an average of 1.6 (based on 77 responses out of 86) offers of financial aid whereas, the Shows had 0.3 based on 77 responses out of 131). To what extent the above differences can help to predict a Show or No-Show will be discussed in the next chapter.

Perception of University Variables

The two groups differed on the perception of availability of financial aid at MSU and location of campus. No-Shows were significantly less satisfied with respect to MSU's communications on, and individual attention to, admission and financial aid. It may be noted that both the Shows and No-Shows with no offer of financial aid from MSU rate the availability of financial aid at MSU lower than the Shows and No-Shows of the same level (Master's or Doctoral) who were offered financial aid by MSU. In the choice of a university, financial aid was given higher importance, whereas the location of campus and low costs (including tuition) were given lower importance by the No-Shows as compared to the Shows.

Demographic and Economic Characteristics

As in the earlier analysis, there were no sex differences between the groups but they differed in marital status (35.9 percent of the Shows and 62.8 percent of the No-Shows were single). For 0.8 percent of the Shows (one student who didn't initially have financial aid picked it up later in the program) and 47.7 percent of the No-Shows, financial aid was a major source of support during their Master's program. The parents of No-Shows had a significantly higher average annual income than that of shows.

One might now examine whether the same sort of similarities and dissimilarities exist between the groups of Doctoral students that were offered no financial aid by MSU.

Similarities and Dissimilarities Between Shows And No-Shows Who Were Offered No Financial Aid For The Doctoral Program By MSU In The Fall 1967

The summary of analysis is presented in Table 4.4 and the three broad groups of variables are discussed below.

Academic Characteristics

There seemed to be significant differences in entrance GPA between shows and no-shows. Shows had an average GPA of 3.40 as compared to 3.25 for that of No-Shows. A word of caution is, however, necessary at this point. The records indicate that MSU has been conservative in accepting students directly to the doctoral program. So with one or two exceptions, all the Shows in the doctoral program had Master's degrees, whereas among the No-Shows, a considerable percentage might have had only their bachelor's degrees. As a matter of fact, it was a frequent complaint from the No-Shows that they were admitted to the Master's program when they had sought admission into the Doctoral program. To whatever extent the Master's GPA might be higher than the undergraduate, there would be some bias in this comparison. Even with lower GPA, No-Shows had a significantly higher average number of admissions and financial aid offers.

Perception of University Variables

No-Shows perceived the availability of financial aid at MSU significantly lower than did Shows. The location of the MSU campus was significantly lower in attractiveness for the No-Shows than Shows. No-Shows were also not very pleased with MSU's promptness of information on financial aid. In the choice of a university,

Table 4.4: Comparison of Shows and No Shows - Doctoral Applicants with no Offer of Financial Aid From MSU.

GROUP Variables Under Comparison	SHOWS (Max n = 86)	NO SHOWS (Max n = 31)	X^2
(1)	(2)	(3)	(4)
Ratings of MSU Variables			
1. Curriculum in the major field	4.0 (81)	4.2 (29)	4.84
2. Faculty reputation in the major field	3.8 (81)	3.9 (29)	6.42
3. General reputation	3.8 (81)	3.8 (30)	9.36
4. Financial aid available	3.1 (78)	2.0 (28)	35.90**
5. Educational facilities	3.3 (80)	3.8 (28)	14.86*
6. Location of campus	3.7 (81)	3.2 (28)	13.45*
7. Promptness of information about admission	4.0 (85)	3.9 (29)	5.94
8. Promptness of information about financial aid	3.1 (80)	2.8 (28)	16.12**
9. Individual attention to admission and financial aid	3.5 (83)	3.1 (28)	5.12
Ranking of Variables+			
1. Curriculum in the major field	2.87	3.351	5.04
2. Faculty reputation	2.53	3.57	10.98*
3. General reputation	2.31	1.93	3.63
4. Financial aid available	0.86	3.32	48.05**
5. Educational facilities	1.10	1.12	6.65
6. Location of campus	1.75	0.23	17.03**
7. Low costs (including tuition)	0.45	0.36	6.17
Academic Characteristics			
1. Entrance GPA	3.40 (82)	3.25 (30)	6.69*
2. # of admissions	1.1 (63)	3.6 (31)	43.42**
3. # of financial offers	0.4 (51)	2.1 (29)	40.75**
Demographic Characteristics			
1. Sex	86.0% Males	96.8% Males	2.66
2. Marital Status	15.1% Single	35.5% Single	6.04*
Economic Characteristics			
1. Average gross annual income of parents	$9,750 (70)	$9,750 (28)	
2. Major source of support			
a) Financial aid	0 (0%)	13 (46.4%)	
b) Wife's earnings	12 (14.6%)	9 (32.1%)	
c) Personal savings	3 (3.7%)	1 (3.6%)	
d) Parental assistance	3 (3.7%)	2 (7.1%)	
e) Loan	4 (4.9%)	1 (3.6%)	
f) Other resources	60 (73.2%)	2 (7.1%)	

+ Ranking on 6 point scale (5-0)-5 Most influential factor,...,0 Not included in the top five factors

* Differences significant at 5% level

** Differences significant at 1% level

Note: Figures within the parentheses when otherwise not specified indicate the # of responses to the item under consideration.

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Rating Scale

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2 = unattractive
3 = neither
4 = attractive
5 = very attractive

No-Shows placed significantly high importance on faculty reputation and availability of financial aid, whereas the Shows gave significantly higher importance to the location of campus.

Demographic and Economic Characteristics

As in the earlier three comparisons, the two groups differed significantly in marital status (35.5 percent single among No-Shows as compared to 15.1 percent among the Shows). For 46.4 percent of the No-Shows who were not awarded financial aid by MSU, the major source of their support was financial aid in the university they were attending.

Discussion of Analyses 4-1 to 4-4 Before going to the remaining two comparisons that are also of interest, it would be better to discuss the findings of each of the comparisons and examine their consistency, which might lead to some valid inferences.

In all the four comparisons, No-Shows had a higher number of alternatives (number of admissions and financial aid offers) than the Shows. The No-Shows with offers of financial aid from MSU for the Master's program had significantly higher GPA's than did the Shows belonging to the same category. On the contrary, the Shows without financial aid in the Doctoral program had significantly better entrance GPA's than the comparable category of No-Shows. Part of the differences in the latter comparison might be attributed to differences in entrance level (entering doctoral program with the Bachelor's or Master's degree) and samller sample size of No-Shows. In the remaining two comparisons there was no evidence of differences in entrance GPA between the two groups belonging to similar categories.

In all four comparisons, the No-Shows perceived the attractiveness of the availability of financial aid at MSU to be much lower than did the Shows belonging to similar categories. The No-Shows (both Masters and Doctoral) who were offered financial aid by MSU perceived the attractiveness of curriculum in the major field significantly lower than did the comparable Shows. Further, in all four comparisons the location of the MSU campus was significantly less attractive to the No-Shows than the Shows. The availability of educational facilities at MSU was rated significantly higher by the No-Shows than the Shows in three out of four comparisons.

Among the factors that influence the choice of a university, financial aid was given significantly higher importance and the location of campus significantly lower importance by the No-Shows than the Shows in all the four comparisons. In two of the comparisons (Masters with MSU's offer of financial aid, Doctoral with no offer of aid from MSU) No-Shows placed significantly higher importance on faculty reputation in the choice of a university than did the corresponding Shows. Low cost (including tuition) was considered as a more important factor by the Shows in the choice of a university than the No-Shows.

One thing of predominant significance was that a higher percentage of No-Shows were single. In all four comparisons, the two groups differed significantly in marital status. From this, it appears that the No-Shows are on the average a younger, more mobile (less importance to the location of the campus) and more ambitious group (applying to more places for admission and financial aid)

than the Shows. There appeared to be some indication (but not enough evidence for generalization) that the No-Shows come from relatively more well-to-do families (higher average annual income for parents) than the Shows.

To what extent can the above similarities and dissimilarities help to predict whether an applicant will be a Show or No-Show? That is the focus of the next chapter, which will be taken up after discussing the remaining two comparisons.

Similarities And Dissimilarities Between Levels Of Higher Education (Doctoral, Masters and Seniors)

Knowledge of what factors are considered to be important in educational buying behavior at each level of higher education is important from the marketing point of view for formulating the product, promotion and pricing strategies in the management of an educational institution. The summaries of analysis of the most influential variables that the students say determine their choice of a university are presented in Tables 4.5D, 4.5M, 4.5S (D, M and S stand for Doctoral, Master's and Senior levels respectively). These tables are computed by estimating on the basis of the sample the score on ranking scale for each variable by aid/no aid category and then computing the pooled estimate (weighted average for each variable in a level. The summary of column (7) in Tables 4.5D, 4.5M and 4.5S, representing the relative importance by Doctoral, Master's and Seniors respectively, is conveniently presented in Table 4.6.

Table 4.5D: Ranking of University Variables Considered to be Most Influential in the Choice of a University by Doctoral Students.

University Variable	Aid (N=2086) Average Points (estimate)	Rank	No Aid (N=992) Average Points (estimate)	Rank	Pooled Estimate for Doctoral Population (N=3078) Average Points (estimate)	Rank
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Curriculum in the major field	3.31	1	2.88	1	3.18	1
Faculty reputation in the major field	3.19	2	2.53	2	3.00	2
General reputation of the University	2.03	4	2.39	3	2.13	3
Financial aid through the University	2.34	3	0.82	7	1.88	4
Off campus job opportunities for self and wife	0.14	11	0.72	8.5	0.31	10.5
Campus job opportunities for self and wife	0.18	10	0.72	8.5	0.34	9
Educational facilities	0.89	6	1.06	6	0.94	6
Location of campus	1.07	5	1.77	4	1.29	5
Appearance of campus	0.30	9	0.32	11	0.31	10.5
Employment opportunities after completion of degree	0.69	8	1.25	5	0.86	7
Low costs	0.72	7	0.44	10	0.63	8
Loan facilities	0.13	12	0.12	12	0.12	12

INDEX: Ranking Scale (5 to 0)

5 = most influential

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1 = relatively less influential

0 = not included in the top 5 rankings

Note: Redefinition of scale in Question 17, Appendix: 3-1.

Table 4.5M: Ranking of University Variables Considered to be Most Influential in the Choice of a University by Master's Students.

Category	Aid (N=1573)		No Aid (N=2398)		Pooled Estimate For All the Master's Students (N=3971)	
University Variables	Average Points (estimate)	Rank	Average Points (estimate)	Rank	Average Points (estimate)	Rank
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Curriculum in the major field	3.57	1	3.10	1	3.29	1
Faculty reputation in the major field	2.32	3	2.20	3	2.25	3
General reputation of the University	2.42	2	2.46	2	2.44	2
Financial aid through the University	2.14	4	0.36	10	1.07	6
Off campus job opportunities for self and wife	0.18	10	0.48	8	0.36	10
Campus job opportunities for self and wife	0.14	11	0.26	11	0.21	11
Educational facilities	1.13	5	0.92	7	1.00	8
Location of campus	1.08	6	1.96	4	1.61	4
Appearance of campus	0.38	9	0.47	9	0.43	9
Employment opportunities after completion of degree	0.88	7	1.45	5	1.22	5
Low costs	0.72	8	1.28	6	1.06	7
Loan facilities	0.04	12	0.06	12	0.05	12

INDEX: Rating Scale (5 to 0)

5 = most influential

:

1 = relatively less influential

0 = not included in the top 5 rankings

Note: Redefinition of scale in Question 17, Appendix: 3-1.

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Table 4.5S: Ranking of University Variables Considered to be Most Influential in the Choice of a University by the Senior Students.

Category	Aid (N=1303)		No Aid (N=5903)		Pooled Estimate of the Population of Senior Students (N=7206)	
University Variables	Average Points (estimate)	Rank	Average Points (estimate)	Rank	Average Points (estimate)	Rank
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Curriculum in the major field	2.86	1	2.17	3	2.35	2
Faculty reputation in the major field	1.82	4	1.04	8	1.18	7
General reputation of the University	2.82	2	3.16	1	3.11	1
Financial aid through the University	1.91	3	0.32	9	0.61	9
Off campus job opportunities for self and wife	0.05	12	0.29	10	0.24	10
Campus job opportunities for self and wife	0.13	11	0.15	11	0.15	11
Educational facilities	0.99	7	1.35	5	1.30	5
Location of campus	1.30	5	2.43	2	2.23	3
Appearance of campus	0.91	9	1.30	6	1.20	6
Employment opportunities after completion of degree	0.92	8	1.09	7	1.07	8
Low costs	0.15	10	0.12	12	0.12	12
Loan facilities	0.15	10	0.12	12	0.12	12

. INDEX: Ranking Scale (5 to 0)

5 = most influential

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1 = relatively less influential

0 = not included in the top 5 rankings

Table 4.6: Ranking Of University Variables According To The Amount Of Influence In The Choice Of A University By Level.

Level / Variable	Rank assigned by Doctoral	Master	Senior
Curriculum in the major field	1	1	2
Faculty reputation in the major field	2	3	7
General reputation of the University	3	2	1
Financail aid through the University	4	6	9
Off campus job opportunities for self and wife	10	10	10
Campus job opportunities for self and wife	9	11	11
Educational facilities	6	8	5
Location of campus	5	4	3
Appearance of campus	11	9	6
Employment opportunities after completion of degree	7	5	8
Low costs	8	7	4
Loan facilities	12	12	12

From the above table one can visualize certain clear cut patterns in the ranking of variables. For example,

a) The higher the level of a student, the greater the relative importance of faculty reputation in the choice of a university.

b) The lower the level, the greater the relative importance placed on general reputation.

c) The higher the level, the greater the relative importance of financial aid.

d) The higher the level, the lower the relative importance of the location of the campus.

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e) The lower the level, the greater the relative importance of costs (including tuition).

To test the differences, if any, in the order of ranking of the variables between levels, let us consider the problem in the following way. Suppose that the above ranks are assigned by three individuals, each respresenting a level. The problem now amounts to the testing of the agreement in the order of ranking of these variables between the representatives (judges) of the three groups. One can use any of the rank correlation methods, say Kendall's τ, to measure the agreement between judges. With 3 judges, there are 3 independent comparisons, considering two at a time.

Let D = Representative (judge) from the Doctoral population

M = Representative (judge) from the Master's population

S = Representative (judge) from the Senior's population

To test whether there is an association between the ranks assigned by the representatives of Doctoral and Master's programs, arrange the rankings of either one of them in the natural order and compute τ as follows:

Judge	Rank											
M	1	2	3	4	5	6	7	8	9	10	11	12
D	1	3	2	5	7	4	8	6	10.5	10.5	9	12

$$R = (11-0) + \ldots + (1-0)$$

$$= 50$$

$\tau = \dfrac{R}{\frac{1}{2}N(N-1)} = \dfrac{50}{66} = 0.76$ is a measure of agreement between the ranks assigned by the representatives of the doctoral and master's populations. Testing the significance of τ by normal approximation yields a Z (Z is approximately normally distributed zero mean a

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with zero mean and unit variance) value equal to 3.409, which rejects the null hypothesis of no association between the rankings of the representatives of the two groups at 1% level of significance.

Similarly, the coefficient of rank correlation between the rankings of the representatives of Master and Senior student groups is equal to 0.67, which is significant at 1% level ($Z = 3.04$). Therefore, the null hypothesis of no association between the rankings of the representatives of Master and Senior student populations is rejected.

Following the same procedure, value of τ between the representatives of Doctoral and Senior populations is computed to be equal to 0.50. This yields a Z value equal to 2.26 which is not significant at 1% level of significance, indicating no evidence to reject the null hypothesis of no association between the rankings of the two representatives.

This implies that the ranking of variables that influence the choice of a university are different for Doctoral and Senior levels. This result reconciles the fragmented findings of various behavioral studies. For example, the study of Carnegie Foundation which was based on a sample from undergraduate population concluded that general reputation of a university as perceived by the student determines the choice of his educational institution.[4] Leonard Beach's study, based on a sample from graduate population, that financial aid is one of the most influential factors in the

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[4] Carnegie Corporation of New York (1966). Op cit.

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selection of a graduate school.[5] A similar study by Allan Grimes (for details refer to Appendix 4) concluded that almost 50 percent of no-shows went elsewhere because of financial reasons.[6] The present study supports the two findings (Table 4.6) and at the same time reconciles the differences by attributing them to differences in the levels (Doctoral and Seniors).

Similarities And Dissimilarities Between Aid/No Aid Categories Within a Level

It is of interest to know whether the aid/no aid categories within a level differ in the three broad groups of variables considered in the analysis 1 to 5. If there exist such differences, it could be due either to the financial aid or some other concomitant (or auxiliary) variable like entrance GPA. In either case, the analysis is important in the formulation of promotional policies to increase the selective demand for education.

In Tables 4.7D, 4.7M and 4.7S the differences between Aid/No Aid categories have been indicated in Column 10 (* and ** stand for significance at 5% and 1% level respectively). The two categories differ significantly in all the three levels with respect to the rating of financial aid, as well as promptness of information on financial aid.

From Tables 4.8D, 4.8M and 4.8S, it can be inferred that there are significant differences in entrance GPA between Aid/No Aid

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5 Leonard B. Beach (1965). Op cit.

6 Allen Grimes (1968): Survey of No-Shows, Memorandum, Department of Political Science, Michigan State University, East Lansing, January 1968.

Table 4.7D: Rating of University (MSU) Variables by Doctoral Students as Perceived at the Time of Admission to MSU (Questions 16 and 40 & Appendix 1.1) by Aid/No Aid Categories

University Variables	Aid (N=2086) Mean	S.d.	n (max=205)	No Aid (N=992) Mean	S.d.	n (max=85)	Pooled Estimate for Doctoral Student Population (N=3078) Mean	S.d.	Differences between Aid and No-Aid categories

Table 4.7D: Rating of University (MSU) Variables by Doctoral Students as Perceived at the Time of Admission to MSU (Questions 16 and 40 & Appendix 3.1) by Aid/No Aid Category.

University Variables	Aid (N=2086) Mean	S.d.	n (max=205)	No Aid (N=992) Mean	S.d.	n (max=85)	Pooled Estimate for Doctoral Student Population (N=3078) Mean	S.d.	Differences between Aid and No-Aid categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Curriculum in the major field	4.1	0.7	202	4.0	0.8	80	4.1	0.7	
2. Faculty reputation in the major field	4.0	0.8	201	3.8	0.8	80	3.9	0.8	
3. General reputation of the University	3.7	0.7	200	3.9	0.8	80	3.8	0.7	
4. Financial aid through the University**	3.7	1.0	202	3.1	1.0	77	3.5	1.0	**
5. Off campus job opportunities for self and wife*	3.0	0.7	197	3.2	0.9	77	3.1	0.8	*
6. Campus job opportunities for self and wife*	3.0	0.7	196	3.2	1.0	77	3.1	0.8	*
7. Educational facilities*	3.3	0.8	200	3.4	0.9	79	3.3	0.8	*
8. Location of campus	3.4	1.1	200	3.7	1.1	80	3.5	1.1	
9. Appearance of campus	3.9	0.9	196	3.7	0.9	78	3.8	0.9	
10. Employment opportunities after completion of degree	3.7	0.8	200	3.7	1.0	79	3.7	0.8	
11. Low costs	3.2	1.0	200	2.9	1.1	79	3.1	1.0	
12. Loan facilities	3.1	0.5	199	3.0	0.5	76	3.1	0.5	
13. Promptness of information before application	4.0	0.9	204	4.0	0.9	84	4.0	0.9	
14. Clarity of information before application	3.8	0.9	204	3.8	0.8	84	3.8	0.9	
15. Completeness of information before application	3.7	1.0	204	3.6	0.9	84	3.7	1.0	
16. Accuracy of information before application	3.7	0.9	203	3.7	0.9	84	3.7	0.9	
17. Promptness of information about admission	4.1	1.0	203	4.0	1.0	84	4.1	1.0	
18. Promptness of information about financial aid**	3.6	1.2	200	3.1	0.9	79	3.4	1.1	**
19. Individual attention about admission and financial aid	3.7	1.1	202	3.5	1.1	82	3.6	1.1	

* Differences between the categories (Aid/No Aid) significant at 5% level (Chi Square Test for equality of proportions)

** Differences between the categories (Aid/No Aid) significant at 1% level (Chi Square Test for equality of proportions)

INDEX:

Rating Scale (1 to 12):
1 = very unattractive
2 = unattractive
3 = neither
4 = attractive
5 = very attractive

Rating Scale (13 to 19):
1 = very unsatisfactory
2 = unsatisfactory
3 = no opinion
4 = satisfactory
5 = very satisfactory

N = population size
n = sample responded
S.d. = standard deviation
Total sample: Aid = 250
No Aid = 180

Table 4.7M: Rating of University (MSU) Variables by Master's Students as Perceived at the Time of Admission to MSU (Questions 16 and 40 & Appendix 3.1) by Aid/No Aid Category.

University Variables	Aid (N=1573)			No Aid (N=2398)			Pooled Estimate for the population of Master's Students (N=3971)	Differences between Aid and No-Aid categories
	Mean	S.d.	n (max=111)	Mean	S.d.	n (max=111)		

Table 4.7M: Rating of University (MSU) Variables by Master's Students as Perceived at the Time of Admission to MSU (Questions 16 and 40 & Appendix 3.1) by Aid/No Aid Category.

University Variables	Aid (N=1573) Mean	Aid S.d.	Aid n (max=131)	No Aid (N=2398) Mean	No Aid S.d.	No Aid n (max=131)	Pooled Estimate for the population of Master's Students (N=3971) Mean	Pooled S.d.	Differences between Aid and No-Aid categories
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Curriculum in the major field	4.1	0.7	129	4.0	0.8	125	4.0	0.8	
2. Faculty reputation in the major field	3.7	0.8	129	3.7	0.8	125	3.7	0.8	
3. General reputation of the University	3.8	0.7	129	3.9	0.8	125	3.9	0.8	
4. Financial aid through the University**	3.8	0.9	126	2.9	0.8	120	3.3	0.8	**
5. Off campus job opportunities for self and wife*	3.0	0.7	125	3.1	0.8	117	3.1	0.8	*
6. Campus job opportunities for self and wife*	3.1	0.6	124	3.1	0.9	119	3.1	0.8	*
7. Educational facilities*	3.6	0.8	129	3.5	0.7	124	3.5	0.7	*
8. Location of campus	3.5	1.0	126	3.9	1.0	126	3.7	1.0	
9. Appearance of campus	3.8	0.9	128	4.0	0.9	123	3.9	0.9	
10. Employment opportunities after completion of degree	3.6	1.0	126	3.8	0.8	120	3.7	0.9	
11. Low costs*	3.0	1.1	126	3.3	1.2	123	3.2	1.2	*
12. Loan facilities	3.1	0.5	126	3.0	0.5	118	3.0	0.5	
13. Promptness of information before application	3.9	1.0	128	4.0	0.9	127	3.0	0.9	
14. Clarity of information before application	3.8	0.9	128	3.9	0.9	127	3.9	0.9	
15. Completeness of information before application	3.7	1.0	128	3.9	0.9	127	3.8	0.9	
16. Accuracy of information before application	3.7	0.9	126	3.8	1.0	126	3.8	1.0	
17. Promptness of information about admission	4.1	1.1	128	4.2	0.8	127	4.2	0.9	
18. Promptness of information about financial aid**	3.7	1.1	128	3.1	0.7	118	3.3	0.9	**
19. Individual attention about admission and financial aid	3.5	1.2	129	3.3	0.9	124	3.4	1.0	

* Differences between categories (Aid/No Aid) significant at 5% level.

** Differences between categories (Aid/No Aid) significant at 1% level.

INDEX:

Rating Scale (1 to 12)
1 = very unattractive
2 = unattractive
3 = neither
4 = attractive
5 = very attractive

Rating Scale (13 to 19)
1 = very unsatisfactory
2 = unsatisfactory
3 = no opinion
4 = satisfactory
5 = very satisfactory

N = population size
n = sample responded
S.d. = standard deviation
Total sample: Aid = 204
No Aid = 209

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Table 4.6D:

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categories among seniors and masters but not among doctoral students. This implies a closer competition for financial aids among doctoral students than among masters and senior students.

Table 4.8D: Distribution of Students by Incoming Quality (as measured by Entrance GPA) in Aid/No Aid Categories Among Doctoral Students.

Entrance GPA / Category	≥ 3.5	3.0 ≤ GPA < 3.5	GPA < 3.0	Total	Mean
(1)	(2)	(3)	(4)	(5)	(6)
Aid	92	94	15	201	3.45
	(45.8)	(46.8)	(7.4)		
No Aid	33	41	7	81	3.40
	(40.7)	(50.6)	(8.7)		
Pooled estimate	1359	1477	242	3078	3.43
	(44.1)	(48.0)	(7.9)		

Chi Square (EQUALITY OF PROPORTION) = 1.80 NOT SIGNIFICANT

Note: Numbers within parentheses indicate percentages.

Table 4.8M: Distribution of Students by Incoming Quality (as measured by Entrance GPA) in Aid/No Aid Categories Among Master's Students.

Entrance GPA Category	GPA ≥ 3.5	3.0 ≤ GPA < 3.5	2.5 ≤ GPA < 3.0	GPA < 2.5	Total	Mean
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid (N=1573)	29 (23.0)	64 (50.8)	28 (22.2)	5 (4.0	126+	3.20
No Aid (N=2398)	16 (13.2)	46 (38.0)	49 (40.5)	10 (8.3)	121++	3.05
Pooled Estimate (N=3971)	678 (17.1)	1710 (43.1)	1321 (33.2)	262 (6.6)	3971 (100.0)	3.11

\+ Non response to the item = 5

++ Non response to the item = 10

χ^2 = 13.999 significant at 1% level.

Note: Figures within parentheses indicate percentages.

Table 4.8S:

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Table 4.8S: Distribution of Students by Incoming Quality in Aid/No Aid Categories Among Senior Students.

Entrance GPA Category	GPA ≥ 3.5	3.0 ≤ GPA < 3.5	2.5 ≤ GPA < 3.0	GPA < 2.5	Total	Mean
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid (N=1303)	31 (31.6)	36 (36.8)	25 (25.5)	6 (6.1)	98+	3.20
No Aid (N=5903)	4 (4.8)	16 (19.0)	18 (2.14)	46 (54.8)	84++	2.90
Pooled estimate for the population of Senior Students (N=7206)	695 (9.6)	1600 (22.3)	1596 (22.1)	3315 (46.0)	7206 (100.0)	2.95

\+ Non response to the item = 39

++ Non response to the item = 36

$\chi^2 = 59.877$ Highly significant at 1% level.

Note: Figures within parentheses indicate percentages.

The two categories (Aid/No Aid) also differ with respect to the average number of admissions and financial aid offers, as shown in Table 4.9.

Table 4.9: Average Number of Financial Aid Offers and Admissions Among Levels and Aid/No Aid Categories.

	Seniors		Masters		Doctoral	
	Aid (n=137)	No Aid (n=120)	Aid (n=131)	No Aid (n=131)	Aid (n=204)	No Aid (n=86)
Average number of admissions	1.3 (111)	1.3* (80)	1.6 (92)	1.0 (87)	1.8 (170)	1.1 (63)
Average number of financial aid offers	0.7 (110)	0.1 (71)	0.9 (85)	0.3 (77)	1.0 (155)	0.4 (51)

*: <u>No</u> difference between aid/no aid categories at 5% level of significance.

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The analysis indicates that there is no association between Aid/No Aid category and sex. However, there appears to be some association between martial status and Aid/No Aid category in all three levels, as shown in Tables 4.10D, 4.10M and 4.10S.

Table 4.10D: Distribution of Doctoral Students by Martial Status in Aid/No Aid Categories.

Martial Status / Category	Single	Married/ Divorced	Total
(1)	(2)	(3)	(4)
Aid	56 (27.3)	148 (72.7)	204
No Aid	13 (15.3)	73 (84.7)	86
Total	69 (23.4)	221 (76.6)	290

CHI SQUARE = 5.10* (significant at 5% level)

Note: Figures within parentheses indicate percentages.

Table 4.10M: Distribution of Master's Students by Martial Status in the Aid/No Aid Categories.

Martial Status / Category	Single	Married/ Divorced	Total
(1)	(2)	(3)	(4)
Aid	69 (53.1)	61 (46.9)	130+ (100.0)
No Aid	47 (35.9)	84 (64.1)	131 (100.0)
Total	116 (42.7)	145 (54.9)	261 (100.0)

+ Non response to the item = 1

CHI SQUARE = 7.78** (significant at 1% level) able 4.1

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Table 4.10S: Distribution of Senior Students by Martial Status in the Aid/No Aid Categories.

Marital Status / Category	Single	Married/ Divorced	Total
(1)	(2)	(3)	(4)
Aid	108 (78.8)	29 (21.2)	137 (100.0)
No Aid	79 (65.8)	41 (34.2)	120 (100.0)
Total	187 (68.2)	70 (30.5)	257 (100.0)

CHI SQUARE = 5.43* (Significant at 5% level)

From the above tables it is evident that a higher percentage of the students receiving financial aid are single. It may be that financial needs to continue education force some no-aid category students to get married earlier. There is no evidence of differences between the two categories in the average annual income of parents in all the three levels. It may be that financial aids are not necessarily awarded strictly on economic needs.

In this chapter the main concern was in finding the similarities and differences between two groups (Shows and No-Shows), levels (Doctoral, Masters and Seniors) and categories (Aid/No Aid). To what extent can this descriptive knowledge aid us in predicting whether an applicant will be a potential show of no-show? Knowledge of this nature can aid in finding new means (marketing strategies) of handling the no-shows so as to convert them to potential shows. The focus of the next chapter is on classification of consumers into different groups with as few variables as possible.

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CHAPTER V

CLASSIFICATION OF SUBJECTS INTO SHOWS AND NO-SHOWS FOR EDUCATIONAL PURCHASE FROM MSU

The aim of any researcher is knowledge which is comprised of three types - descriptive, predictive and control. The descriptive knowledge includes facts about the phenomenon under observation. These descriptive facts are usually informative and may constitute the raw material for predictive knowledge. When the researcher seeks to predict, he does not attempt initially to demonstrate a cause and effect relationship between the dependent variable whose variation is being predicted and a set of independent or explanatory variables. When he can predict fairly accurately, he may try to establish the cause and effect relationship by direct experimentation or by indirect inference. Obviously control knowledge is more powerful and is usually the aim of most researchers. The theory or theories of education consist of all three types of knowledge.

In the last chapter, the descriptive knowledge about the educational consumers has been extensively studied. The present chapter is devoted to gaining the predictive knowledge about some aspects of graduate enrollment, whereas the next chapter will be concerned with control knowledge. The aspect of the phenomena that are the foci of the present study is educational buyer behavior. "Who" buys "where" and "why" are some of the questions on which knowledge is sought. More specifically, is it possible o predict whet

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to predict whether an individual with certain characteristics will buy education from a given educational institution (MSU)? Such a prediction problem may be viewed as a classification problem: classifiaction of consumers into shows and no-shows on the basis of certain characteristics; i.e. it is no longer of interest to the researcher to find similarities and dissimilarities between shows and no-shows on each of the relevant characteristics but to consider all of them simultaneously to classify a subject into one of the groups (shows or no-shows).

One method of classification is to use a technique known as discriminant analysis. The procedure involves finding a linear discriminant score for each variable that minimizes within group variation and maximizes between group variation. The between group variation, when all the relevant characteristics are simultaneously taken into account, is measured by a concept known as "Distance" (Mahalanobi's D^2). The higher the "distance," the greater the dissimilarities between the groups. If the groups are exactly similar (no dissimilarities), some errors are inevitable in classification. The method of classification is reduced to a toss of a coin (random assignment) if the groups are exactly similar. On the basis of the linear discriminant scores for each variable, the likelihood of an individual belonging to either one of the groups is computed. The individual is assigned to a group for which the likelihood is a maximum.

Using the above theory, an attempt is made to classify subjects into shows and no-shows on the basis of some important characteristics with respect to which the two groups differed, as indicated

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as indicated by the descriptive analysis of the last chapter. Tentatively 23 such variables are chosen for the initial discriminant analysis. The computer library program on discriminant analysis developed by the Health Science Computing Facility at the UCLA (BMDO5M) has been utilized for analysis and classification of subjects into shows and no-shows. The same taxonomy (level and category) as in the last chapter has been followed in the classification of students. A brief explanation of Discriminant Analysis followed by the computer output for one case is presented in Appendix 5. After discussion of the merits of classification on the basis of the knowledge provided by the 23 variables, attempts were made to decrease the number of variables to a manageable size without affecting very much the accuracy of classification. Suppose no additional information other than what is contained in the application form is available; then the value of the classificatory knowledge must also be examined. The BMDO5M computer routine provides the following broad categories of analysis:

i) the distance between the groups as measured by Mahalanobis D^2 and its level of significance.

ii) the mean values and the linear discriminant scores for each variable and by group.

iii) the evaluation of classification functions for each subject and, finally, the classification matrix based on the largest probability that the subject may belong to either one of the groups.

The above steps of analysis are carried out in the classification of students into shows and no-shows of education in the following four cases:

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<u>Classification of Subjects Sampled Who Were Offered Financial Aid For Master's Program Into Shows and No-Shows For MSU:</u> (Classification 5-1)

(a) With 23 variables included for discriminating the two groups, Mahalonobis D^2 is 419.90 which is highly significant (D^2 is distributed as χ^2 with 23 degrees of freedom) at the 1% level of significance. This implies that there are differences between the two groups when all the 23 variables are simultaneously taken into account.

The classification matrix is as follows:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	115	16	131
	No-Shows	14	120	134
	Total	129	136	265

The merit of the above discrimination function can be evaluated by comparing the actual fraction of correct classification with the fraction of correct classification that would have occurred by mere chance.

Let

p = the true proportion of shows

α = the proportion classified as shows

Then the probability of an individual being correctly classified by chance is

P(correct) = P(correct/classified as show)P(Classified as show)

+ P(correct/classified as no-show)P(Classified as no-show)

i.e., $P(\text{correct}) = p\cdot\alpha + (1-p)(1-\alpha)$ (1)

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In the above classification

$p = 131/265 = 0.4943$, $1-p = 0.5057$

$\alpha = 129/265 = 0.4868$, $1-\alpha = 0.5132$

Proportion that may be correctly classified by chance:

$= (0.4943)(0.4868) + (0.5057)(0.5132)$

$= 0.2406 + 0.2595 = 0.5001$ (2)

The fraction of correct classification in the above classification matrix

$= 235/265 = 0.8868$ (3)

Comparing (2) and (3), we infer that the discriminant function classifies the subject much more correctly than could be done by random assignment.

Reduction of Number of Variables Used in the Classification

The above classification is impressive, but the information on all the 23 variables is seldom available to the researcher in advance. One would like to reduce the number of variables with only minute reduction in the accuracy of classification, so what should the criterion be for picking up (or dropping) the variables? The procedure followed here and the rationale behind it are as follows:

We know that the higher the distance (D^2) between the groups, the better the discrimination. The factors that directly contribute to the D^2 are the differences between the group mean scores and the differences between the group linear discriminant scores for each variable. So, in the choice of a given number of variables, one may start with the variable that contributes the most to D^2 [i.e. Max $d_{1i} \cdot \ell_{1i}$ where

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$$d_{1i} = \bar{x}_{1i} - \bar{x}_{2i} \quad \text{and}$$

$$\ell_{1i} = L_{1i} - L_{2i}$$

$\bar{x}_{1i}$ = Group I mean score for the ith variable

$\bar{x}_{2i}$ = Group II mean score for the ith variable

L_{1i} = linear discriminant score for the ith variable in Group I

L_{2i} = linear discriminant score for the ith variable in Group II

Using this procedure, five variables were chosen to be used for classification. This is a fairly rational procedure, though there could be more sophisticated procedures to determine the "optimum" number of variables to be used for classification. For example, one could introduce the concept of the expected value of information by considering the incremental cost of information and the cost of misclassification in the absence of that information. A rational decision maker would add variables as long as the incremental cost of information on a variable is less than the cost of misclassification in the absence of that information. This problem of optimization, by itself, is a separate problem which will not be discussed in greater detail here.

(b) Classification of Subjects (Masters' Students with MSU's Offer of Financial Aid) Into Shows and No-Shows Using Only Five Variables

The five variables that were chosen using the criterion described above are: importance of faculty reputation in the choice of a University, importance of financial aid in the choice of a University, marital status of the individual, number of financial aid offers received, and the comparability (higher, equal or lower) of MSU's offer with other offers. Incidentally, these were some of the variables which were highly significant the I lev

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at the 1% level in the descriptive analysis presented in the last chapter (Table 4.1). The distance (D^2) between the two groups when only the above five variables are used is 218.49, which is still highly significant at the 1% level.

The classification matrix is:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	116	15	131
	No-Shows	26	108	134
	Total	142	123	265

The fraction of correct classification = 0.8453 (4)

With only about 4 percent sacrifice of accuracy in classification, one can reduce the number of variables from 23 to five. This is no doubt quite impressive, but at the time of receiving the application the administrator may not have information on all the variables (not even the last set of five variables) unless he takes some special measures. So, for a person who is sceptical on securing additional information the analysis may not sound pragmatic. Therefore, let the superiority of classification be judged using only the variables that are common to the questionnaire and the application form, such as grade point average, marital status, home state and the like. Unfortunately, the data on home state has not been included in the questionnaire but there are questions [Questions 16(h) and 17(h) for the Shows and No-Shows respectively] which indirectly measure the attractiveness of the location of the MSU campus. Using only these 3 variables, the classification matrix obtained is as follows:

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		Classified As		
		Shows	No-Shows	Total
True State	Shows	81	50	131
	No-Shows	47	87	134
	Total	128	137	265

Using the same terminology as in 5.1 (a) and (b)

$p = 0.4943$ $\qquad$ $1-p = 0.5057$

$\alpha = 0.4830$ $\qquad$ $1-\alpha = 0.5170$

Proportion that may be classified correctly by chance

$$= (0.4943)(0.4830) + (0.5057)(0.5170)$$

$$= 0.5001 \qquad (5)$$

Proportion that is classified correctly (above classification matrix)

$$= 0.6340$$

Comparing (5) and (6), it is inferred that discriminant analysis classified about 13.4 percent better than random classification. The D^2 statistic in the above case is equal to 27.61 which is significant for 3 degrees of freedom at 1% level. This implies that the method presented has superior discriminatory power in the classification of subjects into shows and no-shows even without additional information on the applicant. In the above analysis "attractiveness of location of campus" is used as an approximation to the home state. The reasons for the approximation are:

i) non availability of this data on the questionnaire

ii) even if it were available, the variable "home state" cannot be quantified (unless treated as a binary variable) iii)

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iii) attractiveness of location of campus may be a better measure than home state for obvious reasons.

The above classification based on only three variables, though statistically significant, may not be extremely valuable from the pragmatic point of view. The precision of classification might improve if more information contained in the application form is used. For example, the probability of show and no-show might be related to the age of the applicant (as the two groups shows and no-shows, differ with respect to marital status) or time lag between undergraduate and the intention to go for graduate studies or the college/university he has attended, etc. This needs further research including the quantification of some of the variables.

The next problem in hand is the classification of Doctoral students belonging to the same category (offer of financial aid from MSU).

Classification Of Subjects Who Were Offered Financial Aid For the Doctoral Program Into Shows and No-Shows For MSU

(a) Utilizing all 23 variables as in the case of 5.1 (a), the distance between the groups is 306.62 which is highly significant at the 1% level.

The classification matrix is as follows:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	174	30	204
	No-Shows	6	69	75
	Total	180	99	279

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Using the same terminology as in 5.1:

$p = 0.7311 \quad , \quad 1-p = 0.2689$

$\alpha = 0.6451 \quad , \quad 1-\alpha = 0.3549$

$$P(\text{correct by chance}) = 0.4761 + 0.0954$$

$$= 0.5670 \qquad (7)$$

The proportion that is correctly classified $= \frac{243}{279} = 0.8709$ (8)

The merit of the discrimination function may be judged by comparing (7) and (8). The error in classification is less than 15 percent.

(b) <u>Reduction of Number of Variables</u>

It is now feasible to try to reduce the number of variables, as was done earlier, with only minute effect on the accuracy of classification. Referring to the linear discriminant scores and following the procedure explained before, six variables that contribute most to the distance (D^2) between the groups were chosen to be included for classification. These variables are: marital status, individual's perception of curriculum in the major field, availability of financial aid, location of MSU campus, number of financial aid offers, and comparability of MSU's offer of financial aid with that of others. From Table 4.2 in the last chapter, one can infer that these are some of the variables that were highly significant in the descriptive analysis of the differences between the groups. This may also be considered as a cross-check on the descriptive and classification analysis.

With these six variables, the classification matrix is:

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		Classified As		
		Shows	No-Shows	Total
True State	Shows	171	33	204
	No-Shows	13	62	75
	Total	184	95	279

Here $p = 0.7311$ $\quad 1-p = 0.2689$

$\alpha = 0.6591$ $\quad 1-\alpha = 0.3409$

P(correct by chance) $= 0.4819 + 0.0917$

$= 0.5736$ (9)

= Proportion that may be correctly classified by chance

The proportion that is actually classified correctly

$= 0.8751$ (10)

With only six variables, the discriminant function is classifying as accurately as it did with 23 variables. One should note that (10) and (8) may be compared, taking into account (7) and (9). This demonstrates the ability of the discriminant function to predict shows and no-shows with a small number of variables.

(c) Classification Using The Information Available in the Application Form

As in the earlier analysis one may wish to classify the consumers of education as shows and no-shows without using any additional information other than what is available in the application form. With the use of three variables, marital status, entrance GPA and the rating of attractiveness of the location of MSU campus (as substituted for home state), the classification matrix is as follows:

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		Classified As		
		Shows	No-Shows	Total
True State	Shows	124	80	204
	No-Shows	26	49	75
	Total	150	129	279

$p = 0.7311$ $\quad$ $1-p = 0.2686$

$\alpha = 0.5376$ $\quad$ $1-\alpha = 0.4624$

$$P(\text{correct classification by chance}) = 0.3930 + 0.1243 = 0.5173 \quad (11)$$

$$\text{Actual classification} = \frac{173}{279} = 0.6200 \quad (12)$$

The significance of classification is tested using the D^2 value = 19.10 which follows Chi-square with 3 degrees of freedom. This is significant at 1% level rejecting the null hypothesis of no difference between the actual classification and random classification.

Classification Of Subjects Who Were Offered No Financial Aid For the Masters' Program Into Shows and No-Shows For MSU

(a) As in the earlier cases the initial classification was done using all the 23 variables. The distance (D^2) between the groups is 348.66, which is highly significant at 1% level. The classification matrix is as follows:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	123	8	131
	No-Shows	17	69	86
	Total	140	77	217

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The proportion of shows = p = 0.6037

Proportion classified as shows = α = 0.6452

P(correct classification by chance) = $p \cdot \alpha + (1-p)(1-\alpha)$

$$= 0.3895 + 0.1406 = 0.5301 \tag{13}$$

Proportion that is actually classified correctly

$$= 0.8848 \tag{14}$$

A discriminant function based on 23 variables classified subjects into shows and no-shows with only 11.5% error.

(b) <u>Reduction of the Number of Variables Used for Classification</u>

As in the previous two cases, six variables (which contribute most to D^2) were chosen by examining the differences between the groups in the linear discriminant scores of each variable. These variables are: marital status, perception of the attractiveness of MSU's campus location, availability of financial aid, importance of the availability of financial aid and location of campus, number of financial aid offers received, and parent's average annual income. These are some of the variables with respect to which there were highly significant differences (Table 4.3 in the last chapter) between the two groups.

With these seven variables, the classification matrix is as follows:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	116	15	131
	No-Shows	22	64	86
	Total	138	79	217

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Here $p = 0.6036$ $1-p = 0.3964$

$\alpha = 0.6359$ $1-\alpha = 0.3641$

P(correct by chance) = 0.3838 + 0.1443 = 0.5281 (15)

Proportion correctly classified = 0.8294 (16)

From (15) and (16), the merit of the discriminant function is demonstrated. This could also be inferred from the value of $D^2 = 199.92$ which is significant at 1% level.

(c) Classification Using The Information Available In The Application Form

As in the two previous cases classification may be done using only the information avialable in the application form--marital status, entrance GPA and attractiveness of location of MSU campus (which is a rough measure of MSU campus distance from the applicant's home town). With these three variables, the classification matrix is:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	82	49	131
	No-Shows	29	57	86
	Total	111	106	217

$p = 0.6036$ $1-p = 0.3964$

$\alpha = 0.5115$ $1-\alpha = 0.4885$

P(correct classification by chance) = 0.3087 + 0.1936

= 0.5023 (17)

Actual portion of correct classification = 0.6405 (18)

Comparing (17) and (18), it is evident that the discriminant analysis classifies about 14 percent better than the random lassificat

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classification. The significance of the above result may be judged from the D^2 value obtained, which is equal to 34.41. This is significant at the 1% level, rejecting the null hypothesis of no difference between actual classification and random classification.

The last classification problem that concludes this chapter is between the shows and no-shows who were offered no financial aid for the doctoral program.

Classification of Subjects Who Were Offered No Financial Aid For The Doctoral Program Into Shows and No-Shows For MSU

(a) The initial analysis with 23 variables gave a value of D^2 equal to 272.08 which is highly significant at the 1% level of significance. The classification matrix is as follows:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	85	1	86
	No-Shows	3	28	31
	Total	88	29	117

Proportion of shows = 0.7350

Proportion classified as shows = 0.7521

$$P(\text{correct by chance}) = 0.5528 + 0.0657$$

$$= 0.6185 \qquad (19)$$

Actual percentage correct classification = 96.58 (20)

The discriminant function commits an error less than 3.5 percent in classifying the shows and no-shows, which is extremely impressive.

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(b) Reduction in the Number of Variables Used For Classification

The same procedure described earlier is followed in choosing an important set of variables from the available set of 23 variables. The seven variables that contributed most to the distance between the groups are: marital status, perception of availability of financial aid at MSU, location of campus, importance given to the financial aid and location of campus in the choice of a university, number of financial aid offers and the entrance GPA. As shown in Table 4.4 in the last chapter, these were some of the variables with respect to which the two groups differed very significantly. With these seven variables, the classification matrix is:

		Classified As		
		Shows	No-Shows	Total
True State	Shows	81	5	86
	No-Shows	6	25	31
	Total	87	30	117

$p = 0.7350$ $1-p = 0.2650$

$\alpha = 0.6207$ $1-\alpha = 0.3793$

P(Correct by chance) = 0.5465 + 0.0680 = 0.6145 (21)

Actual portion of correct classification = 0.9059 (22)

With only seven variables, the error in classification is less than ten percent.

(c) Classification Using Only The Information Available In The Application Form

Using marital status, entrance GPA and attractiveness of campus location the classification matrix is as follows:

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		Classified As		
		Shows	No-Shows	Total
True State	Shows	55	31	86
	No-Shows	13	18	31
	Total	68	49	117

Here $p = 0.7350$ $\quad 1-p = 0.2650$

$\alpha = 0.5811$ $\quad 1-\alpha = 0.4189$

$$P(\text{correct classification by chance}) = 0.4271 + 0.1110$$

$$= 0.5381 \qquad (23)$$

$$\text{Actual portion classified correctly} = \frac{73}{117} = 0.6339 \qquad (24)$$

D^2 for the classification = 11.94 which is just significant at 1% level (table value of χ^2 for 3 degrees of freedom at 1% level = 11.34).

From the above analysis it is evident that one can predict an applicant to be a "show" or "no-show" with only a small amount of additional information.

The population under consideration being young and educated, they may not hesitate to express their free opinions on what they consider as most important in the choice of a university or their perceptions of a particular educational institution. Even if this is not feasible, with only information that is already available in the application form, it has been demonstrated that the prediction (classification as show or no-show) is significantly better than "guessing" at random.

With the descriptive and predictive background presented in Chapters IV and V, the next goal is control knowledge, the merit of which may be dmonstrated by a specific predictive model of educational buying behavior. This is the focus of the next chapter.

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CHAPTER VI

A PREDICTIVE MODEL OF EDUCATIONAL BUYING BEHAVIOR

The analysis of the last two chapters indicates that financial aids may be considered as one of the control variables influencing educational buying behavior. However strong the influence of this control variable may be, there is always some uncertainty as to whether an individual with a given entrance grade point average will "buy" (show) or "not buy" (no-show) education from MSU in the absence or presence of this control variable. The presence of this uncertainty is a major problem to the university administrators in a variety of decisions. For example, the administrator may like to know the estimated demand (enrollment) in a particular level or course curriculum well in advance in order to allocate the resources, such as teaching hours, number of sections, building space and the like; or the problem may be that of granting a specified number of admissions and financial aids to result in a specified enrollment in a given level, course curriculum or college. When the resources in terms of teaching hours, financial aids, building space, etc., are limited, the problem may be one of publicizing the available facilities to the prospective buyers in order to stimulate demand and then selecting the best students among the available applicants. All these administrative decisions are to be made in the presence of uncertainty. The science of measuring uncertainty is known as "probability." A model that describes the behavior in terms of

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probability is known as "probabilistic model." This chapter is devoted to the development of a predictive model of educational buying behavior which is probabilistic in nature. The probabilistic model describes the graduate educational buying behavior from MSU of an individual with a given entrance GPA and in a given level and aid/no aid category. Two more models--a Regression Model and a Systems Model--which are closely related to the focus of this chapter are presented in Appendix 6.2 and 6.3 respectively. The Regression Model (Appendix 6.2) is also a probabilistic model and describes the relationship of the subjective probability of attendance in the absence of financial aid, with the characteristics of the individual as explanatory variables. The relationships between the "posterior" subjective probability and the individual characteristics may enable one to predict the attendance of an individual with certain given characteristics. The Systems Model demonstrates the impact of different financial aid policies on enrollment. This model may help to set guidelines for sound policies of financial aid allocation. With this brief introduction to the models of educational systems, the focus of this chapter--Probabilistic Model--may be presented:

Probabilistic Model

A model that describes the buying behavior of graduate education in terms of probabilities (measure of uncertainty) may be termed as a probabilistic model. What are the variables that are to be included in such a model? What is the rationale for the choice of these variables? These issues may be briefly discussed before going to th

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going to the actual modeling aspects of educational purchase behavior.

Rationale for the Choice of Variables Included in the Probabilistic Model

It was seen in Chapter IV that the acceptance or rejection of an educational product package is dependent on the "mix" of different value satisfactions provided by the educational product package. These "ingredients" of the "mix" consist of the university variables such as modernization of curriculum, availability of financial aid, faculty reputation, location of campus, general reputation and the like. In this set of influential variables, financial aid is one of the important variables on which the administrator may have some control (amount of aid and time demanded from the graduate assistant), subject to meeting its teaching and research commitments. Further various studies[1] indicate that financial aid is given much more importance in the actual choice of an educational institution than what people normally "say" (for further discussion on the identification of control variable, please refer to Appendix 6.3). Therefore, one of the most influential variables--financial aid--may be treated as a control variable in modeling the graduate educational purchase behavior.

The above discussion indicates that financial aid is an important "ingredient" in the "product package," but most of the educational institutions may be able to sell their products (educational services) with no financial aid at all provided they

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1 Robert C. Pace and Ann McFee (1960). Op cit., Leonard B. Beach (1965). Op cit., and Allen Grimes (1968). Op cit.

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completely ignore the incoming student quality (relaxation of minimum standards of acceptance). In offering a product package (accepting a student), the educational institution is taking a risk--the risk of the student not rising to the specified standards in his performance at the university. The experience of most educational institutions has demonstrated that the risk is more if the incoming student's quality is lower and decreases with increase in the quality of the incoming students. Further, the aim of any good educational institution is to produce the best "out-going" products, which in turn may enhance the reputation of the university. It is a fairly recognized fact that the quality of outputs is a function of the quality of inputs. Therefore, to turn out good products (developed manpower), it is necessary to improve the quality of inputs (incoming students). The quality of inputs depends on financial aid, as indicated in Table 6.0.

Table 6.0: Average Probability of Accepting MSU's Educational Product Package In the Absence of Financial Aid by Different Classes of Incoming Student Quality and by Level.

Level \ Entrance GPA	$GPA \geq 3.5$	$3.0 \leq GPA < 3.5$	$2.5 \leq GPA < 3.0$	$GPA < 3.0$
M	0.3381	0.5614	0.5771	-
D	0.3184	0.4265	0.5694	-

Note: Figures in the above table are estimated on the basis of subjective probabilities of individuals receiving aid in a given level and entrance GPA class.

From Table 6.0, it is evident that the higher the student quality, the lower the probability of accepting MSU's educational product without financial aid. Incidentally, it may also be noticed that for any e

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for any entrance GPA class, the probability of accepting the product without financial aid is lower for doctoral students than for the master's students. This serves as a cross check on the finding in Chapter IV that the higher the level, the greater the importance to financial aid.

The above discussion provides a rationale for considering the incoming student quality and financial aid in the probabilistic model presented below. Further, the above discussion also provides a rationale for developing separate models for each level (Masters and Doctoral) since experience elsewhere[2] in the analysis also indicates that such a distinction is meaningful.

Modeling of Educational Purchase Behavior

The probability that a student with a given entrance GPA would accept the educational product package from MSU is the sum of two probabilities: the probability that he accepts MSU's product with financial aid, plus the probability that he accepts MSU's product given no financial aid. We may reduce the entrance GPA's into four classes and express the probability of show as follows:

$$\{S/G_i\} = \{S/FG_i\}\{F/G_i\} + \{S/\bar{F}G_i\}\{\bar{F}/G_i\} \qquad (1)$$

$$i = 1,\ldots,4 \quad \text{(Classification of entrance GPA).}$$

where

$\{S/G_i\}$ = probability of accepting MSU's product (show) given that

[2] Comparison of shows and no-shows with respect to entrance GPA indicated no evidence of differences when the analysis was done on the graduate (Masters plus Doctoral) students but when the analysis was done separately for each level (Masters and Doctoral) there were significant differences between the shows and no-shows in entrance GPA.

the individual has an entrance GPA falling in the i^{th} class.

$\{S/FG_i\}$ = probability of an individual with entrance GPA in the i^{th} class interval accepting MSU's product (show) given financial aid.

$\{F/G_i\}$ = probability of financial aid for a given entrance GPA.

$\{S/\bar{F}G_i\}$ = probability of an individual with entrance GPA in the i^{th} class accepting MSU's product given no financial aid.

$\{\bar{F}/G_i\}$ = probability of no financial aid for a given entrance GPA.

One may note here that $\{S/G_i\}$ may be directly computed by taking the ratio of the number of shows to the number of accepted applicants in a given GPA class for each level (Master and Doctoral). This agrees with (1) as a cross check.

Modeling of Educational Purchase Behavior of Master's Students Using the Fall 1967 Data

Data Requirements

To evaluate (1), one needs the knowledge of the conditional probabilities which may be estimated for each level using the Fall 1967 data. This requires the knowledge of the distribution of shows and no-shows populations by entrance GPA class and aid/no aid categories. The data for the two populations by above classifications are not available in suitable form, and hence the following methods of estimation are used.

Method of Estimation

The accepted number of graduate level students in the Fall 1967 were 4838, out of which only 2074 actually enrolled (shows), leaving 2764 as no-shows. The distribution of shows and no-shows by level are:

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	Shows		No-Shows	
Doctoral	753	Estimated from the records of the Registrar's Office (MSU)	594	Estimated from the first systematic sample. (Maximum likelihood estimate.)
Master's	1125		1877	
Non degree	196		293	

Knowing the size of the two populations, the next step is to estimate their distribution by entrance GPA class and aid/no aid categories. This is presented in Table 6.1 and the procedures of estimation follows next.

Table 6.1: Distribution of Master's Applicants (Shows) by Entrance GPA in Aid/No Aid Categories.

Category / Entrance GPA	Aid	No Aid	Total	{F}	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
GPA ≥ 3.5	103	90	193	0.53	0.47
3.0 ≤ GPA < 3.5	226	258	484	.47	.53
2.5 ≤ GPA < 3.0	99	275	374	.26	.74
GPA < 2.5	18	56	74	.24	.76
Total	446	679	1125		

The total number of new arrivals (shows) in Fall 1967 to the Master's program were 1125. Among these were estimated to be 446 who had MSU's offer of financial aid and 679 that enrolled with no aid from MSU. [Maximum likelihood estimate assuming that financial aids were equally distributed to the new arrivals and the transition shows of the Master's program. The total enrollment (Master's Program) of 3971 was made up of 1573 students with financial aid and 2398 with no financial aid from MSU.] Knowing the totals in aid (column 2) and no aid (column 3) categories, the distribution by entran

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by entrance GPA is obtained using the sample survey data (Table 4.8M on page 70). For example, 23.0 percent (Table 4.8M) of 446 is equal to 103 (rounded off to the nearest integer) as indicated in column (2) corresponding to the GPA $\geq$ 3.5. Column (4) is then obtained by adding columns (2) and (3). Columns (5) and (6) are obtained by taking the ratios of column (2) and (3) to column (4) respectively. It may be noted that the proportion or fraction of the population that is with MSU's offer of financial aid in any entrance GPA class serves as an estimate of the probability (relative frequency concept) of financial aid in that particular GPA class. From column (5), it is seen that the probability of financial aid decreases with decrease in the quality (entrance GPA) of a student.

Similar details of the distribution of no-shows population by entrance GPA class and aid/no aid categories are presented in Table 6.2.

Table 6.2: Distribution of Master's Applicants (No-Shows) by Entrance GPA in Aid/No Aid Categories.

Category / Entrance GPA	Aid	No Aid	Total	$\{F\}$	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
GPA $\geq$ 3.5	208	308	516	0.40	0.60
3.0 $\leq$ GPA $<$ 3.5	178	643	821	.22	.78
2.5 $\leq$ GPA $<$ 3.0	47	457	504	.09	.91
GPA $<$ 2.5	3	33	36	.08	.92
Total	436	1441	1877		

The number of no-shows who had MSU's offer of financial aid was obtained from the data secured from every department through the

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Graduate Dean's office. Of the 680 no-shows who had financial aid offer from MSU, 436 were Master's applicants and 244 were doctoral applicants. The total no-shows population (Master's) was estimated earlier as 1877, which is made up of 436 with MSU's offer of aid and 1441 with no offer of aid from MSU. From the systematic sample, the distribution by entrance GPA class (column 4) was obtained. The distribution of applicants belonging to aid category by entrance GPA [column (2)] was estimated from the responses to the sample survey. And finally, the distribution by entrance GPA class for the no-aid category [column (3)] was obtained by subtracting column (2) from column (4). Columns (5) and (6) were obtained as before. From the above table [column (5)] it can also be seen that the probability of financial aid decreases with a decrease in entrance GPA. To evaluate (1), the probability of financial aid for a given entrance GPA, [$\{F/G_i\}$] should be known. Considering Tables 6.1 and 6.2, it is seen that the values of $\{F/G_i\}$ are consistently higher in any GPA class for the shows (6.1) than for the no-shows (Table 6.2). This probably implies that, in any entrance GPA class, greater proportion of students with offer of financial aid from MSU did "show" as compared to the proportion that didn't show (no-show) with MSU's offer of financial aid. Whether this could be attributed to the presence of a higher percentage of Michigan residents (about 44 percent in the graduate school) in shows than in no-shows (an estimated 17 percent of no-shows are Michigan residents) needs further analysis. Further, this is "posterior" data and there may not have been significant differences in "a priori" probability of getting financial aid in any entrar

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Table 6.3.

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any entrance GPA class. The "a priori" probability may be obtained by pooling the data in Tables 6.1 and 6.2. This is presented in Table 6.3.

Table 6.3: Distribution of Master's Applicants (Shows and No-Shows) by Entrance GPA in Aid/No Aid Categories.

Category / Entrance GPA	Aid	No Aid	Total	$\{F\}$	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
GPA ≥ 3.5	311	398	709	0.44	0.56
3.0 ≤ GPA < 3.5	404	901	1305	.31	.69
2.5 ≤ GPA < 3.0	146	732	878	.17	.83
GPA < 2.5	21	89	110	.19* .09	.81 .91

* Based on small frequencies. Therefore, the estimate is modified by approximating it to be the same ration as $\frac{(.17)}{(.31)}$.

The frequencies in columns (2), (3) and (4) are obtained by adding the respective columns and rows of Tables 6.1 and 6.2. Columns (5) and (6) are obtained by taking the ratios of columns (2) and (3) to column (4) respectively. Column (5) in Table 6.3 is an estimate of probability of getting financial aid in the Master's program at MSU for a student in a given entrance GPA class. Here again, one can observe the decrease in chances of getting financial aid as the entrance GPA decreases.

The next step in the analysis is to calculate $\{S/FG_i\}$ and $\{S/\bar{F}G_i\}$ as shown in Table 6.4.

Table 6

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Table 6.4: Probability of Show (attendance) for Master's Applicants Given Aid/No Aid from MSU and by Entrance GPA.

Entrance GPA	$\{S/FG_i\}$	$\{S/\overline{F}G_i\}$
(1)	(2)	(3)
≥ 3.5	0.33	.23
$3.0 \leq GPA < 3.5$	.56	.29
$2.5 \leq GPA < 3.0$	.68	.38
$GPA < 2.5$	.86	.63

$$\text{Column (2) in Table 6.4} = \frac{\text{Column (2) in Table 6.1}}{\text{Column (2) in Table 6.3}}$$

$$\text{Column (3) in Table 6.4} = \frac{\text{Column (3) in Table 6.1}}{\text{Column (3) in Table 6.3}}$$

From the above table, it is evident that the probability of attendance (show) is higher with financial aid than without financial aid in any entrance GPA class. Further, the probability of "show" given financial aid increases with decrease in GPA and the probability of "show" without financial aid decreases as the GPA increases.

With Table 6.4, all the necessary information to evaluate (1) is available. This is presented in Table 6.5.

Table 6.5: Probability of Attendance of a Master's Student with a Specified Entrance GPA Given that He Has Been Offered Aid/No Aid from MSU.

Entrance GPA	$\{S/FG_i\}\{F/G_i\}$	$\{S/\overline{F}G_i\}\{\overline{F}/G_i\}$	$\{S/G_i\}$
(1)	(2)	(3)	(4)=(2)+(3)
< 3.5	(.33)(.44)	(.23)(.56)	.27
$3.0 \leq GPA < 3.5$	(.56)(.31)	(.29)(.69)	.37
$2.5 \leq GPA < 3.0$	(.68)(.17)	(.38)(.83)	.43
$GPA < 2.5$	(.86)(.09)	(.63)(.91)	.65

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Comments: For any specified entrance GPA, one can assess from Table 6.5 the probability of attendance (show) of an applicant who has been granted admission at MSU. Notice the probability of attendance increases with a fall in entrance GPA.

Tables 6.4 and 6.5 are useful for administering a limited financial budget. Table 6.4 gives an estimate of probability of attendance (show) of a person with given entrance GPA in the presence of financial aid (column 2) and in the absence of financial aid (column 3). This may imply that if a good student receives no financial aid, he is more likely to attend elsewhere (no-show for MSU) and if a poor student receives financial aid, he is very likely to attend (show for MSU). With or without financial aid in any GPA class there is always some uncertainty as to whether he will accept MSU's product package. Table 6.5 (column 4) provides a measure of this uncertainty. These probabilities may not be the same for all universities and may not be static (fixed) for a university, but in the short-run these may not change radically. The amount of financial aid, attractiveness of other variables of product package, competitors' actions, changes in people's tastes, government legislation, etc. are some of the factors that may influence these probabilities. Periodic updating of these probabilities is certainly not above the reach of a scientific management-oriented educational institution. Tables 6.1 through 6.5 may be represented in a summary form by a probability tree as shown in Figure 6.1. $\{G_i\}$ is obtained by taking the ratio of the frequency of G_i to the total frequency. For example, $\{G_i\} = \frac{709}{3002} = 0.24$. With the help of a probability

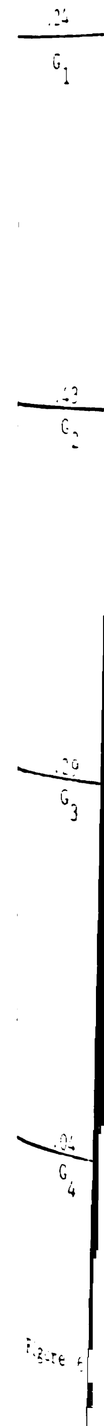
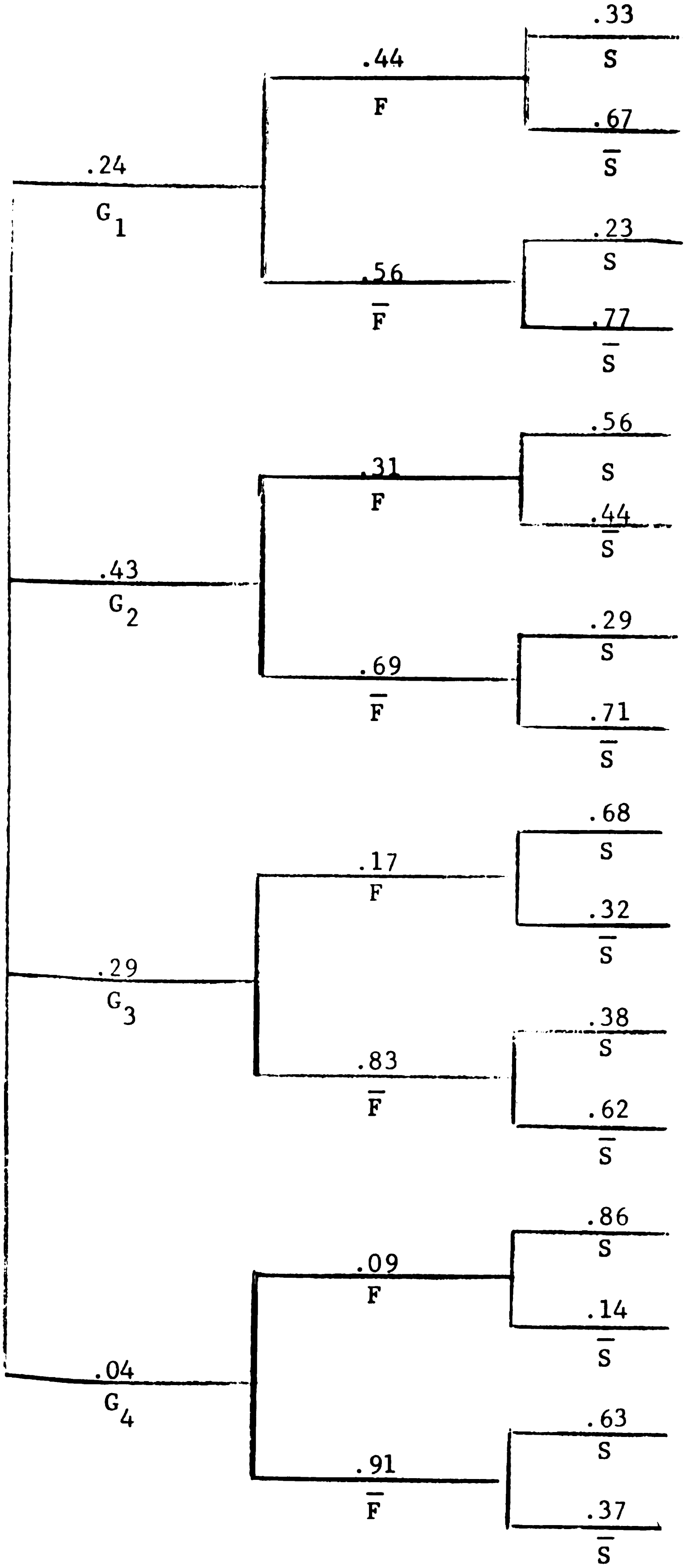


Figure 6



Where

G_1 = GPA $\geq$ 3.5

G_2 = 3.0 $\leq$ GPA < 3.5

G_3 = 2.5 $\leq$ GPA < 3.0

G_4 = GPA < 2.5

F = financial aid

$\bar{F}$ = no financial aid

S = show

$\bar{S}$ = no-show

Note: Letters below the line (branch) indicate events and the figures above the line indicate probability of that event.

Figure 6.1: Probability Tree Showing the Probability of Acceptance of MSU's Product Package with Financial Aid (F)/No Financial Aid ($\bar{F}$) by the Students of Master's Program Belonging to Different Incoming Quality Classes, G_i (entrance GPA).

tree one can answer a variety of questions using the conditional probability and Bayes theorem. The problem in hand is that of finding the probability of acceptance (show) of MSU's product package with aid/no aid by a student with a specified entrance GPA (G_i). The entrance GPA is known to the administrator in advance; what he wants to know is the probability that an individual would be a show or no-show if he offers him financial aid and if he doesn't offer him financial aid. In terms of probability, the administrator's interest is to find $\{S/G_i,F\}$ where S, G_i and F are as defined in Figure 6.1. Suppose the administrator is interested in finding the probability that a student with a GPA ≥ 3.50 would accept (show) MSU's educational product package. Using the probability tree, one can evaluate

$$\begin{aligned}\{S/G_1\} &= \{S/G_1F\}\{F/G_1\} + \{S/G_1\bar{F}\}\{\bar{F}/G_1\} \\ &= (.33)(.44) + (.23)(.56) \\ &= (0.27)\end{aligned}$$

Similarly, the probability of show (S) or no-show ($\bar{S}$) may be evaluated for any GPA class if financial aid is offered or if no financial aid is offered. In the foregoing analysis no provision was made for the amount of financial aid in assessing the probability of attendance. Most of the time, it is not only the granting of aid but also the amount of aid which would affect the student's educational buying behavior. As such, the amount of financial aid per student is an important issue in the allocation of limited funds at the disposal of the decision maker. He may be interested in assessing the probability of attendance at MSU of a student with a known entrance GPA, if he offers him the "going rate" (the "going rate" or "market rate" is estimated by the decision maker), below the going rate, or above the going rate. Consideration of "going rate" is more relevant than the fixed amount of financial aid, for obvious reasons. Such a knowledge is useful for planning and allocation of resources.

Let S = Show

G_i = i^{th} GPA class

G_1 = GPA ≥ 3.5

G_2 = $3.0 \leq$ GPA < 3.5

G_3 = GPA < 3.0 (last two classes of GPA are pooled due to lack of sufficient data)

θ_j = Measure of comparability of financial aid.

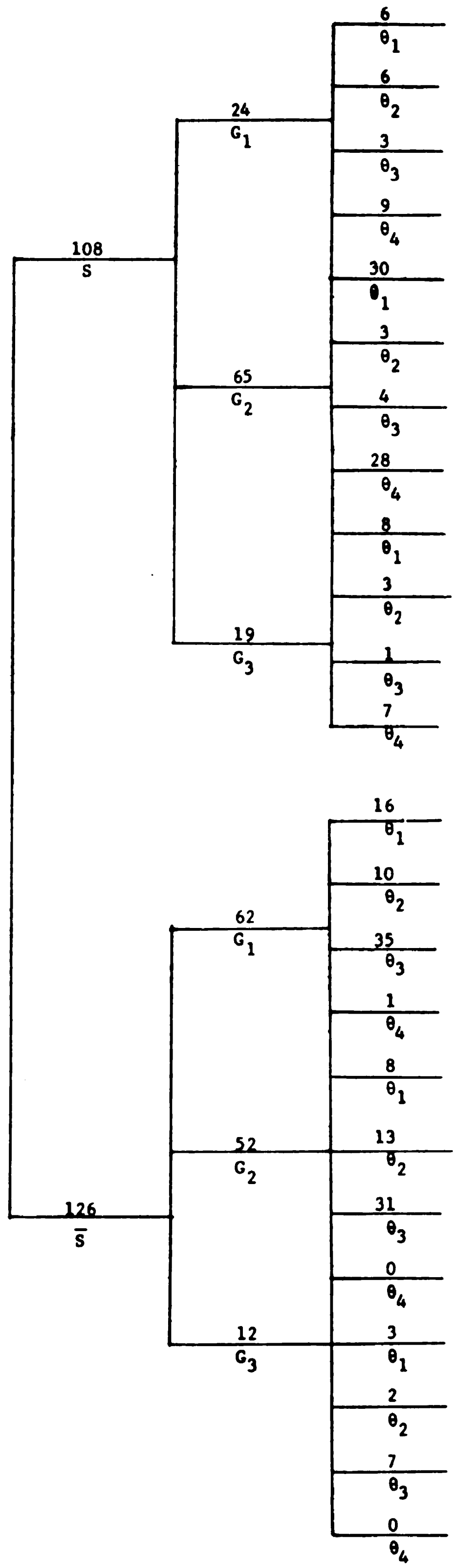
θ_1 = best other offer received is lower than MSU's offer

θ_2 = best other offer received is same as MSU's offer

θ_3 = best other offer received is higher than MSU's offer

θ_4 = those who applied for financial aid to MSU only

How much higher is "higher"?, etc. are subjective and crude approximations; assumptions (amount of financial aids are equal; every one within a GPA class has an equal chance of getting financial aid) are made to demonstrate methods of arriving at a quantitative decision rather than going into greater depths of assessing the actual amounts. Then the probability, $\{S/G_i,\theta_j\}$, may be estimated for different classes of entrance GPA and comparable ranks of financial aid offers on the basis of the survey data (column 29, card 2). The sample response is presented in Figure 6.2 and the probability tree corresponding to the data in Figure 6.3.



Where

S: Show

$\bar{S}$: No-show

G_1: GPA $\geq$ 3.5

G_2: 3.0 $\leq$ GPA $<$ 3.5

G_3: GPA $<$ 3.0

θ_1: Best other offer received is lower than MSU's offer

θ_2: Best other offer received is same as MSU's offer

θ_3: Best other offer received is higher than MSU's offer

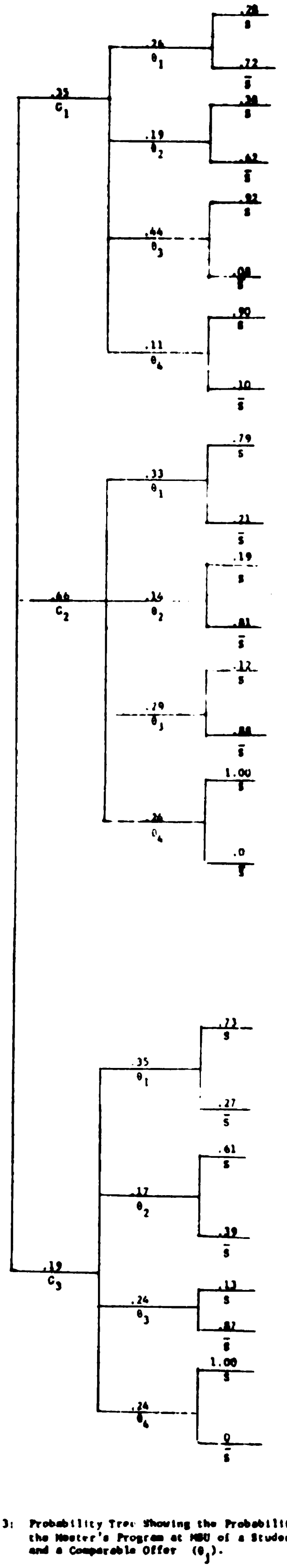
θ_4: Those who applied for financial aid to MSU only

Note: * Non response = 23

** Non response = 8

Figure 6.2: Cross Tabulation of Responses From Shows (n = 131) and No-shows (n = 134) Who Had MSU's Offer of Financial Aid by Entrance GPA and the Comparability of MSU's Offer with Other Offers Received.

Using the information in Figure 6.2 and the Tables 6.1 and 6.2, the following probability tree is obtained.



Where

S: Show

$\bar{S}$: No-Show

G_1: GPA ≥ 3.5

G_2: 3.5 ≤ GPA < 3.0

G_3: GPA < 3.0

θ_1: Best other offer received is lower than MSU's offer

θ_2: Best other offer received is same as MSU's offer

θ_3: Best other offer received is higher than MSU's offer

θ_4: Those who applied for financial aid to MSU only

Note: Letters below the line (branch) indicate events and the figures above the line indicate the probability of that event.

Figure 6.3: Probability Tree Showing the Probability of Attendance (Show) to the Master's Program at MSU of a Student with a Given GPA (G_i) and a Comparable Offer (θ_j).

Computation of the probability tree in Figure 6.3:

$\{G_i\}$ are obtained by weighing the two populations according to their size. For example $\{G_i\}$ = (.5056)(.230) + (.4944)(.477)

(Proportion of Shows in Aid Category) (Proportions of Shows with G_1) + (Proportion of No-Shows in Aid Category) (Proportion of No-Shows with G_1)

Similarly for each G_i, θ_j $j = 1,\ldots,4$ are obtained by appropriately weighing the two populations.

$\{\theta_j\}$ is obtained by taking the proportion $\dfrac{\theta_i}{\sum_{j=1}^{4} \theta_j}$ in each G_i.

The same procedure is followed to compute $\{S\}$ and $\{\bar{S}\}$. For example $\{S\}$ corresponding to G_1 θ_1 is equal to

$$\frac{(.5056)(6)}{(.5056)(6) + (.4944)(16)} = .28$$

From the probability tree the following inference could be made: The probability of "Show" ($\{S\}$) is higher (almost certain) if the applicant did not apply for financial aid to other places (θ_4). Further, the probability of attendance is lower if an individual has a higher offer than MSU's offer (θ_3) than if he has a "similar" offer in any of the entrance GPA classes. The probability of attendance is higher if the individual's other best offer is lower than MSU's offer (θ_1) than if his other best offer is higher than MSU's offer (θ_3) in any of the entrance GPA classes. However, there are some distortions in the probabilities that are worth mentioning. For example, $\{S/\theta_1\}$ may be expected to be higher than $\{S/\theta_2\}$ or $\{S/\theta_3\}$ in any G_i. This is not so under G_1. Further, $\{S/G_2\}$ drops suddenly from 0.79 given θ_1 to 0.19 given θ_2. There are at least two reasons for the wide fluctuations in the probabilities.

i) High non response to the item from Shows (36.6 percent non response from Shows as compared to 6.3 percent for that of No-Shows).

ii) Large number of frequencies are accounted by θ_4 among Shows (33.6 percent did not try elsewhere for financial aid).

With the above mentioned limitations the validity of the probabilities may be weakened to the administrator for any policy decision on financial aid allocation. One method of using the probabilities would be to take the average, assuming $\{S/\theta_i\}$ is the same for all G_i. This would yield the following probabilities:

$$\{S/\theta_1\} = .60$$

$$\{S/\theta_2\} = .39$$

$$\{S/\theta_3\} = .26$$ [3]

Even with this modification there is some inconsistency for interpretation, since $\{S/\theta_3\}$ is lower than $\{S/\bar{F}\}$ (from Table 6.4). To solve this inconsistency, one possible approach would be to treat all students who did not apply elsewhere (other than MSU) for financial aid as similar to those who applied to other places besides MSU. Under this assumption, the frequencies under θ_4 would be proportionately distributed among θ_1, θ_2 and θ_3 in each G_i. The probability tree so obtained is presented in Figure 6.4. The probabilities in Figure 6.4 are obtained in the same way as in Figure 6.3. Some of the earlier mentioned problems in

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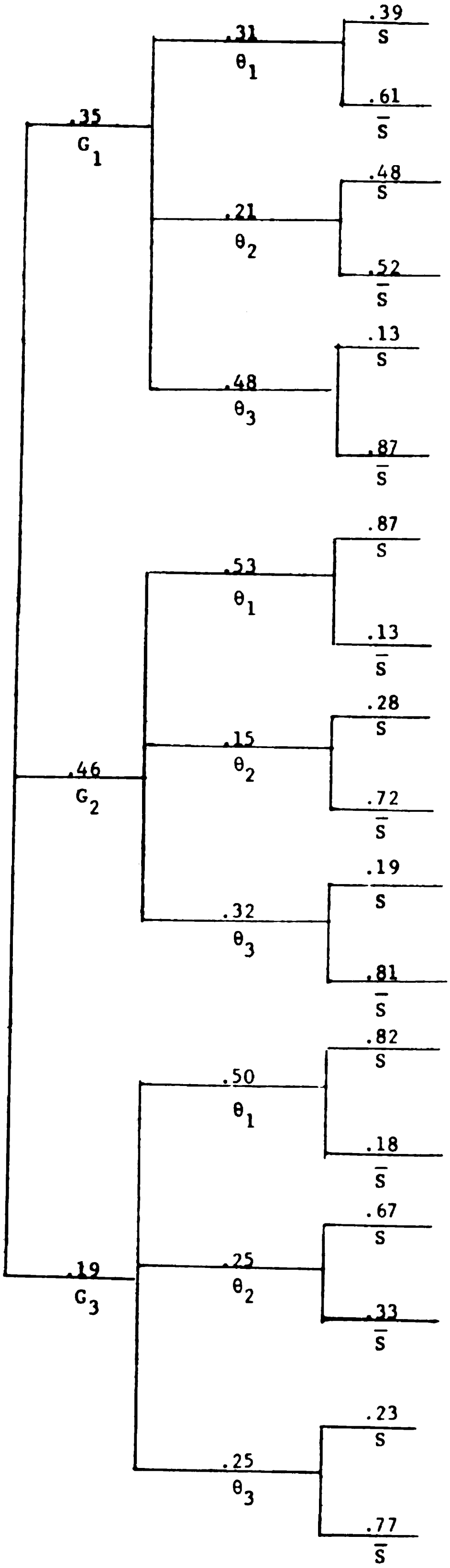
[3] Adjusted to be of same ratio as $\frac{(.39)}{(.60)}$.



Where

S: Show

$\bar{S}$: No-Show

G_1: GPA ≥ 3.5

G_2: $3.5 < \text{GPA} \leq 3.0$

G_3: GPA < 3.0

θ_1: Best other offer received is lower than MSU's offer

θ_2: Best other offer received is same as MSU's offer

θ_3: Best other offer received is higher than MSU's offer

θ_4: Those who applied for finanacial aid to MSU only

Figure 6.4: **Probability Tree Showing the Probability of Attendance (Show) to the Master's Program at MSU of a Student with a Given GPA (G_i) and a Comparable Offer (θ_j).**

(Assuming θ_4 is distributed proportionately among θ_1, θ_2 and θ_3 in each G_i)

interpretation, such as $\{S/G_1\theta_1\} < \{S/G_1\theta_2\}$, exist here, too. Taking the average, as in the earlier case:

$$\{S/\theta_1\} = .69$$

$$\{S/\theta_2\} = .48$$

$$\{S/\theta_3\} = .33^4$$

With the above modifications, these probabilities may be used for some policy decision in the allocation of financial aids.

Probabilistic Model in Determining the Policies of Financial Aid Allocation

How the incoming student quality is affected by different policies of financial aid allocation is one of the most important problems of any institution of higher education. An institution's reputation depends on the quality of its products. The quality of outgoing manpower depends on the quality of the incoming students. The incoming student quality is partly a function of the financial aid (Table 6.3.2 shows that the higher the entrance GPA, the lower the chances of attendance without financial aid). For a given amount of financial aid, what policies of allocation would yield the best incoming student quality?

The above problem may be answered utilizing the knowledge provided by the probabilistic model. It may be desirable to analyze the policies of each college since the incoming quality may differ from college to college. Lack of sufficient data precludes going into such finer classifications. So, within any level, the analysis here could only be done by the aggregation of colleges, rather than by individual college.

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4 Adjusted to be of same ratio as $(\frac{.48}{.69})$.

Incoming Student Quality to the Master's Program for Different Policies of Financial Aid Allocation The interaction between the incoming student quality and policies of financial aid allocation may be demonstrated using the Master's population.

The number of teaching and research assistantships are usually determined on the basis of teaching and research commitments of the department or college. Although the above constraint has considerably reduced the degrees of freedom of the administrator, he may still have some influence on the amount of aid per student; i.e., the required graduate assistant's or research assistant's time for a given budget be obtained from a larger number of graduate students (giving quarter time to more students) or from relatively fewer students (three-fourths time for most students). At least to this extent the administrator has some control on the number of students and the amount of financial aid per student. Incidentally, it may also be noted that the availability of graduate (teaching and research) assistantships is very much influenced by the research market, undergraduate market--for educational services as well as the university's policy on faculty time release.

The students in aid/no aid categories, both among the shows and the no-shows, are affected by the financial aid policy decision. Thus, it is appropriate to consider all of them in the analysis.

Different Policies of Financial Aid Allocation

i) Suppose there are 500 half-time financial aids of $250 each. Let it be assumed that assistantships are granted strictly on the basis of entrance GPA. Then, taking into consideration the results (based on an average financial aid of $250.) obtained in Table 6.4, the distribution of students in aid/no aid categories may be obtained as shown in Table 6.6.

Table 6.6: Distribution of Incoming Master's Student Quality in Aid/No Aid Categories Assuming Financial Aid of $250 Per Month Granted Solely on the Basis of GPA

GPA Category	G_1	G_2	G_3	G_4	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid	234	266	0	0	500	3.56
No Aid	0	241	334	69	644	2.83
Total	234	507	334	69	1144	3.15*

* Average incoming quality as measured by GPA.

Computation of the above table is as follows:

It is assumed that the number of applications meeting MSU's standards will be the same as when financial aid per student remains at $250 per month. There are 709 applicants with GPA = G_1 and $\{S/FG_1\}$ = 0.33 (from Table 6.4). Expected number of Shows = 709 (.33) = 234. The remaining 266 assistantships are offered to students with G_2. $\{S/FG_2\}$ = .56. To get an expected number of 266 shows, financial aid should be offered to 474 applicants. Out of 1305 applicants, there would still be 832 applicants in G_2, but no financial aids left. $\{S/\overline{F}G_2\}$ = 0.29 (Table 6.4). Expected number of shows = 832 (.29) = 241. Similarly, expected number of shows in G_3 given no aid = 878(.38) = 334; and the expected number of shows in G_4 given no aid = 110 (.63) = 69. With the above policy average GPA in aid category = 3.56. Since financial aid is granted solely on the basis of GPA, 266 in the aid category will have a higher GPA than 241 in the no-aid category belonging to the same GPA class. This is taken into account assuming that the 507 students are equally distributed in the GPA class (3.50 - 3.00).

Average GPA in no-aid category = 2.88

Overall GPA of new enrollment (Shows) = 3.15

Total number of shows = 1144.

ii) Let us now suppose that the total financial aid budget is the same, but it is distributed to a greater number of students (less per student, say $200 per month). The number of financial aids would be 625. Suppose $200 is considered as a below "market rate," then using the probabilistic model, the enrollment and incoming quality may be predicted as shown in Table 6.7. It is assumed that the number of applicants is not affected by such policy.

Table 6.7: Distribution of Incoming Master's Student Quality in Aid/No Aid Categories Assuming Financial Aid of $200 Per Month Granted Solely on the Basis of GPA.

GPA Category	G_1	G_2	G_3	G_4	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid	233	392	0	0	625	3.44
No Aid	0	34	334	69	437	2.71
Total	233	426	334	69	1062	3.14

Table 6.7 is computed in the same way as Table 6.6, but the average probability of $\{S/\theta_3\}$ from Figure 6.4 is used. One can notice from the table that:

Average GPA in aid category = 3.44

Average GPA in no aid category = 2.71

Overall GPA for the population = 3.14

Total enrollment = 1062

iii) Suppose the financial aid per student is increased to $300. Assuming that the total financial aid is the same, and $300 is "above the going market rate," the enrollment and incoming quality of students may be predicted using the probabilistic model as shown in Table 6.8. Here again, the number of applicants meeting MSU's standards is assumed to be the same.

Table 6.8: Distribution of Incoming Master's Student Quality in Aid/No Aid Categories Assuming Financial Aid of $300 Per Month Granted Solely on the Basis of GPA.

GPA Category	G_1	G_2	G_3	G_4	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aid	417	0	0	0	417	3.77
No Aid	24	378	334	69	805	2.97
Total	441	378	334	69	1222	3.24

With the above policy, the average GPA in aid category = 3.77

Average GPA in no aid category = 2.97

Overall average GPA of new arrivers = 3.24

Total enrollment (Shows) = 1222.

Considering (i), (ii), and (iii) the probabilistic model predicts that the incoming student quality and enrollments are higher if the average amount of financial aid is above the average "going rate." The predictability of this model is consistent with the actual state of affairs that appear to prevail in the prestigeous institutions.[1] The model shows that by increasing the amount of financial aid per student receiving financial aid, the net effect is positive (attraction of better quality students is higher than repulsion of low quality students). This demonstrates the usefulness of the probabilistic model in decision making on the allocation of scarce resources in university administration.

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1 Seymour E. Harris (1962). Op cit.

Modeling of Educational Purchase Behavior of Doctoral Students

From Tables 6.3.3 and 4.6 it is evident that the educational purchase behavior varies by the levels (Doctoral, Master's and Seniors) of higher education. Therefore, the probabilistic model developed for the Master's students may not accurately predict the educational purchase behavior of Doctoral students. Thus, an attempt is made in this section to develop a probabilistic model for the Doctoral students. The analysis is done on similar lines as for the Master's applicants using the Fall 1967 data. In the Fall 1967, 1347 students were accepted by MSU for the Doctoral program, out of which 753 actually enrolled (shows), leaving 594 as no-shows. The distribution of shows and no-shows by entrance GPA class and aid/no aid category is necessary for the development of the probabilistic model; these are presented in Tables 6.9 and 6.10 for the shows and no-shows respectively.

Table 6.9: Distribution of Doctoral Applicants (Shows) by Entrance GPA in Aid/No Aid Categories.

Category / Entrance GPA	Aid from MSU	No Aid From MSU	Total	$\{F\}$	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
≥ 3.5	234	99	333	.70	.30
$3.0 \leq GPA < 3.5$	239	123	362	.66	.34
$GPA < 3.0$	37	21	58	.65	.35
Total	510	243	753		

Computation of Table 6.9: The total in the aid category is estimated on the basis of the proportion of students receiving aid in the Doctoral program. The no-aid total is obtained by subtraction. Using Table 4.8D, the distribution by entrance GPA class is obtained.

Columns (5) and (6) are obtained by taking the ratios of columns (2) and (3) respectively to column (4). From the above table, it is seen that the probability of financial aid decreases with decreases in GPA. Comparing the above table with Table 6.1, one can infer that the probability of financial aid is higher for the Doctoral student than for the Master's student. Similarly the distribution of Doctoral no-shows in aid/no aid categories is shown in Table 6.10.

Table 6.10: Distribution of the Doctoral Applicants (No-Shows) by Entrance GPA in Aid/No Aid Categories.

Category / Entrance GPA	Aid from MSU	No-Aid from MSU	Total	$\{F\}$	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
≥ 3.5	130	236	366	.36	.64
3.0 ≤ GPA < 3.5	97	101	198	.49	.51
GPA < 3.0	17	13	30	.57	.43
Total	244	350	594		

Column (4) total is estimated from the first systematic sample. Column (2) total is estimated from the data secured from the departments through the Graduate Dean's office. The distributions by entrance GPA in (2) and (3) are estimated from the responses to the questionnaires. As earlier, columns (5) and (6) are obtained by taking the ratios of Columns (2) and (3) respectively to column (4).

The estimated probabilities in (5) and (6) of Table 6.10 appear to be misleading in the sense that the probability of financial aid appears to increase as the entrance GPA decreases. There are several possible explanations for observing this phenomenon.

i) This may imply that a smaller proportion of people with GPA equal to or better than 3.5 rejected (No-Shows) MSU's offer of aid, whereas a greater proportion of those in lower GPA classes rejected (No-Shows) the financial aid (might have received a better product package from elsewhere).

ii) This may imply that the entrance GPA is not the only criterion on which the granting of financial aid is based. Probably at the doctoral level they may be looking at

a) Test scores (GRE)

b) The school from which the applicant got his highest degree. Some administrators consider this as an important criterion in predicting the success in the doctoral program on the basis of accumulated evidence.

c) Ability (previous experience) to assist in teaching.

iii) Students apply to the doctoral program with the bachelor or master's degree. This heterogeneity in the minimum qualification makes the entrance grade point average not directly comparable.

These are some of the possible explanations of the observed probabilities in column (5) of Table 6.10.

From Tables 6.9 and 6.10 the pooled estimates for the distribution of doctoral applicants in Aid/No Aid categories by entrance GPA are obtained as presented in the Table 6.11.

Table 6.11: Distribution of All Doctoral Applicants by Entrance GPA in Aid/No Aid Categories.

Category Entrance GPA	Aid from MSU	No Aid from MSU	Total	{F}	$\{\bar{F}\}$
(1)	(2)	(3)	(4)	(5)	(6)
≥ 3.5	364	335	699	.52	.48
3.0 ≤ GPA < 3.5	336	224	560	.60	.40
GPA < 3.0	54	34	88	.61	.39
Total	754	593	1347		

Columns (2), (3) and (4) of Table 6.11 are obtained by adding the respective columns in Table 6.9 and 6.10. From Tables 6.9 and 6.10 one can obtain $\{S/FG_i\}$ and $\{S/\bar{F}G_i\}$ as shown in Table 6.12.

Table 6.12: Probability of Attendance of a Doctoral Student Given Aid/No Aid and by Entrance GPA.

Entrance GPA	$\{S/FG_i\}$	$\{S/\bar{F}G_i\}$
(1)	(2)	(3)
≥ 3.5	.64	.30
3.0 ≤ GPA < 3.5	.71	.55
GPA < 3.0	.80*	.62

With the help of the above information one can evaluate (1). This is tabulated in Table 6.13.

Table 6.13: Probability of Attendance of a Doctoral Student Given Aid/No Aid from MSU and by Entrance GPA.

Entrance GPA	$\{S/FG_i\}\{F/G_i\}$	$\{S/\bar{F}G_i\}\{\bar{F}/G_i\}$	$\{S/G_i\}$
(1)	(2)	(3)	(4)
≥ 3.5	(.64)(.52)	(.30)(.48)	.48
3.0 ≤ GPA < 3.5	(.71)(.60)	(.55)(.40)	.65
GPA < 3.0	(.69)(.61)	(.62)(.39)	.66

* Adjusted to be the same ratio as $(\frac{.71}{.64})$.

Comments: As in Table 6.5, it may also be noted in Table 6.13 that the probability of show increases with a fall in entrance GPA. Another interesting feature is that the analysis indicates that the probability of show is higher for a doctoral applicant than a master's applicant in the corresponding entrance GPA class. This might have to do with the attraction value MSU provides to doctoral applicants in terms of probably more financial aids, teaching and research experiences, and other value satisfactions such as inexpensive and convenient married housing and employment opportunities for student wives (76 percent of doctoral students are married as compared to 55 percent of the master's students).

The predictive knowledge that has been demonstrated in Tables 6.5 and 6.13 is of immense value to the administrators in terms of the multitude of marketing variables, such as allocation of financial aids, available to effectively achieve the predetermined goals of the educational institution.

The same results may be obtained using a probability tree as demonstrated in the case of master's applicants. Because of the redundancy of the analysis, it is not being presented here. However, the knowledge of how the decisions are made by the students if they have a lower, same or a better offer of financial aid than that of MSU may be of interest to the decision maker. Therefore, it is presented in the form of a probability tree for analysis as shown in Figure 6.5. The probabilities, as in the earlier case, are estimated from the sample response (Figure 6.5) and the distribution of Doctoral shows and no-shows by GPA class (Tables 6.9 and 6.10 respectively).

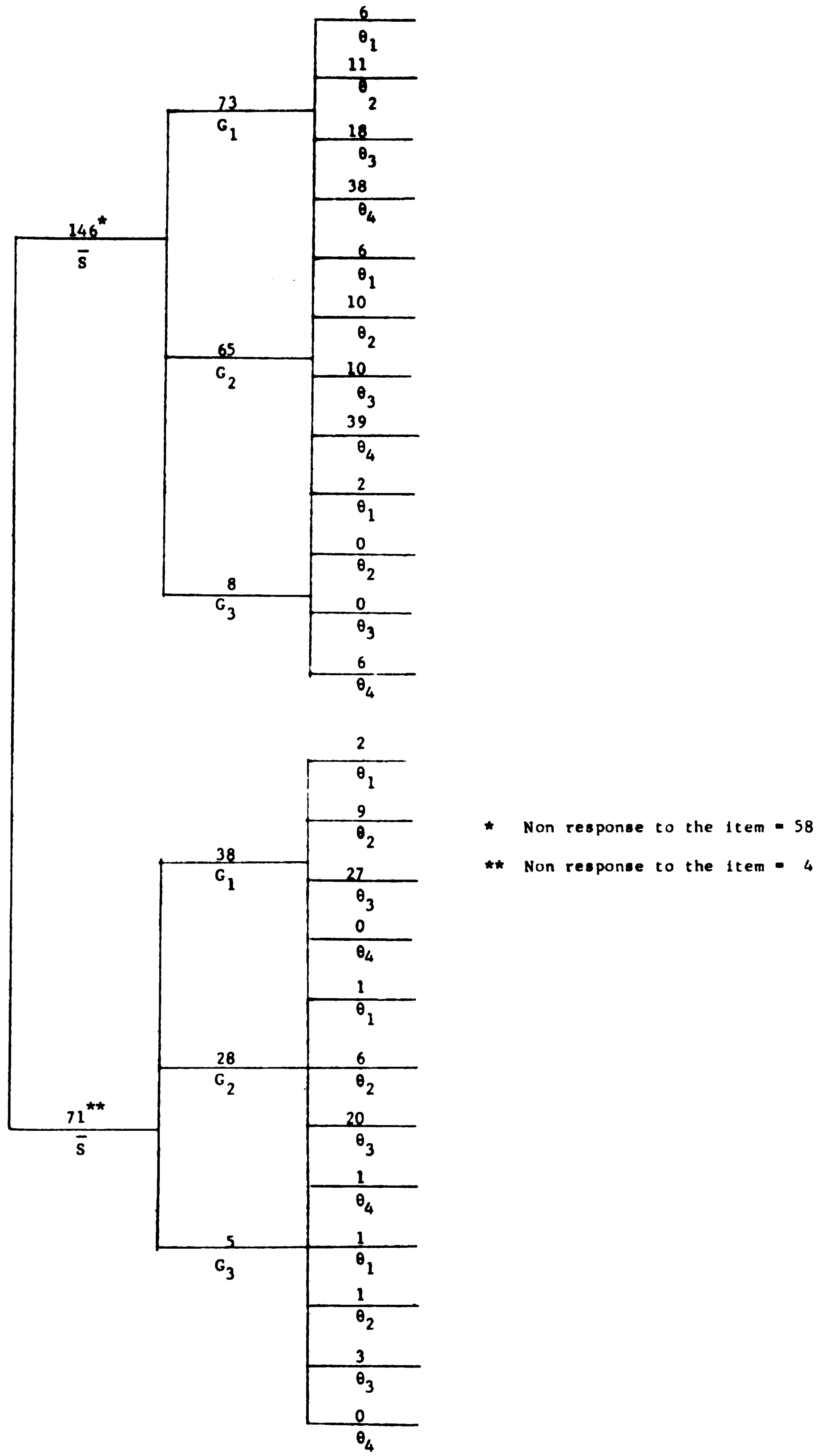


Figure 6.5: Cross Tabulation of Sample Survey Data of Fall 1967 Doctoral Shows and No-Shows (with MSU's offer of financial aid) by Entrance GPA and Comparability of Other Best Offer Received.

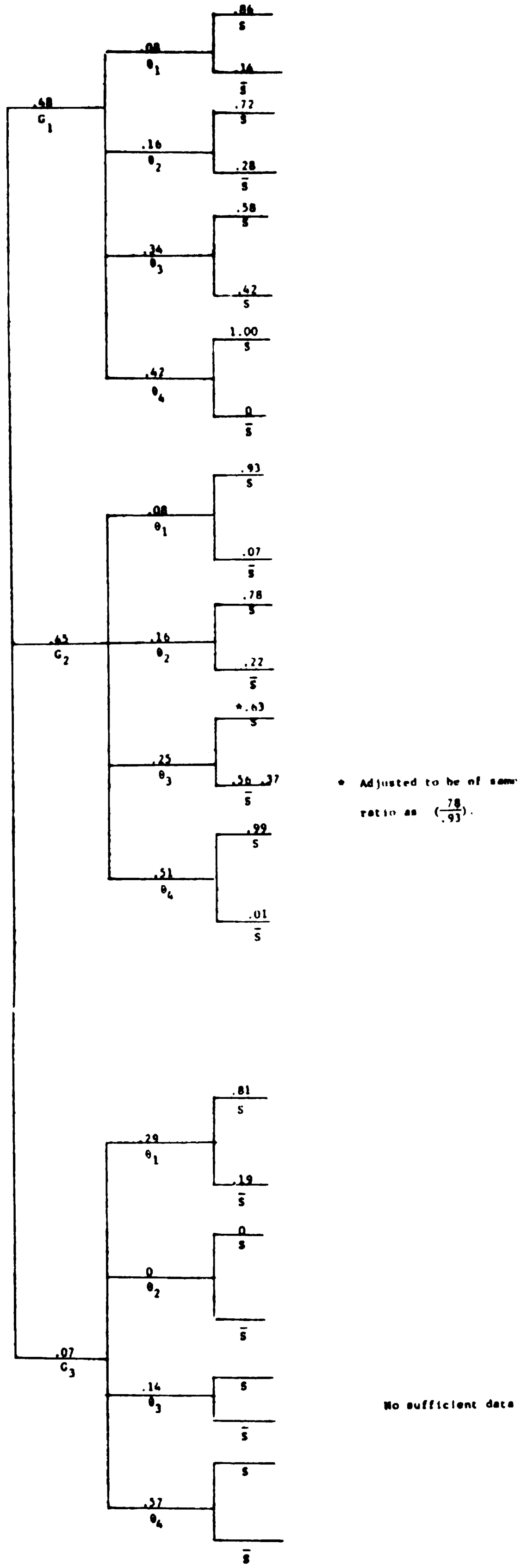


Figure 6.6: Probability Tree Showing the Probability of Attendance of a Doctoral Applicant by Entrance GPA and a Comparable Offer of Financial Aid From MSU.

From Figure 6.6, it is seen that the probability of attendance (show) is higher if MSU's offer is higher than the other best offer (θ_1) than if it is equal or lower in any GPA class. Comparing Figures 6.4 and 6.6, one could infer that the probability of show is higher for a Doctoral student than for the corresponding master's student. If the above probabilities could be assumed to be correct, this may indicate at least a couple of things. First, it appears that MSU offers a better value satisfaction in terms of educational product package to the doctoral students than to the master's students. Second, it may be due to the limited number of alternatives (number of schools offering similar programs) open to the doctoral candidates. The observed phenomenon that probability of attendance is greater if he is a doctoral student than if he is a master's student $[\{S/G_i, \theta_j\}_D > \{S/G_i, \theta_j\}_M]$ appears to be consistent with the experience of MSU administrators. The next step is to demonstrate how the model can be applied by the administrator in his decision making on the allocation of limited financial aids to predict the enrollment and incoming student quality for various administrative policies.

Probabilistic Model To Predict Doctoral Enrollment and Incoming Student Quality for Different Policies of Financial Aid Allocation

i) Suppose there are 600 half-time assistantships intended for new doctoral applicants, each valued at $300 per month, and suppose the allocation of financial aid is solely on the basis of entrance GPA. Using Tables 6.11 and 6.12, the resulting new enrollment and incoming student quality may be obtained as presented in Table 6.14.

Table 6.14: Distribution of Incoming Doctoral Student Quality in Aid/No Aid Categories Assuming Financial Aid of \$300 Per Month Granted Solely on the Basis of GPA.

GPA	G_1	G_2	G_3	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)
Aid	449	151	0	600	3.66
No Aid	0	191	54	245	3.05
Total	449	342	54	845	3.48*

* Average incoming quality of students to the doctoral program.

The figures in the above table are obtained exactly the same way as those in Table 6.6. As the average financial aid in the doctoral program was about \$300 per month during the reference period of Table 6.12, and if the number of applicants (Table 6.11) could be assumed to be the same, then the above table values may be obtained by multiplying the number of applicants with the probability of attendance in corresponding GPA class and aid/no aid category.

ii) Suppose the total amount of financial aid available is the same as in (i), but the administrator decides to offer \$250 per month, again strictly on the basis of GPA; then the resulting enrollment and incoming student quality may be obtained as shown in Table 6.15.

Table 6.15: Distribution of Incoming Doctoral Student Quality in Aid/No Aid Categories Assuming Financial Aid of \$250 Per Month Granted Solely on the Basis of GPA.

GPA	G_1	G_2	G_3	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)
Aid	407	313	0	720	3.54
No Aid	0	35	54	89	2.94
Total	407	348	54	809	3.47*

* Average incoming quality of students to the doctoral program.

The above table is obtained by assuming \$250 per month is "below market rate" ($\{S/G_i, \theta_3\}$ in Figure 6.6) and also assuming the number of applications (Table 6.11) is not affected by such a policy. Comparing Tables 6.14 and 6.15, one may infer that the enrollment as well as average incoming quality decreases as the amount of financial aid per student receiving aid decreases. It is of interest to know what happens (as predicted by the model) if the financial aid is increased.

iii) Let it be assumed that the total amount of financial aid available is the same, but the administrator decides to allocate \$350 per month for a student receiving financial aid. Assuming that \$350 per month is "above market rate" and assuming that the number of applicants is unaffected by such a policy, using Tables 6.11 and 6.6 the following table showing the resulting enrollment and incoming quality of students may be obtained.

Table 6.16: Distribution of Incoming Doctoral Student Quality in Aid/No Aid Categories Assuming Financial Aid of \$350 Per Month Granted Solely on the Basis of GPA.

GPA	G_1	G_2	G_3	Total	Average GPA
(1)	(2)	(3)	(4)	(5)	(6)
Aid	514	0	0	514	3.76
No Aid	30	308	54	392	3.20
Total	544	308	54	906	3.52*

* Average incoming quality of students to the doctoral program.

Discussion: From Tables 6.14 through 6.16, the following inference may be made under the specified assumptions.

Assumptions: All colleges offering doctoral programs at MSU are equally good and equally competitive and admit a uniform quality of students. All colleges offer an equal amount of financial aid and the demand is uniform in all fields. GPA is a valid measure of incoming student quality.

Inference:

i) Allocation of financial aid strictly on the basis of GPA yields a better average quality of incoming student (3.48 as compared to 3.43) and also attracts more students (845 as compared to 754).

ii) For a given amount of total financial aid, the enrollment as well as average quality of incoming student would be higher if the financial aid per student receiving aid is higher than the "market rate" than if it is same or below the "market rate."

iii) By spreading the given amount of financial aid to fewer students (more per student receiving aid), the resulting net effect (attraction of some good students and loss of some average or below average students) is positive; i.e., by spreading the total available financial aid to more students, the university may be offering aid to some students who may attend the university anyway. In such a case it does not necessarily increase the selective demand.

iv) It could be shown on similar lines that, when the enrollment is also fixed, then the policy that offers higher than "market rate" also increases minimum standards of MSU's acceptance of students to the doctoral program. It is evident that there is a positive interaction between the amount of financial aid offered and the enrollment, as well as incoming student quality. The social welfare aspects of concentrating aid on fewer students as compared to diluting the same and spreading it to more students is itself a separate issue which falls outside the scope of the present research. This demonstrates the usefulness of the probabilistic model in decision-making in the administration of the university's scarce resources. The present research concludes with the summary of findings and implications presented in the next chapter.

CHAPTER VII

CONCLUSIONS AND MODELING IMPLICATIONS

The concluding chapter focuses on two points: i) summary of the findings, and ii) recommendations for future studies.

i) Summary of Findings

The differences in acceptance or rejection of graduate education from MSU are seen to be associated with two types of variables--individual variables and environmental variables (often termed as I and E variables). The individual variables may again be split into academic characteristics and the perception of the environment (university variables). The evidence of strong association between the above set of variables and buying behavior does not directly establish the causal relationship: one can arrive at such a conclusion only on an inferential basis. Treating the graduate educational purchase behavior as a dependent variable and individual characteristics and environmental variables as independent variables, this study has focused on finding the relationships between educational purchase behavior and the set of independent variables. The issues considered in the investigation are:

i) Finding the similarities and dissimilarities between those who accepted MSU's graduate educational product package, shows, and those who rejected MSU's graduate educational product package, no-shows.

ii) The descriptive knowledge on the similarities and dissimilarities has been utilized to predict whether an applicant would be a show or no-show on the basis of certain known characteristics.

iii) The final focus was on identification of important variables that are supposed to influence the selective demand for graduate education. Considering financial aid as a control variable, a Probabilistic Model was presented in order to describe and predict the graduate educational purchase behavior at MSU.

The following are the major findings of this study:

1. There are similarities and dissimilarities between shows and no-shows with respect to academic characteristics, perceptions of the MSU variables, and the demographic and economic characteristics of the individual. On the basis of the dissimilarities, it is possible to aid prediction of whether an applicant will be a show or no-show.

2. The acceptance or rejection of graduate education from an institution is influenced by a number of variables, some of which may be controlled (manipulated) by the administrator whereas some others may not.

3. The set of variables that influence acceptance or rejection of an educational product is different for different levels of higher education. At the doctoral level, curriculum in the major field, faculty reputation, general reputation and financial aid are considered to be most influential in the choice of a university, whereas at the senior level, general reputation, curriculum in the major field, location of campus and costs including tuition are considered to be most influential.

4. In the above set of influential variables, it is financial aid that may be varied by the administrator subject to the constraint

of meeting the teaching and research commitments. Further, there is evidence to believe that financial aid is a more influential variable in the choice of a university than most people admit.

5. The effect of financial aid on enrollment and incoming student quality is estimated. The effect of financial aid is greater at higher levels (Doctoral and Master's) than at the lower levels (undergraduate) of higher education.

6. In any level of higher education, the higher the quality of student, the lower the chances of his accepting the educational product without financial aid.

7. The higher the quality of student, the higher the number of alternatives (admissions and financial aid offers) at his disposal. The higher the number of alternatives, the lower the chances of accepting a given educational product; i.e., the incoming student quality is directly proportional to the availability of financial aid.

8. Treating financial aid as a control variable, a Probabilistic Model to describe the graduate educational purchase behavior is developed for different entrance GPA classes within a level. Given the entrance GPA, the model can predict the probability of "show" (for MSU) with aid or without aid.

9. The model also demonstrates how the purchase behavior of education by an individual with a given GPA varies with different policies of financial aid allocation, such as when the offer is below "market rate," same as "market rate," or above "market rate." The probability of show is higher if MSU's offer is higher than the best other offer, than if it is equal or lower.

10. For a given amount of total financial aid, the enrollment as well as the average quality of incoming students would be higher if the financial aid per student receiving aid were higher than the "market rate" than if it were the same or below the "market rate."

Implications of the Above Findings in Marketing the Educational Services:

1. Consumers at different levels of higher education (Doctoral, Masters and Seniors) look for different "mixes" of ingredients (university variables). Therefore, the marketing strategies of educational services should be different.

2. Even within any level of higher education, the strategies may vary depending on the segment of the market (quality of students) to be appealed to by the educational institution.

3. Financial aid is an important variable in attracting quality students, but it alone cannot attract enough quality students. Blending of a balanced "mix" of ingredients (curriculum development, recruitment of well-known faculty, etc.) that will make the product more acceptable seems to be very important in marketing educational services.

4. For a given financial aid budget the policy that allocates financial aid to fewer students (more students receiving aid) increases the incoming quality of students as well as the enrollments. This may imply two things: first, by such a policy the gain from the good students due to attractive financial aid is higher than the loss due to the nonavailability of financial aids for "average" students. Second, such a policy also increases the minimum standards of granting admissions if the size of graduate

school by level and field is fixed; i.e., the standards must be raised due to increase in demand caused by the more attractive financial aid offers.

ii) Recommendations For Future Studies

Progress in any science is rapid if the time lag between the theoretical developments and the applications is minimal. Some theoretical models of resource allocation (say state-space model) exist, but the lack of quality data is a contributing factor for the slow progress in the applied side. Though this is a virgin area for fruitful research, the researcher is very much handicapped by lack of established research methodology in this field. Following are some of the suggestions which may contribute towards narrowing such a gap.

a) In modeling the student sector, it may be better to standardize the grade point average or develop some other quality index (a combination of various test-scores) for measuring the incoming student's quality.

b) Information on "resident/non-resident" or data on the origin of the applicant may be important in determining the educational purchase behavior.

c) Instead of assuming all financial aids to be of equal value, the amount may be expressed in standard units since the amount of aid is also an important factor influencing a student's purchase behavior of education.

d) There are many variables influencing a student's purchase behavior of education. All these variables may not necessarily be non-overlapping. A rational approach may be to group variables belonging to the same category and develop an index (measure) for each group of variables (say, socio-economic characteristics). This is likely to relieve the researcher from some problems of measurement and analysis.

APPENDICES

TERMS AND DEFINITIONS

QUESTIONNAIRES

REGRESSION MODEL

SYSTEMS MODEL

APPENDIX 1

TERMS AND DEFINITIONS

Education: Refers both to the process (learning) and to its result--product (developed manpower). Thus, the same word refers to the means as well as the goals.

Show: An applicant who has accepted an educational product offered by MSU at a particular point of time.

No-Show: An applicant who has not accepted an educational product offered by MSU during a specified time period. This may imply that he has accepted a product at another university or postponed attending a school.

Financial Aid: Financial aids include teaching assistantships, research assistantships, fellowships, scholarships, tuition scholarships and grants.

Fellowship or Scholarship: Fellowship or scholarship may be defined as a grant made to an exceptionally able, but financially needy student to aid him to continue his education.

Teaching or Research Assistantship: Teaching or research assistantship may be defined as an aid usually granted to an exceptionally promising graduate student as a subsidy to reduce the price of education. A student receiving such aid is expected to devote a specified number of hours per week in assisting teaching or research commitments of the department granting such aid.

Symbols:

$\{\ \}$ Indicates the probability of an event

S/F Indicates the event S given the occurence of event F.

{S/F} Indicates the conditional probability of an event S given the occurrence of event F.

{S/G,F} Indicates the conditional probability of an event S given the joint occurrence of events G and F.

APPENDIX 2

SAMPLING OF NO-SHOWS FROM THE RECORDS OF THE ADMISSIONS OFFICE AT MSU

Particulars noted from each of the selected applicant:

Name:

Sex:

Marital Status:

Date of Birth:

Degree or Credits Earned:

Applied to (Dept.): Admission: __________ Financial Aid: ______

Level:

School Last Attended:

GPA:

Home Address:

CARD DESIGN INDEX (CDI) for the above information

Card 1:

Columns	Particulars Recorded
1-3	Identification number
4-23	Name
24-43	Number and street
44-58	City
59-78	State and zip code (zip code 74-78)
80	Punch "3"

Card 2:

Columns	Particulars Recorded
1-3	Identification number
4	Sex
5	Marital Status
6-9	Date of birth (Month and year)
10-11	Degree/credits earned
12-13	Applied to (Dept. code)
14	Admission and financial aid
15-16	Level of admission
17-22	School last attended
23-26	GPA (2-place decimal)
80	Punch "4"

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

COLLEGE OF ENGINEERING · ENGINEERING BUILDING

May 1, 1968

APPENDIX 3-1: Copy of the Letter Mailed Along with the Questionnaire to the Shows.

To: (Advanced Students at MSU)

As part of a research program sponsored by the National Science Foundation, Office of Education and Manpower Studies we are conducting an in depth study of the decisions made by graduates in selecting their graduate schools This information will be used in an effort to determine the influence of various financial aid programs on graduate enrollments and in an effort to model, mathematically, certain aspects of the university business operation.

We are drawing a random sample of about 10% of our graduate and senior student population. The fact you have this questionnaire in hand implies that you are part of this random sample.

Your answers will be held in strict confidence by our staff members and the analysis will in no way associate your name with your answers. We must ask for student numbers in order to know which persons in the random sample have not returned their answers to us.

For your convenience, we are enclosing a postage paid, self addressed envelope. However, we prefer the questionnaire be returned by Campus mail. The pilot study indicated that it takes about 20 minutes to fill out the questionnaire.

We thank you in advance for your cooperation. Your cooperation will help us answer questions that are of direct concern to the institutions of higher education.

Sincerely,

H E Koenig

H. E. Koenig, Director
Systems Science Program

HEK:nab
enclosure

APPENDIX 3-1: Questionnaire Sent to the Shows.

SURVEY OF ADVANCED STUDENTS AT MSU - SPRING 1968

Systems Science Group
Division of Engineering Research
Michigan State University

1. What is your major (department)? ______________________________

2. What are your minors (departments), if any?

a) ______________________________
b) ______________________________
c) ______________________________

3. What is your program level? (PLEASE CHECK ONE)

a) Senior	☐	(15-4)
b) Master's candidate	☐	(15-6)
c) Doctoral candidate	☐	(15-7)
d) 3rd or 4th year Veterinary Medicine	☐	(15-9)
e) Other (SPECIFY) ______________________	☐	(15-1)

4. What is your sex? (CHECK ONE)

a) Male	☐	(16-1)
b) Female	☐	(16-2)

5. What is your marital status? (CHECK ONE)

a) Single	☐	(17-1)
b) Married	☐	(17-2)
c) Widowed, Divorced or Separated	☐	(17-3)

6. If married, does your spouse earn part of your family income? (CHECK ONE)

a) Yes	☐	(18-1)
b) No	☐	(18-2)

7. When did you first consider the possibility of attending MSU? (CHECK ONE)

a) 8th grade or earlier	☐	(19-1)
b) 9th - 10th grade	☐	(19-2)
c) 11th - 12th grade	☐	(19-3)
d) During the years between high school and undergraduate	☐	(19-4)
e) During undergraduate years	☐	(19-5)
f) During the years I was not in school between undergraduate and graduate	☐	(19-6)
g) During graduate years	☐	(19-7)
h) During the time I was not in school after graduate studies	☐	(19-8)

8. Do any of your family members (parents, wife, brothers, sisters) attend, or have they attended, MSU? (CHECK ONE)

a) Yes	☐	(20-1)
b) No	☐	(20-2)

9. Who other than yourself do you think had the most influence upon your decision to come to MSU? (CHECK ONE)

a) No one else	☐	(21-1)
b) Parents	☐	(21-2)
c) Faculty at MSU	☐	(21-3)
d) Teachers in high school	☐	(21-4)
e) High school counselor	☐	(21-5)
f) Other alumni of MSU	☐	(21-6)
g) High school friends	☐	(21-7)
h) Others (SPECIFY)	☐	(21-8)

____

10. What type or types of financial resources are supporting your studies at MSU? (CHECK AS MANY AS APPLY)

a) Financial aid**	☐	(22-1)
b) Campus job (full or part-time)	☐	(23-1)
c) Off-campus job (full or part time)	☐	(24-1)
d) G.I. Bill	☐	(25-1)
e) Wife's earnings	☐	(26-1)
f) Personal savings	☐	(27-1)
g) Parental assistance	☐	(28-1)
h) Loan	☐	(29-1)
i) Other resources (SPECIFY)	☐	(30-1)

____

11. In the above list of resources which <u>one</u> contributes the major part of your income? (CIRCLE THE LETTER TO THE LEFT OF THE RESOURCE CHOSEN) (31)

<u>IF YOU ARE NOT RECEIVING FINANCIAL AID, PLEASE SKIP TO QUESTION 14.</u>

12. If you receive financial aid, what type of financial aid is it? (CHECK ONE)

a) Graduate Teaching Assistantship	☐	(32-1)
b) Graduate Research Assistantship	☐	(32-2)
c) Fellowship	☐	(32-3)
d) Tuition scholarships only	☐	(32-4)
e) Other scholarship	☐	(32-5)
f) Other aid (SPECIFY)	☐	(32-6)

____

**Financial Aids in the present study include teaching assistantships, research assistantships, fellowships, scholarships, tuition scholarships and grants.

NOTE: Financial Aids do <u>not</u> include loans.

13. If you receive either a fellowship, scholarship or tuition scholarship, which one of the following statements is true about the financial aid you receive? (CHECK ONE)

a) It is specified to a particular field of study and can be used at MSU only. ☐ (33-1)

b) It is general (unspecified as to field) and can be used at MSU only. ☐ (33-2)

c) It is specified to a particular field of study and would be valid at any university I chose to attend. ☐ (33-3)

d) It is general (unspecified as to field) and would be valid at any university I chose to attend. ☐ (33-4)

14. At the time you completed the formal application requesting financial aid, did you already have an informal understanding from a faculty member at MSU that financial aid would be available to you? (CHECK ONE)

a) Yes ☐ (34-1)

b) No ☐ (34-2)

c) Not sure ☐ (34-3)

d) Did not apply for financial aid ☐ (34-4)

15. Which one of the following statements is true of all financial aid you ever received? (CHECK ONE)

a) I received financial aid continuously since the beginning of my present degree program (including Summer). ☐ (35-1)

b) I received financial aid continuously since the beginning of my present degree program (except Summer). ☐ (35-2)

c) I received financial aid continuously, but it began after I started my present degree program (except possibly Summer terms). ☐ (35-3)

d) I received financial aid intermittently in my present degree program. ☐ (35-4)

e) I did not receive any financial aid in my present degree program. ☐ (35-5)

16. Please indicate how attractive each of the following characteristics of MSU was when you made the decision to come to MSU. (CIRCLE ONE NUMBER IN EACH ROW BELOW)

	Very Unattractive	Unattractive	Neither	Attractive	Very Attractive	
__a) Curriculum of my major	1	2	3	4	5	(36)
__b) Faculty reputation in my field	1	2	3	4	5	(37)
__c) General reputation of the university	1	2	3	4	5	(38)
__d) Financial aid through the university	1	2	3	4	5	(39)
__e) Off-campus job opportunities for myself and wife	1	2	3	4	5	(40)
__f) Campus job opportunities for myself and wife	1	2	3	4	5	(41)
__g) Educational facilities (library, computer, etc.)	1	2	3	4	5	(42)
__h) Location of campus	1	2	3	4	5	(43)
__i) Appearance of the campus	1	2	3	4	5	(44)
__j) Employment opportunities after completion of degree	1	2	3	4	5	(45)
__k) Low costs (tuition and other expenses)	1	2	3	4	5	(46)
__l) Loan facilities	1	2	3	4	5	(47)

17. Please select the <u>five</u> factors from the list (a through l) in question 16 which you think are <u>most</u> influential in your decision to attend a university. Rank them in order of their influence by filling the numbers one (1) through five (5) in the spaces to the left in question 16.

NOTE: 1 = Most influential

5 = Least influential

18. Please name some university (other than Michigan State University) you know well.

____
Name (without abbreviation)   Location (city and state)

19. How did you first get to know about the university named in question 18?

a) I was a student there in the past. ☐ (66-1)

b) I knew someone who was a student there. ☐ (66-2)

c) I know about it in some other way. (SPECIFY) ☐ (66-3)

____

20. Compared to the university named in question 18, how would you rate MSU on each item below? (CIRCLE ONE NUMBER IN EACH ROW)

	MSU is much worse	MSU is worse	no opinion	MSU is better	MSU is much better	
a) Financial aid available	1	2	3	4	5	(7)
b) Library facilities	1	2	3	4	5	(8)
c) Computer facilities	1	2	3	4	5	(9)
d) Faculty guidance	1	2	3	4	5	(10)
e) Curriculum	1	2	3	4	5	(11)
f) Workshops	1	2	3	4	5	(12)
g) Costs including tuition fees	1	2	3	4	5	(13)
h) Friendliness of students	1	2	3	4	5	(14)
i) Intercollegiate athletics	1	2	3	4	5	(15)
j) Housing for married students	1	2	3	4	5	(16)
k) Dormitories	1	2	3	4	5	(17)
l) Academic reputation	1	2	3	4	5	(18)
m) Instruction	1	2	3	4	5	(19)
n) Loan facilities	1	2	3	4	5	(20)
o) Student-faculty ratio (graduate)	1	2	3	4	5	(21)
p) Student-faculty ratio (undergraduate)	1	2	3	4	5	(22)

21. When you applied to MSU, to how many other universities did you apply simultaneously?

Number: ____________ (24)

22. How many of these universities admitted you?

Number: ____________

23. Did you apply for financial aid at MSU and/or other universities? (CHECK ONE)

a) At MSU	☐	(26-1)
b) At other universities	☐	(26-2)
c) At both MSU and other universities	☐	(26-3)
d) Did not apply for financial aid	☐	(26-4)

24. If you did ask for financial aid, what is the main reason you decided to ask for financial aid? (CHECK ONE)

a) I needed the money to continue my education.	☐	(27-1)
b) I desired the professional and educational benefits of work experience.	☐	(27-2)
c) I felt that my past record justified financial aid.	☐	(27-3)
d) Other reasons (SPECIFY)	☐	(27-4)

____

25. Did you receive offers of financial aid from MSU and/or other universities? (CHECK ONE)

a) From MSU	☐	(28-1)
b) From other universities	☐	(28-2)
c) From both MSU and other universities	☐	(28-3)
d) Did not receive offers of financial aid	☐	(28-4)

26. If you checked "C" above, how does MSU's offer compare with the best of the other offers? (CHECK ONE)

a) Higher than MSU's offer	☐	(29-1)
b) Same as MSU's offer	☐	(29-2)
c) Lower than MSU's offer	☐	(29-3)
d) Not comparable to MSU's offer	☐	(29-4)

27. How many of the other universities offered you financial aid?

Number: __________ (30)

28. If MSU had not given you financial aid, what would have been your most likely action? (CHECK ONE)

a) I would have gone to another school. ☐ (31-1)

b) I would have looked for employment (campus or off-campus) and attended MSU. ☐ (31-2)

c) I would have used other forms of support (loans, etc., parents-wife support) and attended MSU. ☐ (31-3)

d) I would have accepted employment and post-poned attending school. ☐ (31-4)

e) Difficult to say. ☐ (31-5)

29. In the absence of financial aid from MSU what was the probability you would have attended MSU? (CHECK ONE)

a) 0% chance ☐ (32-1)

b) 1% to 20% chance ☐ (32-2)

c) 21% to 40% chance ☐ (32-3)

d) 41% to 60% chance ☐ (32-4)

e) 61% to 80% chance ☐ (32-5)

f) 81% to 99% chance ☐ (32-6)

g) 100% chance ☐ (32-7)

30. Why did you decide to obtain the degree (B.A., M.S., Ph.D., etc.) you are now working on? (CHECK BOXES ON RIGHT)

a) Someone else thought I should go to graduate school. ☐ (33)

b) I am interested in pursuing advanced studies for scholarly reasons. ☐ (34)

c) The type of career I want requires this degree. ☐ (35)

d) I could not get the job I wanted, so I decided to stay in school. ☐ (36)

e) Other factors (PLEASE SPECIFY) ☐ (37)

____

31. Please select the one factor from the list in question 30 which you think was <u>most</u> influential in your decision. (CIRCLE THE LETTER TO THE LEFT OF THE STATEMENTS IN QUESTION 30) (38)

32. Which one of the following statements is true about your current payment of tuition fees? (CHECK ONE)

- a) I pay in-state tuition fees because I am a resident of Michigan. ☐ (39-1)
- b) I pay in-state tuition fees because of the financial aid I receive from MSU. ☐ (39-2)
- c) I pay in-state tuition fees because of other special considerations. ☐ (39-3)
- d) I pay out-of-state tuition fees. ☐ (39-4)
- e) I have a tuition scholarship which completely pays my tuition fees. ☐ (39-5)

33. Which one of the following statements is true about your opinion of MSU's ability to pay (tuition) plan?

- a) I am in favor of the ability to pay plan. ☐ (40-1)
- b) I am against the ability to pay plan. ☐ (40-2)
- c) I am indifferent (neutral) to the ability to pay plan. ☐ (40-3)

34. What do you expect your annual starting salary will be when you complete the degree for which you are working? (CHECK ONE)

- a) Under $5,000 ☐ (47-1)
- b) $5,000 to $6,999 ☐ (47-2)
- c) $7,000 to $8,999 ☐ (47-3)
- d) $9,000 to $10,999 ☐ (47-4)
- e) $11,000 to $12,999 ☐ (47-5)
- f) $13,000 to $14,999 ☐ (47-6)
- g) $15,000 to $16,999 ☐ (47-7)
- h) $17,000 or over ☐ (47-8)

35. What would your starting salary be without the degree you are now working for? (CHECK ONE)

a) Under \$5,000	☐	(48-1)
b) \$5,000 to \$6,999	☐	(48-2)
c) \$7,000 to \$8,999	☐	(48-3)
d) \$9,000 to \$10,999	☐	(48-4)
e) \$11,000 to \$12,999	☐	(48-5)
f) \$13,000 to \$14,999	☐	(48-6)
g) \$15,000 to \$16,999	☐	(48-7)
h) \$17,000 and over	☐	(48-8)

36. If you are currently an undergraduate student, which one of the following statements describes your plans for graduate study? (CHECK ONE)

a) I plan to attend graduate school at MSU in the future.	☐	(49-1)
b) I plan to attend graduate school elsewhere in the future.	☐	(49-2)
c) I am not certain about my graduate school plans.	☐	(49-3)
d) I do not intend to go to graduate school.	☐	(49-4)

37. If you are currently beyond a bachelor's degree, which one of the following statements describes your plans for further graduate study? (CHECK ONE)

a) I plan to attend graduate school at MSU in the future.	☐	(50-1)
b) I plan to attend graduate school elsewhere in the future.	☐	(50-2)
c) I am not certain about my graduate school plans.	☐	(50-3)
d) I do not intend to go further in graduate school.	☐	(50-4)

38. What is the main reason for your decision in question 36 or 37. (CHECK ONE)

a) Academic reasons	☐	(51-1)
b) Occupational reasons	☐	(51-2)
c) Financial reasons	☐	(51-3)
d) Personal reasons (other than financial)	☐	(51-4)
e) Other reasons (SPECIFY)	☐	(51-5)

____

39. How do you feel about your decision to come to MSU? (CHECK ONE)

a) I am extremely satisfied with my decision.	☐	(52-1)
b) I am somewhat satisfied with my decision.	☐	(52-2)
c) I am neither satisfied nor dissatisfied with my decision.	☐	(52-3)
d) I am somewhat dissatisfied with my decision.	☐	(52-4)
e) I am extremely dissatisfied with my decision.	☐	(52-5)

40. Please indicate how satisfactory each of the following factors was for you during your early experience with MSU. (CIRCLE ONE NUMBER IN EACH ROW)

	Very Unsatis-factory	Unsatis-factory	No Opinion	Satis-factory	Very Satis-factory	
a) Promptness of information before I applied	1	2	3	4	5	(53)
b) Clarity of information before I applied	1	2	3	4	5	(54)
c) Completeness of information before I applied	1	2	3	4	5	(55)
d) Accuracy of information before I applied	1	2	3	4	5	(56)
e) Promptness of information about my admission	1	2	3	4	5	(57)
f) Promptness of information about my financial aid	1	2	3	4	5	(58)
g) Individual attention to information about admission and financial aid	1	2	3	4	5	(59)

41. What in your opinion should MSU do to attract quality graduate students?

____

____

____

____

(60)

42. What is your student number? ________________

43. What was the size of your high school graduating class? (CHECK ONE)

a) Less than 100	☐	(61-1)
b) 100 to 199	☐	(61-2)
c) 200 to 299	☐	(61-3)
d) 300 to 499	☐	(61-4)
e) 500 or more	☐	(61-5)

44. What size town or city did you live in while attending high school? (If you have lived in more than one town or city, check the one size of town where you spent most of your time in high school.)

a) Under 2,000	☐	(62-1)
b) 2,000 to 4,999	☐	(62-2)
c) 5,000 to 9,999	☐	(62-3)
d) 10,000 to 24,999	☐	(62-4)
e) 25,000 to 74,999	☐	(62-5)
f) 75,000 to 149,999	☐	(62-6)
g) 150,000 and over	☐	(62-7)

45. While you were an undergraduate, what was the size of the total student body (both graduate and undergraduate) at the campus you attended. (If you have attended more than one school as an undergraduate, check the one size of campus where you earned the maximum number of credits.)

a) Under 5,000	☐	(63-1)
b) 5,000 to 9,999	☐	(63-2)
c) 10,000 to 19,999	☐	(63-3)
d) 20,000 to 34,999	☐	(63-4)
e) 35,000 and above	☐	(63-5)

46. Please list the name and location of the last one or two colleges or universities attended before entering your present degree program. (Include MSU, if you attended here before entering your present program.)

Name of Institution	Location	Dates of attendance	Degree/credits earned
a)			
b)			

47. What is (was) your GPA? (CHECK ONE IN EACH COLUMN)

In your present degree program (column 1)		At the time of entering your present degree program (column 2)
☐	Equal to or higher than 3.5	☐
☐	Equal to or higher than 3.0 but less than 3.5	☐
☐	Equal to or higher than 2.5 but less than 3.0	☐
☐	Equal to or higher than 2.0 but less than 2.5	☐
☐	Less than 2.0	☐

48. What is your father's education? (CHECK THE HIGHEST DEGREE/ DIPLOMA EARNED)

a) He did not complete high school. ☐ (67-1)
b) He earned a high school diploma. ☐ (67-2)
c) He earned a bachelor's degree. ☐ (67-3)
d) He earned a master's degree. ☐ (67-4)
e) He earned a doctoral degree (Ph. D., Ed. D., M. D., D. D. S., D. V. M., etc.). ☐ (67-5)
f) Other (SPECIFY) ______________________

49. If your father earned a college degree or diploma what was his major field of study? (PLEASE WRITE IN SPACE BELOW)

____

50. Which one of the following statements is true of your father when you were a Senior in high school? (CHECK ONE)

a)	He was self employed.	☐	(70-1)
b)	He was employed by others.	☐	(70-2)
c)	He was unemployed.	☐	(70-3)
d)	He was retired.	☐	(70-4)
e)	Other (SPECIFY)	☐	(70-5)

____

51. What is your mother's education? (CHECK THE HIGHEST DEGREE/ DIPLOMA EARNED)

a)	She did not complete high school.	☐	(71-1)
b)	She earned a high school diploma.	☐	(71-2)
c)	She earned a bachelor's degree.	☐	(71-3)
d)	She earned a master's degree.	☐	(71-4)
e)	She earned a doctoral degree (Ph. D., Ed. D., M. D., D. V. M. etc.).	☐	(71-5)
f)	Other (SPECIFY)	☐	(71-6)

____

52. If your mother earned a college degree or diploma, what was her major field of study? (PLEASE WRITE IN THE SPACE BELOW)

____

53. Which one of the following statements is true of your mother when you were a Senior in high school? (CHECK ONE)

a)	She was a part-time employee.	☐	(74-1)
b)	She was a full-time employee.	☐	(74-2)
c)	She was self employed.	☐	(74-3)
d)	She was not employed.	☐	(74-4)
e)	Other (SPECIFY)	☐	(74-5)

____

54. What is the gross annual income of your parents at the present time? (INCLUDE ALL SOURCES OF INCOME AND CHECK ONE)

a) Under $5,000	☐	(75-1)
b) $5,000 to $7,499	☐	(75-2)
c) $7,500 to $11,999	☐	(75-3)
d) $12,000 to $16,499	☐	(75-4)
e) $16,500 to $20,999	☐	(75-5)
f) $21,000 to $25,499	☐	(75-6)
g) $25,500 and over	☐	(75-7)

55. Regardless of your sex, which of the following statements was most true for you before the mid-February (1968) decision to discontinue student deferments for most graduate students? (CHECK ONE)

a) The draft had <u>not</u> influenced my plans for graduate school.	☐	(76-1)
b) The draft had influenced me to continue or begin graduate school.	☐	(76-2)
c) The draft had influenced me to postpone my graduate studies.	☐	(76-3)
d) The draft had influenced me to withdraw from graduate school.	☐	(76-4)

56. Regardless of your sex, which of the following statements is most true for you now that the decision has been made to discontinue students deferments for most graduate students? (CHECK ONE)

a) The new decision has <u>not</u> influenced my plans for graduate school.	☐	(77-1)
b) The new decision has influenced me to continue or begin graduate school.	☐	(77-2)
c) The new decision has influenced me to postpone my graduate studies.	☐	(77-3)
d) The new decision has influenced me to withdraw from graduate school.	☐	(77-4)

FEMALES NEED NOT CONTINUE FURTHER. THANK YOU VERY MUCH FOR YOUR COOPERATION.

57. What is your present draft classification? (78)

a)	I-A	☐	j)	II-S	☐
b)	I-A-O	☐	k)	III-A	☐
c)	I-O	☐	l)	IV-A	☐
d)	I-S	☐	m)	IV-B	☐
e)	I-Y	☐	n)	IV-C	☐
f)	I-D	☐	o)	IV-D	☐
g)	I-W	☐	p)	IV-F	☐
h)	I-C	☐	q)	V-A	☐
i)	II-A	☐			

Thank you very much for your cooperation. (80-2)

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

COLLEGE OF ENGINEERING · ENGINEERING BUILDING

April 15, 1968

APPENDIX 3-2: Copy of the Letter Mailed Along with the Questionnaire to the No-Shows.

To: (Graduate Applicants Not Attending MSU)

As part of a research program sponsored by the National Science Foundation, Office of Education and Manpower Studies we are conducting an in depth study of the decisions made by graduates in selecting their graduate schools. This information will be used in an effort to determine the influence of various financial aid programs on graduate enrollments and in an effort to model, mathematically, certain aspects of the university business operation.

You are one of a group of persons known to have been admitted to Michigan State University, but did not choose to attend during the Fall term 1967. We hope that you will be willing to take time to give us insight into the factors that contributed to this decision by completing the enclosed questionnaire. We would like for you to be as frank as you possibly can. Your answers will remain anonymous. A postage paid envelope is enclosed for your convenience in returning the completed questionnaire.

We thank you in advance for your cooperation. Your cooperation will help us answer questions that are of direct concern to the institutions of higher education.

Sincerely,

H E Koenig

H. E. Koenig, Director
Systems Science Program

HEK:nab

MICHIGAN STATE UNIVERSITY EAST LANSING · MICHIGAN 48823

COLLEGE OF ENGINEERING · ENGINEERING BUILDING

Copy of the Follow-up Letter Sent to the No-Shows.

To:

During the last week of May you received a questionnaire in conjunction with a project on Higher Education. If you have returned this questionnaire, please consider this letter as expression of appreciation for your cooperation. If you have not, then, once more we request your cooperation in this effort.

Sincerely,

H. E. Koenig

H. E. Koenig, Director
Systems Science Program

HEK:nab

APPENDIX 3-2: Questionnaire Sent to the No-Shows.

SURVEY OF GRADUATE APPLICANTS (FALL 1967) AT MSU

Systems Science Group
Division of Engineering Research
Michigan State University

1. Did you attend a college/university during Fall, 1967? (CHECK ONE)

   a) Yes

   b) No (if 'no' go to 5)

2. If 'Yes' to the above question, what is the name of the university you attended?

   ____

3. What was your major department in the Fall of 1967?

   ____

4. What was your program level in Fall '67? (CHECK ONE)

a) Master's candidate	☐	(15-6)
b) Doctoral candidate	☐	(15-7)
c) 3rd or 4th year veterinary Medicine	☐	(15-9)
d) Other (SPECIFY) ____________	☐	(15-1)

5. What is your sex? (CHECK ONE)

a) Male	☐	(16-1)
b) Female	☐	(16-2)

6. What is your marital status? (CHECK ONE)

a) Single	☐	(17-1)
b) Married	☐	(17-2)
c) Widowed, Divorced or Separated	☐	(17-3)

7. If married, does your spouse earn part of your family income? (CHECK ONE)

a) Yes ☐ (18-1)

b) No ☐ (18-2)

8. When did you first consider the possibility of attending MSU? (CHECK ONE)

a) 8th grade or earlier ☐ (19-1)

b) 9th - 10th grade ☐ (19-2)

c) 11th - 12th grade ☐ (19-3)

d) During the years between high school and undergraduate school ☐ (19-4)

e) During undergraduate school ☐ (19-5)

f) During the years I was not in school, between undergraduate and graduate school ☐ (19-6)

g) During graduate school ☐ (19-7)

h) During the time I was not in school after I had started graduate school ☐ (19-8)

9. Do any of your family members (parents, wife, brothers, sisters) attend, or have they attended MSU? (CHECK ONE)

a) Yes ☐ (20-1)

b) No ☐ (20-2)

IF YOU DID NOT ATTEND A COLLEGE/UNIVERSITY IN THE FALL OF 1967, SKIP TO QUESTION NO. 17.

10. Who, other than yourself, do you think had the most influence upon your decision to go to another school or postpone attending MSU in Fall '67?

a) No one else ☐ (21-1)

b) Parents ☐ (21-2)

c) Faculty at that university ☐ (21-3)

d) Teachers in high school ☐ (21-4)

e) High school counselor ☐ (21-5)

f) Other alumni of that university ☐ (21-6)

g) High school friends ☐ (21-7)

h) Others (SPECIFY) ☐ (21-8)

NOTE: STUDENTS WHO ATTENDED A DIFFERENT SCHOOL IN THE FALL OF 1967 SHOULD ANSWER THE FOLLOWING QUESTIONS WITH RESPECT TO THE SCHOOL THEY ATTENDED IN THE FALL OF 1967.

11. What type or types of financial resources are supporting your studies at the university you are attending. (CHECK AS MANY AS APPLY)

a) Financial aid** ☐ (22-1)

b) Campus job (full or part-time) ☐ (23-1)

c) Off-campus job (full or part-time) ☐ (24-1)

d) G I Bill ☐ (25-1)

e) Wife's earnings ☐ (26-1)

f) Personal savings ☐ (27-1)

g) Parental assistance ☐ (28-1)

h) Loan ☐ (29-1)

i) Other resources (SPECIFY) ☐ (30-1)

____

12. In the above list of resources which one contributes the major part of your income? (CIRCLE THE LETTER TO THE LEFT OF THE RESOURCE CHOSEN.) (31)

IF YOU ARE NOT RECEIVING FINANCIAL AID, PLEASE SKIP TO QUESTION 15.

13. If you receive financial aid, what type of financial aid is it? (CHECK ONE)

a) Graduate TeachingAssistantship ☐ (32-1)

b) Graduate Research Assistantship ☐ (32-2)

c) Fellowship ☐ (32-3)

d) Tuition scholarships only ☐ (32-4)

e) Other scholarship ☐ (32-5)

f) Other aid (SPECIFY) ☐ (32-6)

____

**Financial Aids in the present study include teaching assistantships, research assistantships, fellowships, scholarships, tuition scholarships and grants.

NOTE: Financial Aids do not include loans.

14. If you received either a fellowship, scholarship or tuition scholarship, which one of the following statements is true about the financial aid you receive? (CHECK ONE)

a) It is specified to a particular field of study and can be used at that university only ☐ (33-1)

b) It is general (unspecified as to field) and can be used at that university only ☐ (33-2)

c) It is specified to a particular field of study and would be valid at any university I chose to attend ☐ (33-3)

d) It is general (unspecified as to field) and would be valid at any university I chose to attend ☐ (33-4)

15. At the time you completed the formal application requesting financial aid from MSU, did you already have an informal understanding from a faculty member at MSU that financial aid would be available to you? (CHECK ONE)

a) Yes ☐ (34-1)

b) No ☐ (34-2)

c) Not sure ☐ (34-3)

d) Did not apply for financial aid ☐ (34-4)

16. Which one of the following statements is true of all financial aid you ever received? (CHECK ONE)

a) I have received financial aid continuously since the beginning of my present degree program (including Summer). (35-1)

b) I have received financial aid continuously since the beginning of my present degree program (except Summer). ☐ (35-2)

c) I have received financial aid continuously but it began after I started my present degree program (except possibly Summer terms). ☐ (35-3)

d) I have received financial aid intermittently in my present degree program. ☐ (35-4)

e) I did not receive any financial aid in my present degree program. ☐ (35-5)

17. **Please indicate how attractive each of the following characteristics of MSU were when you made the decision to go to another school or postpone attending MSU in the Fall of '67. (CIRCLE ONE NUMBER IN EACH ROW BELOW)**

	Very Unattractive	Unattractive	Neither	Attractive	Very Attractive	
__a) Curriculum of my major	1	2	3	4	5	(36)
__b) Faculty reputation in my field	1	2	3	4	5	(37)
__c) General reputation of the university	1	2	3	4	5	(38)
__d) Financial aid through the university	1	2	3	4	5	(39)
__e) Off-campus job opportunities for myself and wife	1	2	3	4	5	(40)
__f) Campus job opportunities for myself and wife	1	2	3	4	5	(41)
__g) Educational facilities (library, computer, etc.)	1	2	3	4	5	(42)
__h) Location of campus	1	2	3	4	5	(43)
__i) Appearance of the campus	1	2	3	4	5	(44)
__j) Employment opportunities after completion of degree	1	2	3	4	5	(45)
__k) Low costs (tuition and other expenses)	1	2	3	4	5	(46)
__l) Loan facilities	1	2	3	4	5	(47)

18. **Please select the <u>five</u> factors from the list a through l in question 17 which you think are <u>most</u> influential in your decision to attend a university. Rank them in order of their influence by filling the numbers one (1) through five (5) in the spaces to the left in question 17.**

NOTE: 1 = Most influential

2 = Least influential

IF YOU ATTENDED A UNIVERSITY IN THE FALL OF 1967, SKIP TO QUESTION NO. 21.

19. Please name some university (other than Michigan State University) you know well.

____
Name (without abbreviation) Location (city and state)

20. How did you first get to know about the university named in question 19?

a) I was a student there in the past. ☐ (66-1)

b) I knew someone who was a student there. ☐ (66-2)

c) I know about it in some other way. (SPECIFY) ☐ (66-3)

____

21. Compared to the university you attended in the Fall term '67, (or the university you named in question 19), how would you rate MSU on each item below. (CIRCLE ONE NUMBER IN EACH ROW.)

	MSU is much worse	MSU is worse	no opinion	MSU is better	MSU is much better	
a) Financial aid available	1	2	3	4	5	(7)
b) Library facilities	1	2	3	4	5	(8)
c) Computer facilities	1	2	3	4	5	(9)
d) Faculty guidance	1	2	3	4	5	(10)
e) Curriculum of my major	1	2	3	4	5	(11)
f) Laboratory and shop facilities	1	2	3	4	5	(12)
g) Costs (including tuition fees)	1	2	3	4	5	(13)
h) Friendliness of students	1	2	3	4	5	(14)
i) Intercollegiate athletics	1	2	3	4	5	(15)
j) Housing for married students	1	2	3	4	5	(16)
k) Dormitories	1	2	3	4	5	(17)
l) Academic reputation	1	2	3	4	5	(18)
m) Instruction	1	2	3	4	5	(19)
n) Loan facilities	1	2	3	4	5	(20)
o) Student-Faculty ratio (Graduate)	1	2	3	4	5	(21)
p) Student-Faculty ratio (Undergraduate)	1	2	3	4	5	(22)
q) Faculty attitude towards students	1	2	3	4	5	(23)

22. When you applied to MSU, to how many other universities did you apply simultaneously?

Number: ______ (24)

23. How many of these universities admitted you?

Number: ______ (25)

24. Did you apply for financial aid at MSU and/or other universities? (CHECK ONE)

a) At MSU ☐ (26-1)

b) At other universities ☐ (26-2)

c) At both MSU and other universities ☐ (26-3)

d) Did not apply for financial aid ☐ (26-4)

25. If you did ask for financial aid, what is the main reason you decided to ask for financial aid? (CHECK ONE)

a) I needed the money to continue my education. ☐ (27-1)

b) I desired the professional and educational benefits of work experience. ☐ (27-2)

c) I felt that my past record justified financial aid. ☐ (27-3)

d) Other reasons (SPECIFY) ________________________ ☐ (27-4)

26. Did you receive offers of financial aid from MSU and/or other universities? (CHECK ONE)

a) From MSU ☐ (28-1)

b) From other universities ☐ (28-2)

c) From both MSU and other universities ☐ (28-3)

d) Did not receive offers of financial aid ☐ (28-4)

27. If you checked "C" above, how does MSU's offer compare with the best of the other offers? (CHECK ONE)

a) Higher than MSU's offer ☐ (29-1)

b) Same as MSU's offer ☐ (29-2)

c) Lower than MSU's offer ☐ (29-3)

d) Not comparable to MSU's offer ☐ (29-4)

28. How many of the other universities offered you financial aid?

Number: ______ (30)

29. Which of the following reasons contributed to your decision to go to another school or postpone attending MSU in Fall, 1967? (CHECK AS MANY AS APPLY)

a) I received an offer of more financial aid from another university.	☐	(31-1)
b) I received a similar offer at another university and attended the other university since it was a preferable university.	☐	(32-1)
c) I received a lower offer of financial aid from another university but preferred it since it was a better university.	☐	(33-1)
d) I received an offer of Fellowship or Scholarship at another university which required no time committment.	☐	(34-1)
e) I heard from MSU too late about financial aid and by then, I had decided to go to another university or not attend school in Fall '68.	☐	(35-1)
f) My decision has nothing to do with MSU's offer of financial aid.	☐	(36-1)

30. Referring to the list of reasons in question 29, which one of these reasons made the most important contribution to your decision to go to another school or postpone attending MSU in Fall '67? (CIRCLE THE LETTER TO THE LEFT OF THE REASON ABOVE) (37)

31. If "a" in question 29, how much more financial aid per 10 months were you offered at another university than MSU offered you? (PLEASE SPECIFY AMOUNT)

$____________________ (38)

32. What would have been the minimum amount of MSU's offer of financial aid for a 10 month period in order to have changed your decision about attending MSU in Fall of 1967. (PLEASE SPECIFY AMOUNT)

$____________________ (39)

33. Did the ability to pay plan of MSU influence your decision to go to another school or postpone attending MSU in the Fall of 1967? (CHECK ONE)

a) Yes	☐	(40-1)
b) No	☐	(40-2)

34. Why did you decide to obtain the degree (B.A., M.S., Ph.D., etc.) you are now working on? (CHECK BOXES ON RIGHT)

a) Someone else thought I should go to graduate school. ☐ (41)

b) I am interested in pursuing advanced studies for scholarly reasons. ☐ (42)

c) The type of career I want requires this degree. ☐ (43)

d) I could not get the job I wanted, so I decided to stay in school. ☐ (44)

e) Other factors (PLEASE SPECIFY) ☐ (45)

____

35. Please select the one factor from the list in question 34 which you think was most influential in your decision. (CIRCLE THE LETTERS OF THE STATEMENTS IN QUESTION 34) (46)

36. What do you expect your annual starting salary will be when you complete the degree for which you are working? (CHECK ONE)

a) Under $5,000 ☐ (47-1)

b) $5,000 to $6,999 ☐ (47-2)

c) $7,000 to $8,999 ☐ (47-3)

d) $9,000 to $10,999 ☐ (47-4)

e) $11,000 to $12,999 ☐ (47-5)

f) $13,000 to $14,999 ☐ (47-6)

g) $15,000 to $16,999 ☐ (47-7)

h) $17,000 or over ☐ (47-8)

37. What would your starting salary be without the degree you are now working for? (CHECK ONE)

a) Under $5,000	☐	(48-1)
b) $5,000 to $6,999	☐	(48-2)
c) $7,000 to $8,999	☐	(48-3)
d) $9,000 to $10,999	☐	(48-4)
e) $11,000 to $12,999	☐	(48-5)
f) $13,000 to $14,999	☐	(48-6)
g) $15,000 to $16,999	☐	(48-7)
h) $17,000 and over	☐	(48-8)

38. Which one of the following statements describes your plans for further graduate study? (CHECK ONE)

a) I plan to attend graduate school at MSU in the future.	☐	(50-1)
b) I plan to attend graduate school elsewhere in the future.	☐	(50-2)
c) I am not certain about my graduate school plans.	☐	(50-3)
d) I do not intend to go further in graduate school.	☐	(50-4)

39. What is the main reason for your decision in the last question? (CHECK ONE)

a) Academic reasons	☐	(51-1)
b) Occupational reasons	☐	(51-2)
c) Financial reasons	☐	(51-3)
d) Personal reasons (other than financial)	☐	(51-4)
e) Other reasons (SPECIFY)	☐	(51-5)

____

40. How do you feel about your decision to go to another school or postpone attending MSU in the Fall of 1967? (CHECK ONE)

a)	I am extremely satisfied with my decision.	☐	(52-1)
b)	I am somewhat satisfied with my decision.	☐	(52-2)
c)	I am neither satisfied nor dissatisfied with my decision.	☐	(52-3)
d)	I am somewhat dissatisfied with my decision.	☐	(52-4)
e)	I am extremely dissatisfied with my decision.	☐	(52-5)

41. Please indicate how satisfactory each of the following factors was for you during your early experience with MSU. (CIRCLE ONE NUMBER IN EACH ROW)

	Very Unsatis-factory	Unsatis-factory	No Opinion	Satis-factory	Very Satis-factory	
a) Promptness of information before I applied	1	2	3	4	5	(53)
b) Clarity of information before I applied	1	2	3	4	5	(54)
c) Completeness of information before I applied	1	2	3	4	5	(55)
d) Accuracy of information before I applied	1	2	3	4	5	(56)
e) Promptness of information about my admission	1	2	3	4	5	(57)
f) Promptness of information about my financial aid	1	2	3	4	5	(58)
g) Individual attention to information about admission and financial aid	1	2	3	4	5	(59)

41. What in your opinion, should MSU do to attract quality graduate students?

____

____

____

____

(60)

42. What was the size of your high school graduating class? (CHECK ONE)

a) Less than 100	☐	(61-1)
b) 100 to 199	☐	(61-2)
c) 200 to 299	☐	(61-3)
d) 300 to 499	☐	(61-4)
e) 500 or more	☐	(61-5)

43. What size town or city did you live in while attending high school? (If you have lived in more than one town or city, <u>check the one size of town where</u> you spent <u>most</u> of your time in high school.)

a) Under 2,000	☐	(62-1)
b) 2,000 to 4,999	☐	(62-2)
c) 5,000 to 9,999	☐	(62-3)
d) 10,000 to 24,999	☐	(62-4)
e) 25,000 to 74,999	☐	(62-5)
f) 75,000 to 149,999	☐	(62-6)
g) 150,000 and over	☐	(62-7)

44. While you were an undergraduate, what was the size of the total student body, (both graduate and undergraduate), at the campus you attended. (If you have attended more than one school as an undergraduate, check the <u>one</u> size of campus where you earned the <u>maximum number</u> of credits.)

a) Under 5,000	☐	(63-1)
b) 5,000 to 9,999	☐	(63-2)
c) 10,000 to 19,999	☐	(63-3)
d) 20,000 to 34,999	☐	(63-4)
e) 35,000 and above	☐	(63-5)

45. Please list the name and location of the last one or two colleges or universities attended before entering your present degree program. (Include MSU if you attended here before entering your present program). (64)

Name of Institution	Location	Dates of attendance	Degree/credits earned
a)			
b)			

46. What is (was) your GPA (Grade-Point-Average)? (CHECK ONE IN EACH COLUMN)

In your present degree program (column 1)		At the time of entering your present degree program (column 2)
☐	Equal to or higher than 3.5	☐
☐	Equal to or higher than 3.0 but less than 3.5	☐
☐	Equal to or higher than 2.5 but less than 3.0	☐
☐	Equal to or higher than 2.0 but less than 2.5	☐
☐	Less than 2.0	☐

47. What is your father's educational level? (CHECK THE HIGHEST DEGREE/ DIPLOMA EARNED)

- a) He did not complete high school. ☐ (67-1)
- b) He earned a high school diploma. ☐ (67-2)
- c) He earned a bachelor's degree. ☐ (67-3)
- d) He earned a master's degree. ☐ (67-4)
- e) He earned a doctoral degree. (Ph.D., Ed.D., M.D., D.D.S., D.V.M., etc.). ☐ (67-5)
- f) Other (SPECIFY) ☐ (67-6)

____

48. If your father earned a college degree or diploma what was his major field of study? (PLEASE WRITE IN SPACE BELOW)

____

49. Which one of the following statements is true of your father when you were a Senior in high school? (CHECK ONE)

a) He was self employed.	☐	(70-1)
b) He was employed by others.	☐	(70-2)
c) He was not employed.	☐	(70-3)
d) He was retired.	☐	(70-4)
e) Other (SPECIFY)	☐	(70-5)

____

50. What is your mother's education? (CHECK THE HIGHEST DEGREE OR DIPLOMA EARNED)

a) She did not complete high school.	☐	(71-1)
b) She earned a high school diploma.	☐	(71-2)
c) She earned a bachelor's degree.	☐	(71-3)
d) She earned a master's degree.	☐	(71-4)
e) She earned a doctoral degree (Ph. D., Ed. D., M. D., D. V. M., etc.).	☐	(71-5)
d) Other (SPECIFY)	☐	(71-6)

____

51. If your mother earned a college degree or diploma, what was her major field of study? (PLEASE WRITE IN THE SPACE BELOW)

____

52. Which one of the following statements is true of your mother when you were a Senior in high school? (CHECK ONE)

a) She was a part-time employee.	☐	(74-1)
b) She was a full-time employee.	☐	(74-2)
c) She was self employed.	☐	(74-3)
d) She was not employed.	☐	(74-4)
e) Other (SPECIFY)	☐	(74-5)

____

53. What is the gross annual income of your parents at the present time? (INCLUDE ALL SOURCES OF INCOME AND CHECK ONE)

a) Under $5,000	☐	(75-1)
b) $5,000 to $7,499	☐	(75-2)
c) $7,500 to $11,999	☐	(75-3)
d) $12,000 to $16,499	☐	(75-4)
e) $16,500 to $20,999	☐	(75-5)
f) $21,000 to $25,499	☐	(75-6)
g) $25,500 and over	☐	(75-7)

54. Regardless of your sex, which of the following statements was most true for you before the mid-February (1968) decision to discontinue student deferments for most graduate students? (CHECK ONE)

a) The draft had <u>not</u> influenced my plans for graduate school.	☐	(76-1)
b) The draft had influenced me to continue or begin graduate school.	☐	(76-2)
c) The draft had influenced me to postpone my graduate studies.	☐	(76-3)
d) The draft had influenced me to withdraw from graduate school.	☐	(76-4)

55. Regardless of your sex, which of the following statements is most true for you now that the decision has been made to discontinue student deferments for most graduate students? (CHECK ONE)

a) The new decision has <u>not</u> influenced my plans for graduate school.	☐	(77-1)
b) The new decision has influenced me to continue or begin graduate school.	☐	(77-2)
c) The new decision has influenced me to postpone my graduate studies.	☐	(77-3)
d) The new decision has influenced me to withdraw from graduate school.	☐	(77-4)

FEMALES NEED NOT CONTINUE FURTHER. THANK YOU VERY MUCH FOR YOUR COOPERATION.

56. What is your present draft classification? (78)

a) I-A	☐	j) II-S	☐
b) I-A-O	☐	k) III-A	☐
c) I-O	☐	l) IV-A	☐
d) I-S	☐	m) IV-B	☐
e) I-Y	☐	n) IV-C	☐
f) I-D	☐	o) IV-D	☐
g) I-W	☐	p) IV-F	☐
h) I-C	☐	q) V-A	☐
i) II-A	☐		

Thank you very much for your cooperation. (80-2)

APPENDIX 4

Analysis of the No-Shows Within a Level by College:

It is of considerable importance to analyze the No-Shows by college and level. This could reveal a lot of information about the market position of each college and may possibly help to identify the characteristics of such a segment of the population. Analysis of this nature by every department or college at least once a year can help to sense changes in the competitive environment which may help to formulate sound administrative policies concerning promotion and other allocation of university resources to achieve the predetermined goals most effectively and efficiently. One such study was made by Professor Allen Grimes, who analyzed the No-Shows of the Department of Political Science considering the Fall 1967 data.[1] He concluded that almost half of the No-Shows went elsewhere because of financial reasons. Included in the financial reasons were--higher offer, fellowship (no time committment), financial security (assured financial aid for longer period). About one-third mentioned academic reasons such as notable departments in collateral fields, closer contact with faculty (lower student-faculty ratio) and turnover rate of reputed faculty (more reputed faculty leaving the university than the number

---

[1] Grimes, Allen. Survey of No-Shows, Memorandum, Department of Political Science, (East Lansing, Michigan State University) January 1968.

of incoming faculty belonging to the same category) as influencing their choice of a university. Grimes pointed out that "finally some mentioned communications snarls with the department as a reason for not choosing MSU. Communication seemed to be a somewhat greater problem with those not offered assistantship than those offered financial aid. Their criticisms were: "poor timing, inefficient handling of materials, ambiguous communication and assignment of advisors not in their field." The above study was confined to the No-Shows of Political Science Department only and the timing of course, was a happy coincidence. The most striking thing is that students place much more importance to the financial aids than they actually admit. Above all proper promotional methods including the timing and method of offer do have significant effect on the choice of a university. This is a place where marketing directly plays a dominant role of considerable importance. Allen Grimes quoted the responses of some No-Shows to support his arguments: "... communication between us was horrible; i.e., certain application materials were lost, etc. This was a contributing factor in my choice." Another No-Show: "When I received the letter of acceptance, no mention was made of my application for financial aid. I felt I should have been notified one way or the other about my application for financial aid." Commenting on the timing of offer one No-Show: "Timing of offer was also an important factor. Michigan State's program has considerable appeal, but the offer came at a late date." The present study also indicates that "no-shows" were very much dissatisfied with communication from MSU especially in the offer of financial aid.

The analysis of No-Shows by college and level are presented in the Table 4.1.1 (Master's applicants) and 4.1.2 (Doctoral applicants).

The figures, especially the last two rows should be interpreted very carefully. As the figures in the parentheses indicate, the average amounts are based on a small percentage of respondents, possibly those who received relatively higher offers than that of MSU's. So the average amount higher than MSU's offer and minimum amount for 10 month period that would have changed their decision could possibly be overestimates.

Of the No-Shows who were offered financial aid from MSU, one-third of them said that the main reason for 'No-Show' was higher offer. When the offer was similar, 15 percent of them preferred another because it was a "better university." About 10 percent of the No-Shows with a MSU offer of financial aid, preferred another (better) university though the financial aid offer was lower than that of MSU's. Only about 18 percent said that their decision to go elsewhere had nothing to do with the MSU offer of financial aid. That means 82 percent of the No-Shows decisions could change by manipulating the university variables such as curriculum, financial aid, faculty reputation and communication on admission and financial aid, etc. From the overall analysis it is obvious that financial aid is the single main factor accounting for the highest percent contributing to the "No-Shows". It is also evident from the analysis that other factors like curriculum in the major field and faculty reputation and communications have considerable effect when the financial aid is equal (to another offer) or sometimes even lower. The conclusion is that students look for a "cluster

Table 4.1.1: Analysis of No-Shows (Master's Applicants) by College

College	Business School			Engineering			Social Sciences			Other Colleges		
Variables or criterion under consideration	$\bar{X}$	s.d.	n (max=33)	$\bar{X}$	s.d.	n (max=31)	$\bar{X}$	s.d.	n (max=64)	$\bar{X}$	s.d.	n (max=99)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<u>Rating of MSU Variables</u>												
Curriculum in the major field	4.0	0.7	32	3.8	0.7	31	3.6	1.0	64	3.9	0.8	95
Faculty reputation in the major field	3.7	0.8	32	3.5	0.6	31	3.4	0.9	64	3.7	0.9	95
General reputation	3.9	0.5	32	3.8	0.7	31	3.3	0.9	64	4.0	0.9	95
Financial Aid	2.8	1.3	30	3.3	1.1	31	3.3	1.3	64	3.0	1.3	95
Educational facilities	3.6	0.6	32	3.8	0.7	30	3.6	0.6	62	3.8	0.5	94
Location of campus	3.1	1.0	32	3.4	1.1	31	3.1	1.0	63	3.1	1.0	95
Low costs (including tuition)	3.1	1.0	32	3.2	0.9	29	3.2	0.7	63	3.2	0.8	94
<u>Financial Aid</u>												
From MSU only or MSU and other places	13			25*			46*			54**		
From other places or no offer of aid	20*			6			18			45**		
Average number of offers (excluding MSU's)	1.5(3)			3.1(29)			2.3(57)			2.4(97)		
<u>Main Reason for 'No-Show'</u>												
Higher offer	13			10			19			31		
Similar offer but better University	3			4			12			12		
Lower offer but better University	4			4			10			4		
Fellowship	1			5			7			11		
Heard late from MSU	2			0			7			5		
Nothing to do with financial aid	6			5			6			25		
Average amount higher than MSU's offer	$1400(12)			$1400(10)			$750(22)			$1550(35)		
Minimum amount for 10 months that would have changed the decision	$3500(19)			$3800(21)			$2700(38)			$2600(59)		
Entrance GPA	3.25(32)			3.45(31)			3.25(58)			3.25(97)		

Note: Figures in parentheses indicate the size of response to the item. * One student did not identify either his level or college.

Table 4.1.2: Analysis of No-Shows (Doctoral Applicants) by College

College	Business School			Engineering			Social Sciences			Other Colleges		
Variables or criterion under consideration	$\bar{X}$	s.d.	n (max=24)	$\bar{X}$	s.d.	n (max=7)	$\bar{X}$	s.d.	n (max=31)	$\bar{X}$	s.d	n (max=47)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<u>Rating of MSU Variables</u>												
Curriculum in the major field	3.6	1.0	22	3.2	1.0	6	3.8	1.0	30	4.0	0.6	45
Faculty reputation in the major field	3.9	0.8	22	2.7	0.5	6	3.6	0.8	31	3.8	0.8	43
General reputation	3.4	1.1	22	3.7	1.0	6	3.5	1.0	31	3.9	0.9	45
Financial Aid	2.3	1.3	21	3.8	0.4	6	3.2	1.3	31	2.9	1.1	44
Educational facilities	3.5	0.8	22	3.8	0.8	6	3.6	0.6	30	3.8	0.6	42
Location of campus	3.2	1.0	21	3.5	0.8	6	3.0	1.2	31	3.0	0.8	42
Low costs (including tuition)	3.0	0.8	21	3.2	1.1	5	3.2	0.8	30	3.2	0.8	43
<u>Financial Aid</u>												
From MSU only or MSU and other places	13			7			25*			31		
From other places or no offer of aid	10			0			6			15		
Average number of offers (excluding MSU's)	2.2 (22)			3.4 (7)			3.0 (30)					
<u>Main Reason for 'No-Show'</u>												
Higher offer	16			2			7			15		
Similar offer but better University	2			3			10			7		
Lower offer but better University	0			0			2			2		
Fellowship	1			0			4			5		
Heard late from MSU	0			1			2			3		
Nothing to do with financial aid	2			1			4			11		
Average amount higher than MSU's offer	$1400 (17)			$600 (3)			$1450 (11)			$1350 (22)		
Minimum amount for 10 months that would have changed the decision	$3000 (20)			$4500 (1)			$2960 (15)			$2725 (27)		
Entrance GPA	3.50 (22)			3.50 (7)			3.45 (31)			3.35 (45)		

Note: Figures in parentheses indicate the size of response to the item.

* One student did not identify his level, but record indicates that he might belong to Doctoral level.

of value satisfactions" rather than base their decision on any one of the factors. A deficiency in one of the variables (say financial aid) could cause a damage (fall in sales) which may not be compensated by increasing some other factor (say curriculum development) even quite significantly. The main trick is to "mix" these variables in an 'optimum' way consistent with the goals and objectives of the university. The second conclusion is that though students rank financial aid only next to curriculum and faculty reputation among the factors influencing the choice of a university, in practice as Pace and McFee have pointed out "... financial and practical factors were of substantial influence, academic factors playing a more moderate, secondary role."[2]

This indicates that financial aid is the single most influential factor in the choice of a university. Further, of all the factors students consider most important to their decision in the choice of a university, financial aid is the only variable which the administrator can manipulate in the short-run (subject to the budget constraints of course). In this sense, financial aid has proved itself as one of the most effective control variables in graduate study. This conclusion is supported by an independent study done by Beach.[3] For more discussion on the effectiveness of financial aid as a control variable, please refer to the later part of Chapter VI.

---

[2] Pace, C.R. and A. McFee (1960). Op cit., p. 315.

[3] Leonard B. Beach (1965). Op cit.

APPENDIX 5

Discriminant Analysis: One of the most useful methods of classification is known as discriminant analysis developed by R.A. Fisher.[1] The problem to be solved is as follows: Assume that we have a set of measurements of a number of variables which are classified into two groups. Which linear combination of the various measurements will in a certain way best discriminate between the two groups?

Suppose $x_1,\ldots,x_p$ are a set of explanatory variables whose probability densities are assumed to be multivariate normal[2] with common dispersion matrix (αij), then we want to find the linear function $\ell_1 x_1 + \ldots + \ell_p x_p$ such that the coefficients $\ell_1,\ldots,\ell_p$ will minimize within-group variation and maximize the between group variation.

The procedure then consists of finding the likelihood that a measurement vector comes from each of the groups. The subject is assigned to a group for which the likelihood of his belonging is maximum. The error in classification is minimum if the groups are non-overlapping (higher dissimilarities between the groups). The overall differences between the groups with respect to the p characteristics is measured by a concept known as "Distance"

---

[1] R.A. Fisher (1936), "The use of Multiple Measurements in Texonomic Problems", Annals of Eugenics, Vol. 7, p. 179.

[2] Violation of normality assumption does not seriously effect the results. For details see Stanley Leo Warner (1962), "Stochastic choice of Mode in Urban Travel: Study in Bimary Choice": Northwestern University Press.

(D^2) first introduced by P.C. Mahalanobis.[3]

The computational procedure of D^2 is as follows:

Let $\eta_{11},\ldots,\eta_{p1}$ and $\eta_{12},\ldots,\eta_{p2}$

be the means of the p characteristics for groups 1 and 2 respectively.

Let $d_i = \eta_{i1} - \eta_{i2}$ $(i = 1,\ldots,p)$.

Then

$$D^2 = \Sigma \ell_i d_i$$

The above discussion on discrimnant theory may enable the reader to understand the computer output presented in this section. However, for greater details on linear discriminant functions and the computational procedure of likelihood and D^2, the reader may refer to Rao.[4]

---

[3] Mahalanobis, P.C. (1936): "On Generalized Distance in Statistics". Proc. Nat. Inst. Sc (India) Vol. 12, p. 49.

[4] Rao, C.R. (1952): Advanced Statistical Methods in Biometric Research. (New York: John Wiley & Sons).

APPENDIX 5 (continued)

Computer Output For Classification of Subjects (Master's Students With MSU's Offer of Financial Aid) Into Shows and No-Shows Using Only Five Variables (p. 79).

```
MSU DRUM SCOPE                    VERSION 1.109          06 APRIL 1969
                                                         STARTED AT TIME: 130419   DATE 05/24/69
SEQUENCE NUMBER 548595100001 (PRIORITY 1, PROBLEM TYPE 10)
JOB,574572,RHD,5,00,NAIDU
EQUIP,27=(CISSR),MT(193),RO
FOR,L,X
```

```
FOR1.34                                   05/24/69              PAGE NO.    1

            PROGRAM RECOD
            DIMENSION X(50),XM(50),FMT(20),XX(50)
            INTEGER X
            READ 102,FMT
            READ 101,(XM(I),I=1,5)
        101 FORMAT(20F3.2)
        102 FORMAT(10A8)
            DO 20 I=1,265
            READ FMT,(X(J),J=1,5)
            DO 3 J=1,5
            IF(X(J).EQ.00B)GO TO 4
            XX(J)=X(J)
            GO TO 3
          4 XX(J)=XM(J)
          3 CONTINUE
            IF(X(4).EQ.1.OR.X(4).EQ.4)XX(4)=3
            IF(X(4).EQ.2)XX(4)=2
            IF(X(4).EQ.3)XX(4)=1
            DO 5 J=2,3
            IF(XX(J).EQ.9)GO TO 5
            XX(J)=5-XX(J)
          5 CONTINUE
            WRITE(7,103)(XX(J),J=1,5)
        103 FORMAT(13F6.2)
         20 CONTINUE
            REWIND 7
            END
RUN,2,00,20000

EXECUTION STARTED AT    1304 -16
LOADMAIN,27,2,00,2110

EXECUTION STARTED AT    1304 -25
```

```
BMD05M - DISCRIMINANT ANALYSIS-SEVERAL GROUPS - VERSION OF MAY 27, 1964
HEALTH SCIENCES COMPUTING FACILITY, UCLA

PROBLEM NO,  2M
NUMBER OF VARIABLES   5


SIZE CARD  PROBLM2M 2 5-0-0 7131134 -0 -0 -0 -0                                    1

GROUP                    1                 2                TOTAL

SAMPLE                 131               134                 265

MEAN SCORES
     1                 1,48855           1,37313
     2                 2,12214           3,19403
     3                 1,97710           2,71642
     4                 1,90840           1,31343
     5                 0,55725           2,61940


MATRIX OF CROSS PRODUCTS OF DEV, FROM MEANS - GROUP 1
ROW  1
       36,73282       -16,81679          1,46565         -0,13740          1,33588
ROW  2
      -16,81679       440,04580        -47,63359         -2,53435        -20,91603
ROW  3
        1,46565       -47,63359        512,93130         -4,27481         21,67176
ROW  4
       -0,13740        -2,53435         -4,27481         16,90076        -25,31298
ROW  5
        1,33588       -20,91603         21,67176        -25,31298        224,32061


MATRIX OF CROSS PRODUCTS OF DEV, FROM MEANS - GROUP 2
ROW  1
       31,34328        14,29851          3,17910          2,32836         13,02985
ROW  2
       14,29851       382,95522        -55,62687         -4,14925         -6,10448
ROW  3
        3,17910       -55,62687        387,22388        -15,08955         77,53731
ROW  4
        2,32836        -4,14925        -15,08955         46,83582        -16,01493
ROW  5
       13,02985        -6,10448         77,53731        -16,01493        355,58955

DISPERSION MATRIX
ROW  1
        0,25884        -0,00958          0,01766          0,00833          0,05462
ROW  2
       -0,00958         3,12928         -0,39263         -0,02541         -0,10274
ROW  3
        0,01766        -0,39263          3,42264         -0,07363          0,37722
ROW  4
        0,00833        -0,02541         -0,07363          0,24234         -0,15714
ROW  5
        0,05462        -0,10274          0,37722         -0,15714          2,24300
```

INVERSE OF DISPERSION MATRIX

ROW 1	3.99356	0.00520	-0.01214	-0.20636	-0.10699
ROW 2	0.00520	0.32506	0.03705	0.05311	0.01225
ROW 3	-0.01214	0.03705	0.30281	0.06765	-0.04419
ROW 4	-0.20636	0.05311	0.06765	4.35486	0.30117
ROW 5	-0.10699	0.01225	-0.04419	0.30117	0.47753

TEST OF ACCURACY OF DISPERSION MATRIX INVERSE

ROW 1	1.00000	-0.00000	0.00000	0.00000	-0.00000
ROW 2	-0.00000	1.00000	-0.00000	-0.00000	-0.00000
ROW 3	0.00000	-0.00000	1.00000	0.00000	0.00000
ROW 4	0.00000	-0.00000	-0.00000	1.00000	-0.00000
ROW 5	0.00000	-0.00000	0.00000	0.00000	1.00000

GENERALIZED MAHALANOBIS D-SQUARE 218.48537

THE VALUE 218.48537 CAN BE USED AS CHI-SQUARE WITH 5 DEGREES OF FREEDOM TO TEST THE HYPOTHESIS THAT THE MEAN VALUES ARE THE SAME IN ALL THE 2 GROUPS FOR THESE 5 VARIABLES.

FUNCTION	1	2
COEFFICIENT		
1	5.32935	4.77872
2	1.87901	1.24790
3	1.76372	0.99733
4	8.41798	6.37874
5	0.62022	1.41858
CONSTANT	-13.85933	-12.67087

EVALUATION OF CLASSIFICATION FUNCTIONS FOR EACH CASE

FUNCTION	1	2	LARGEST PROBABILITY	FN.NO.FOR LARGEST PROBABILITY

GROUP 1
CASE

1	0.85153	0.14847	0.85153	1
2	0.91043	0.08957	0.91043	1
3	0.71031	0.28969	0.71031	1
4	0.87367	0.12633	0.87367	1
5	0.94549	0.05451	0.94549	1
6	0.85153	0.14847	0.85153	1
7	0.89241	0.10759	0.89241	1
8	0.92305	0.07695	0.92305	1
9	0.59813	0.40187	0.59813	1
10	0.42102	0.57898	0.57898	2
11	0.95437	0.04563	0.95437	1
12	0.94898	0.05102	0.94898	1
13	0.89241	0.10759	0.89241	1
14	0.91470	0.08530	0.91470	1
15	0.78545	0.21455	0.78545	1
16	0.78545	0.21455	0.78545	1
17	0.94898	0.05102	0.94898	1
18	0.97317	0.02683	0.97317	1
19	0.96359	0.03641	0.96359	1
20	0.85818	0.14182	0.85818	1
21	0.94549	0.05451	0.94549	1
22	0.97317	0.02683	0.97317	1
23	0.81449	0.18551	0.81449	1
24	0.84112	0.15888	0.84112	1
25	0.18642	0.81358	0.81358	2
26	0.40242	0.59758	0.59758	2
27	0.65962	0.34038	0.65962	1
28	0.62902	0.37098	0.62902	1
29	0.96945	0.03055	0.96945	1
30	0.86013	0.13987	0.86013	1
31	0.39350	0.60650	0.60650	2
32	0.86393	0.13607	0.86393	1
33	0.76208	0.23792	0.76208	1
34	0.82706	0.17294	0.82706	1
35	0.83681	0.16319	0.83681	1
36	0.94819	0.05181	0.94819	1
37	0.89241	0.10759	0.89241	1
38	0.94382	0.05618	0.94382	1
39	0.92457	0.07543	0.92457	1
40	0.65598	0.34402	0.65598	1
41	0.94819	0.05181	0.94819	1
42	0.59940	0.40060	0.59940	1
43	0.76782	0.23218	0.76782	1
44	0.05482	0.94518	0.94518	2
45	0.84654	0.15346	0.84654	1
46	0.93630	0.06370	0.93630	1
47	0.86393	0.13607	0.86393	1
48	0.76782	0.23218	0.76782	1
49	0.92305	0.07695	0.92305	1
50	0.95437	0.04563	0.95437	1
51	0.89241	0.10759	0.89241	1
52	0.97317	0.02683	0.97317	1
53	0.87367	0.12633	0.87367	1
54	0.91470	0.08530	0.91470	1
55	0.97317	0.02683	0.97317	1
56	0.89241	0.10759	0.89241	1
57	0.86013	0.13987	0.86013	1
58	0.83681	0.16319	0.83681	1
59	0.95507	0.04493	0.95507	1
60	0.87367	0.12633	0.87367	1
61	0.87545	0.12455	0.87545	1

62	0,89241	0,10759	0,89241	1
63	0,90179	0,09821	0,90179	1
64	0,92305	0,07695	0,92305	1
65	0,72510	0,27490	0,72510	1
66	0,95437	0,04563	0,95437	1
67	0,01384	0,98616	0,98616	2
68	0,91300	0,08700	0,91300	1
69	0,88645	0,11355	0,88645	1
70	0,76782	0,23218	0,76782	1
71	0,71684	0,28316	0,71684	1
72	0,94898	0,05102	0,94898	1
73	0,83681	0,16319	0,83681	1
74	0,86013	0,13987	0,86013	1
75	0,93533	0,06467	0,93533	1
76	0,93337	0,06663	0,93337	1
77	0,84112	0,15888	0,84112	1
78	0,04887	0,95113	0,95113	2
79	0,90643	0,09357	0,90643	1
80	0,96524	0,03476	0,96524	1
81	0,26419	0,73581	0,73581	2
82	0,88117	0,11883	0,88117	1
83	0,92785	0,07215	0,92785	1
84	0,65962	0,34038	0,65962	1
85	0,86393	0,13607	0,86393	1
86	0,79229	0,20771	0,79229	1
87	0,95437	0,04563	0,95437	1
88	0,59940	0,40060	0,59940	1
89	0,94549	0,05451	0,94549	1
90	0,58742	0,41258	0,58742	1
91	0,97317	0,02683	0,97317	1
92	0,85818	0,14182	0,85818	1
93	0,95414	0,04586	0,95414	1
94	0,94121	0,05879	0,94121	1
95	0,97317	0,02683	0,97317	1
96	0,95507	0,04493	0,95507	1
97	0,87889	0,12111	0,87889	1
98	0,59813	0,40187	0,59813	1
99	0,65962	0,34038	0,65962	1
100	0,04316	0,95684	0,95684	2
101	0,13678	0,86322	0,86322	2
102	0,94898	0,05102	0,94898	1
103	0,78545	0,21455	0,78545	1
104	0,82706	0,17294	0,82706	1
105	0,90643	0,09357	0,90643	1
106	0,71684	0,28316	0,71684	1
107	0,01773	0,98227	0,98227	2
108	0,82706	0,17294	0,82706	1
109	0,96047	0,03953	0,96047	1
110	0,71684	0,28316	0,71684	1
111	0,91470	0,08530	0,91470	1
112	0,74316	0,25684	0,74316	1
113	0,94819	0,05181	0,94819	1
114	0,97317	0,02683	0,97317	1
115	0,98917	0,01083	0,98917	1
116	0,80711	0,19289	0,80711	1
117	0,95437	0,04563	0,95437	1
118	0,03431	0,96569	0,96569	2
119	0,94228	0,05772	0,94228	1
120	0,02675	0,97325	0,97325	2
121	0,49921	0,50079	0,50079	2
122	0,93533	0,06467	0,93533	1

123	0.90910	0.09090	0.90910	1
124	0.89241	0.10759	0.89241	1
125	0.90537	0.09463	0.90537	1
126	0.97317	0.02683	0.97317	1
127	0.93630	0.06370	0.93630	1
128	0.78002	0.21998	0.78002	1
129	0.32124	0.67876	0.67876	2
130	0.90910	0.09090	0.90910	1
131	0.64587	0.35413	0.64587	1
GROUP 2				
CASE				
1	0.02731	0.97269	0.97269	2
2	0.34824	0.65176	0.65176	2
3	0.17075	0.82925	0.82925	2
4	0.77845	0.22155	0.77845	1
5	0.04887	0.95113	0.95113	2
6	0.23259	0.76741	0.76741	2
7	0.05982	0.94018	0.94018	2
8	0.20234	0.79766	0.79766	2
9	0.08426	0.91574	0.91574	2
10	0.37746	0.62254	0.62254	2
11	0.31235	0.68765	0.68765	2
12	0.25665	0.74335	0.74335	2
13	0.85153	0.14847	0.85153	1
14	0.07402	0.92598	0.92598	2
15	0.03539	0.96461	0.96461	2
16	0.08426	0.91574	0.91574	2
17	0.61477	0.38523	0.61477	1
18	0.11743	0.88257	0.88257	2
19	0.02021	0.97979	0.97979	2
20	0.06657	0.93343	0.93343	2
21	0.01483	0.98517	0.98517	2
22	0.15082	0.84918	0.84918	2
23	0.04436	0.95564	0.95564	2
24	0.02731	0.97269	0.97269	2
25	0.45083	0.54917	0.54917	2
26	0.15333	0.84667	0.84667	2
27	0.22384	0.77616	0.77616	2
28	0.08331	0.91669	0.91669	2
29	0.00157	0.99843	0.99843	2
30	0.82706	0.17294	0.82706	1
31	0.43412	0.56588	0.56588	2
32	0.99095	0.00905	0.99095	1
33	0.04573	0.95427	0.95427	2
34	0.08426	0.91574	0.91574	2
35	0.97804	0.02196	0.97804	1
36	0.20234	0.79766	0.79766	2
37	0.15173	0.84827	0.84827	2
38	0.30210	0.69790	0.69790	2
39	0.59940	0.40060	0.59940	1
40	0.22384	0.77616	0.77616	2
41	0.11416	0.88584	0.88584	2
42	0.06657	0.93343	0.93343	2
43	0.27223	0.72777	0.72777	2
44	0.05273	0.94727	0.94727	2
45	0.22601	0.77399	0.77399	2
46	0.01325	0.98675	0.98675	2
47	0.00931	0.99069	0.99069	2
48	0.20234	0.79766	0.79766	2
49	0.18563	0.81437	0.81437	2
50	0.40242	0.59758	0.59758	2

51	0.05336	0.94664	0.94664	2
52	0.39350	0.60650	0.60650	2
53	0.04436	0.95564	0.95564	2
54	0.12386	0.87614	0.87614	2
55	0.00442	0.99558	0.99558	2
56	0.39350	0.60650	0.60650	2
57	0.08522	0.91478	0.91478	2
58	0.29094	0.70906	0.70906	2
59	0.19132	0.80868	0.80868	2
60	0.00566	0.99434	0.99434	2
61	0.25491	0.74509	0.74509	2
62	0.07402	0.92598	0.92598	2
63	0.05873	0.94127	0.94127	2
64	0.28439	0.71561	0.71561	2
65	0.00255	0.99745	0.99745	2
66	0.22601	0.77399	0.77399	2
67	0.50054	0.49946	0.50054	1
68	0.64589	0.35411	0.64589	1
69	0.62688	0.37312	0.62688	1
70	0.07450	0.92550	0.92550	2
71	0.05132	0.94868	0.94868	2
72	0.02398	0.97602	0.97602	2
73	0.00738	0.99262	0.99262	2
74	0.94121	0.05879	0.94121	1
75	0.08182	0.91818	0.91818	2
76	0.14923	0.85077	0.85077	2
77	0.13343	0.86657	0.86657	2
78	0.15333	0.84667	0.84667	2
79	0.01397	0.98603	0.98603	2
80	0.09623	0.90377	0.90377	2
81	0.02332	0.97668	0.97668	2
82	0.03025	0.96975	0.96975	2
83	0.00634	0.99366	0.99366	2
84	0.13678	0.86322	0.86322	2
85	0.02699	0.97301	0.97301	2
86	0.59940	0.40060	0.59940	1
87	0.05038	0.94962	0.94962	2
88	0.03856	0.96144	0.96144	2
89	0.22476	0.77524	0.77524	2
90	0.25665	0.74335	0.74335	2
91	0.97140	0.02860	0.97140	1
92	0.00559	0.99441	0.99441	2
93	0.80904	0.19096	0.80904	1
94	0.31235	0.68765	0.68765	2
95	0.11007	0.88993	0.88993	2
96	0.82706	0.17294	0.82706	1
97	0.07450	0.92550	0.92550	2
98	0.18940	0.81060	0.81060	2
99	0.44372	0.55628	0.55628	2
100	0.28693	0.71307	0.71307	2
101	0.11542	0.88458	0.88458	2
102	0.00566	0.99434	0.99434	2
103	0.06624	0.93376	0.93376	2
104	0.59341	0.40659	0.59341	1
105	0.14923	0.85077	0.85077	2
106	0.30553	0.69447	0.69447	2
107	0.18751	0.81249	0.81249	2
108	0.15265	0.84735	0.84735	2
109	0.42102	0.57898	0.57898	2
110	0.10247	0.89753	0.89753	2
111	0.18751	0.81249	0.81249	2

112	0.58349	0.41651	0.58349	1
113	0.08522	0.91478	0.91478	2
114	0.75981	0.24019	0.75981	1
115	0.66081	0.33919	0.66081	1
116	0.10247	0.89753	0.89753	2
117	0.23038	0.76962	0.76962	2
118	0.03338	0.96662	0.96662	2
119	0.62688	0.37312	0.62688	1
120	0.72510	0.27490	0.72510	1
121	0.04383	0.95617	0.95617	2
122	0.00628	0.99372	0.99372	2
123	0.04436	0.95564	0.95564	2
124	0.59940	0.40060	0.59940	1
125	0.01624	0.98376	0.98376	2
126	0.07450	0.92550	0.92550	2
127	0.10544	0.89456	0.89456	2
128	0.82706	0.17294	0.82706	1
129	0.05038	0.94962	0.94962	2
130	0.62523	0.37477	0.62523	1
131	0.79229	0.20771	0.79229	1
132	0.08748	0.91252	0.91252	2
133	0.64304	0.35696	0.64304	1
134	0.25024	0.74976	0.74976	2

CLASSIFICATION MATRIX

FUNCTION	1	2	TOTAL
GROUP			
1	116	15	131
2	26	108	134

APPENDIX 6.1

Miscellaneous Cross Tabulations

Response on the comparability of financial aid received by the sample of shows and no-shows (Master's) who were also offered financial aid by MSU in Fall 1967.

6.1.1: Cross Tabulation of responses from the sample survey by Shows/No-Shows, Entrance GPA and by Aid/No Aid categories.

The following data refer to the Master's applicants who were offered financial aid by MSU in Fall 1967.

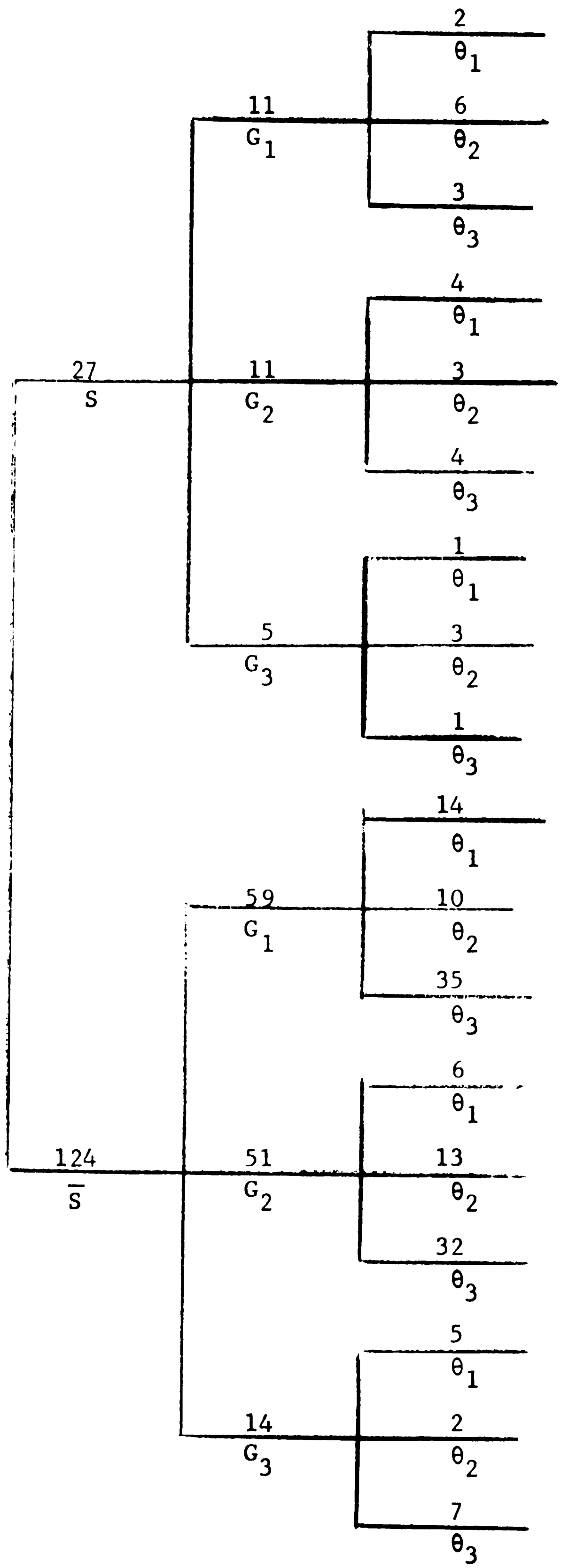
Number of shows in the sample = 131

Number of no-shows in the sample = 134

Population of shows = 1573
(with aid from MSU)

Estimation of population of no-shows (with aid from MSU)
= 436.

Cross tabulation of frequencies are as follows:



Note: S, $\bar{S}$, G_i, θ_j are as defined in Figure 6.2. The numbers above the line (branch) indicate the frequencies falling in the respective cross-classification cell.

Number of Financial Aid Offers Received by Master's Applicants

6.1.2 Number of financial aid offers received by the sample of shows and no-shows (Master's applicants) who were also offered financial aid by MSU is presented below. The figures indicate the offers excluding MSU's offer.

Let θ = number of financial aid offers received (other than MSU's)

Number of financial aid offers received by the sample of Shows and No-Shows.

θ	Shows	No-Shows
0	53	5
1	16	30
2	4	29
3	6	30
4	3	19
5	2	8
6	0	7
7	0	1
8	0	1
≥ 9	1	0
Total	85	130
Non response to the item	46	4

Using the above data, the following probabilities are obtained:

$\{S/F,\theta_j\}$ = Probability of Show given financial aid from MSU and θ_j offers from other places.

$\{S/F,\theta = 0\} = 0.9829$

$\{S/F,\theta = 1\} = 0.7455$

$\{S/F,\theta = 2\} = 0.4327$

$\{S/F,\theta = 3\} = 0.5235$

$\{S/F,\theta = 4\} = 0.4621$

$\{S/F,\theta = 5\} = 0.5937$

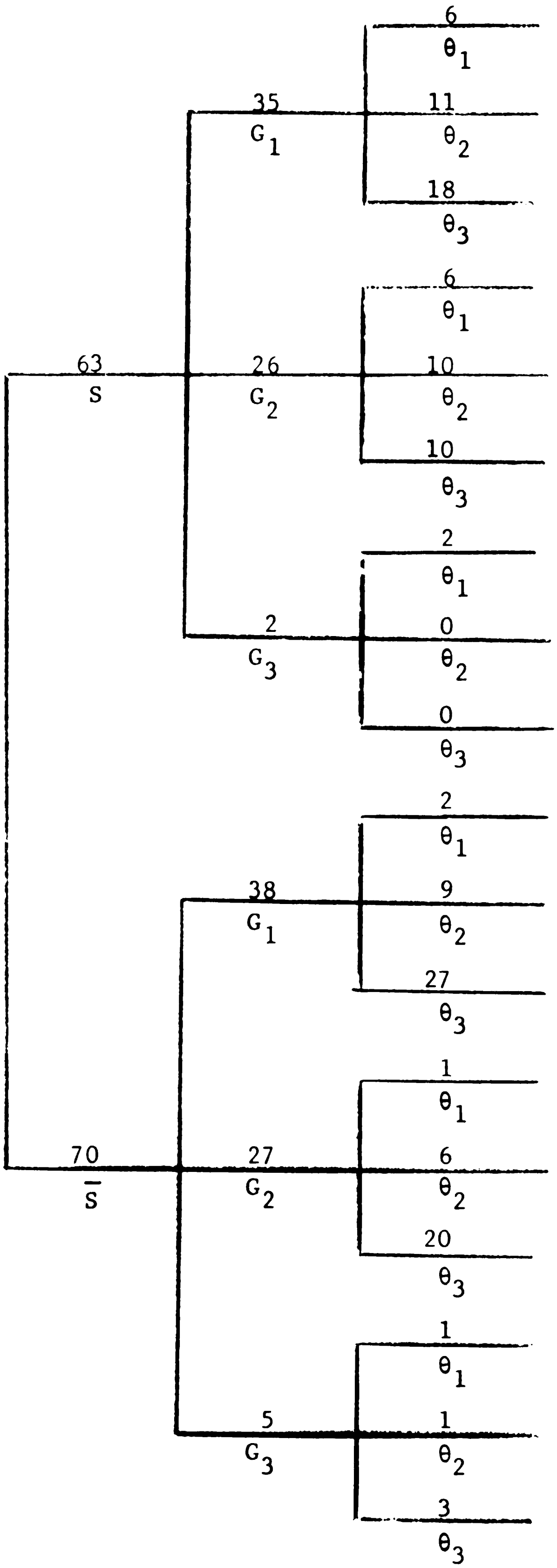
$\{S/F,\theta = 6\} = 0$

-
-
-

The above analysis indicates that the higher the number of financial aid offers, the lower the chances of attending MSU (accepting MSU's product package). The number of financial aid offers received by an applicant is not known to the administrator in advance for predicting the probability of show. But the number of financial aids are highly related with entrance GPA which is known to the administrator. Using this information, the probability of show may be predicted.

6.1.3: Response on the Comparability of Financial Aid Received by the Sample of Shows and No-Shows (Doctoral) Who Were Also Offered Financial Aid by MSU in Fall 1967:

Cross tabulation of responses obtained from the sample of shows and no-shows by entrance GPA and aid/no aid categories is presented below.



Number of Shows in the sample = 204

Number of No-Shows in the sample = 75

Population Size of Shows = 2086

Estimate population size of No-Shows = 244

Note: S, $\overline{S}$, G_i, θ_j are as defined in Appendix 6.1.1. The numbers above the line (branch) refer to the frequencies falling in the respective cross classification cell.

6.1.4: Number of Financial Aid Offers Received by the Doctoral Applicants:

Let θ = number of financial aid offers received (other than the MSU's offer).

Number of financial aid offers received by the sample of shows and no-shows are:

θ	Shows	No-Shows
0	81	0
1	28	14
2	27	20
3	10	15
4	5	15
5	2	6
6	2	2
7	0	3
8	0	0
≥ 9	0	1
Total	155	74
Non response to the item	49	1

Population Size (Shows) = 2086

Estimated population size (No-Shows) = 244

Shows Sample Size = 204

No-Shows Sample Size = 75

From the above data, using the same notation as in Appendix 6.1.2 the following probabilities are obtained:

$\{S/F, \theta = 0\} = 1.00$

$\{S/F, \theta = 1\} = 0.89$

$\{S/F, \theta = 2\} = 0.85$

$\{S/F, \theta = 3\} = 0.73$

$\{S/F, \theta = 4\} = 0.61$

$\{S/F, \theta = 5\} = 0.57$

$\{S/F, \theta = 6\} = 0.79$

$\{S/F, \theta = 7\} = 0$

As in the case of Master's applicants, the above analysis also indicates that the higher the number of financial aid offers, the lower the chances of attending MSU (accepting MSU's product package).

APPENDIX 6.2

REGRESSION MODEL

Multiple Regression Analysis: Multiple regression analysis is used to find the relationship between graduate educational purchase behavior (dependent variable measured in terms of probability of purchase) and a set of independent variables such as individual perceptions of university, academic characteristics and socio-economic and demographic characteristics. It is hypothesized that the dependent variable is a function of a set of independent variables. The magnitude and sign of the regression coefficient indicate the amount and direction of influence respectively of the independent variable on the dependent variable. Whether the amount of influence of an independent variable on the dependent variable is significantly different from zero is judged by testing the significance of the regression coefficient. If the regression fit is good, knowledge of the individual's characteristics and the environmental variables will enable the researcher to predict the probability of the purchase of graduate education at MSU.

In the earlier model, the probability of show was predicted on the basis of only two variables - aid/no aid and the entrance GPA. The problem that is being posed here is slightly different and more specific in nature. The university administrator may be interested in knowing what would happen if he were to withdraw all the financial aids? Such a step may result from a policy decision to improve (divert the resources) other aspects of the university or may be a practical necessity. More specifically the problem is that of estimating the probability of attendance in the absence of financial aid of the subject who has been offered financial aid. Normally, such a question could be answered by observing the proportion of people who were granted financial aid and who would enroll even when the offer of financial aid were withdrawn by MSU. This involves an experimentation which no educational institution would like to undertake under normal circumstances because of the possible deviations from the routine functions as well as the impact of such an experiment on the long-run functioning of the university. If such an experiment were conducted, it would provide an estimate of the probability (relative frequency concept) that an individual with financial aid would be attending MSU without aid assuming the environmental (competition, employment, etc.) conditions are constant. An alternate and more feasible way of estimating the same probability would be by asking a student with financial aid to assess his own probability (subjective probability concept) of attending MSU without aid and then study the relationships to arrive at predictive knowledge. This would be a good estimate if and only if what they say and what they do are the same. Assuming that there is a good agreement between what they say and do, an attempt is made to predict the probability (as they say) that they would be attending MSU without financial aid, i.e., the problem amounts to the prediction of answer to question 29 (Appendix 3-1) given certain characteristics of the individual. The descriptive analysis of chapters four and five and the review of literature indicated that the behavior is a function of a number of variables such as the perception of the university and the socio-economic characteristics of the individual. To determine educational buying behavior in the absence of financial aid, it is logical to isolate the variables that have significant influence and estimate their effect. This can be formulated as a regression problem with "probability of attendance without financial aid" as the dependent variable and the individual and environmental variables as independent variables, i.e.,

$$Y = f(x_1, x_2, \ldots, x_n)$$

where Y = probability of show without the financial aid

x_1 = entrance GPA

x_2 = importance (rank) to the location of campus

x_3 = importance (rank) to the curriculum in the major field

$\vdots$

x_n = parent's income.

The major problem in hand now is to find the functional relationships between the dependent variable (y) and the set of independent variables $(x_1, \ldots, x_n)$ and then use this to arrive at some predictive knowledge. The relevant population for estimating these relationships is the population of students who were offered financial aid by MSU. The experience so far indicates that it is meaningful to treat each level of higher education (undergraduates, Masters and Doctoral) separately. To demonstrate the validity and predictability of the model, the regression model on the doctoral students is presented here and those that correspond to the master's and senior populations are available from the author for reference.

Regression Model to Predict the Probability of Attnedance to the Doctoral Program in the Absence of Financial Aid:

The dependent variable is the subjective probability assessed by the individual students in the doctoral program with financial aid, that they would attend MSU had they not been offered financial aid (Question 29, Questionnaire 3-1). The problem is to predict this subjective probability on the basis of the knowledge on other variables (academic, perception of university and socio-economic variables). The process of isolating the variables that influence the dependent variable may be done by using a least squares computer program. The method consists of picking out one variable that has the maximum effect on the dependent variable and then adding variables one after another till the significant level criterion is met. When this program was run on the responses received from the doctoral students, the variables that were picked out as having the most effect on the dependent variable were:

Attractiveness of financial aid at MSU as perceived by the student and the importance he places on financial aid in the choice of a university (Questions 16 and 17 in Appendix 3.1). The product of these two variables.

Comparability of the financial aid offers received.

Information at the time of admission.

Number of financial aid offers.

Individual attention at the time of admission.

Size of the undergraduate school attended.

The multiple regression equation with the above set of variables is of the form

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + \beta_5 x_{5t} + \beta_6 x_{6t} \qquad (1)$$

$$t = 1, \ldots, n.$$

where

x_{1t} = (Rating of financial aid as perceived by the t^{th} individual) (Importance to the financial aid in the choice of university by the t^{th} individual).

x_{2t} = Comparability of other financial aid offers with that of MSU (3:Higher offer, 2:Similar offer, 1: Lower offer).

x_{3t} = Rating on satisfaction of information at the time of admission by the t^{th} student.

x_{4t} = Number of financial aid offers received by the t^{th} student.

x_{5t} = Rating by the t^{th} student on individual attention paid by the university at the time of admission.

x_{6t} = Size of the undergraduate school attended by the t^{th} student.

The above selected variables were run on least squares computer routine to determine the multiple regression coefficients which are substituted into the equation (1) to obtain the following equation.

$$y_t = 0.7502 - 0.0233x_{1t} - 0.0913x_{2t} + 0.0730x_{3t} - 0.0414x_{4t} - 0.0422x_{5t} - 0.0311x_{6t} \qquad (2)$$

The above six variables yield a multiple correlation coefficient of 0.6863 which implies that the above set of six variables explains about 47 percent of the variance of the dependent variable. The first variable which is highly significant explains about 37 percent of the variance. The high value of β_0 (constant term in (2)) partly explains the error and lack of good predictability. The nature of the problem is such that it is often difficult to predict what "people would say". In this sense, even 47 percent explanation of variance could be a fairly significant contribution.

Interpretation of the regression coefficients:

The sign before the regression coefficient explains the direction of its relationship with the dependent variable.

$\beta_1 = -0.0233 \Rightarrow$ the higher the product (rating score X rank) of rating and ranking of financial aid, the lower the chances of attending MSU without financial aid.

$\beta_2 = -0.0913 \Rightarrow$ the higher the other offers of financial aid received, the lower the chances of attending MSU without aid.

$\beta_3 = 0.0730 \Rightarrow$ the higher the satisfaction on communications with MSU, the higher the chances of attending MSU without financial aid.

$\beta_4 = -0.0414 \Rightarrow$ the higher the number of other offers of financial aid, the lower the chances of attending MSU without financial aid.

$\beta_5 = -0.0422 \Rightarrow$ the higher the individual attention paid at the time of admission, the lower the chances of attending MSU without aid. The "individual attention" is a concomitant variable highly related with entrance GPA and the departmental need.

$\beta_6 = -0.0311 \Rightarrow$ the larger the school from which he has graduated, the lower the chances of attending MSU without financial aid. This again is a concomitant variable highly related with entrance GPA and academic ability.

The number of variables in the above set can be manipulated by the administrator or researcher is limited and part of the information may not be known in advance unless the data is collected along with the application in order to make predictions.

How well the multiple regression model (2) predicts what the students say has been analyzed by a "goodness of fit". A computer program has been prepared to test the goodness of fit and the "predicted" and "observed" values are plotted in a scatter diagram (Figure 6.2.1). The same data are presented in tabular form in Table 6.2.1.

Table 6.2.1: The Relationship Between the Predicted (by the model) and Observed Subjective Probabilities (assessed by the individual students) of Doctoral Students.

		Predicted Probability					
		0	.01-.20	.21-.40	.41-.60	.61-.80	.81-1.00
Observed Probability	0	16	30	12	10	4	
	.01-.20	2	8	9	3	2	
	.21-.40		1	10	6	2	
	.41-.60		1	5	6	9	2
	.61-.80		1		2	9	
	.81-1.00			6	12	31	5

The concentration of frequencies on the diagonal cells of the above table or the scatter diagram show a fair association between the predicted values and observed values.

The major focus of the regression model is to see the interrelationships between the subjective probabilities and the various characteristics of the individual. If the same individual is asked

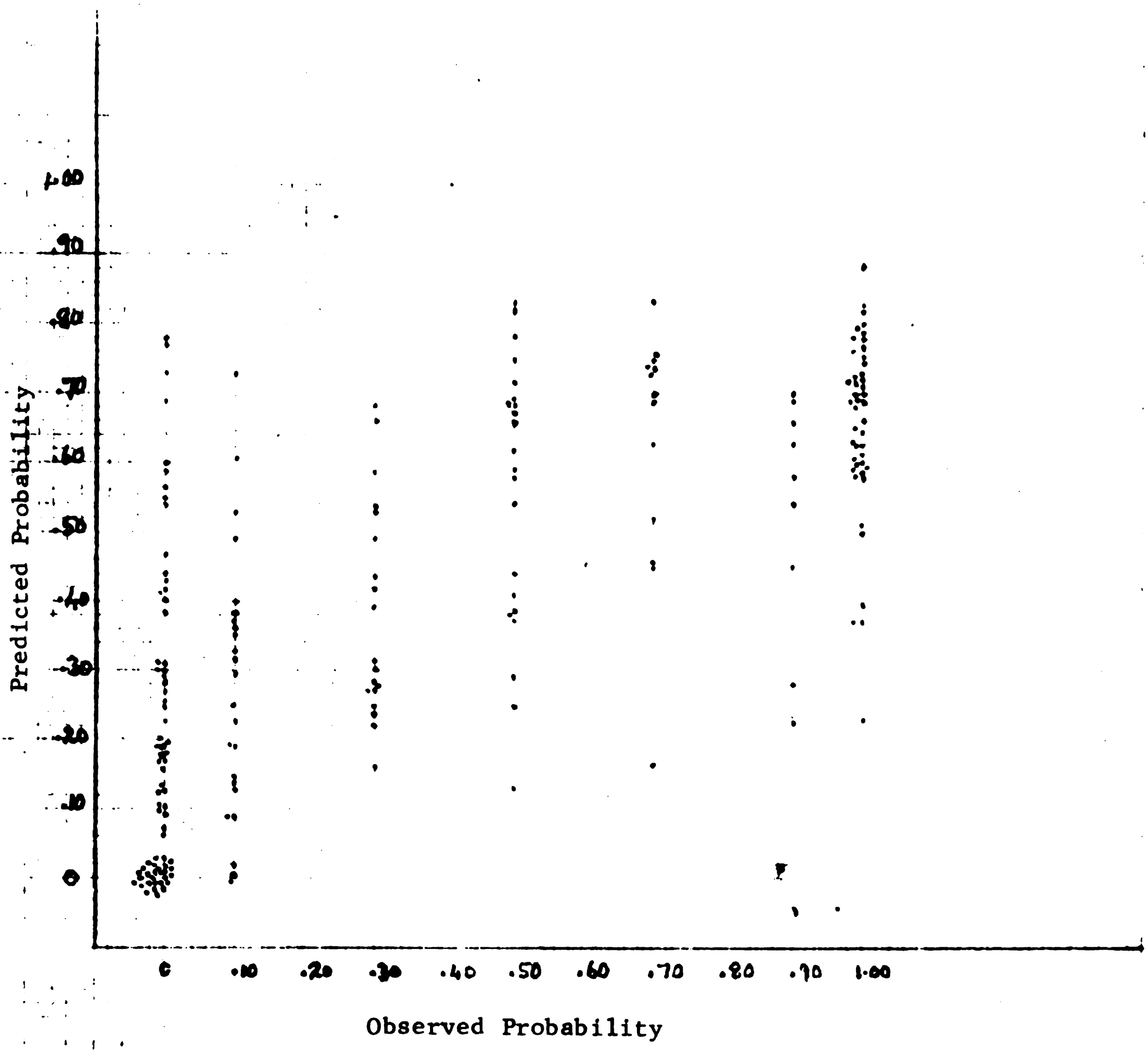


Figure 6.2.1 Scatter Diagram Showing the Relationship Between the "Predicted" and "Obscrved" Probabilities.

(Doctoral Students)

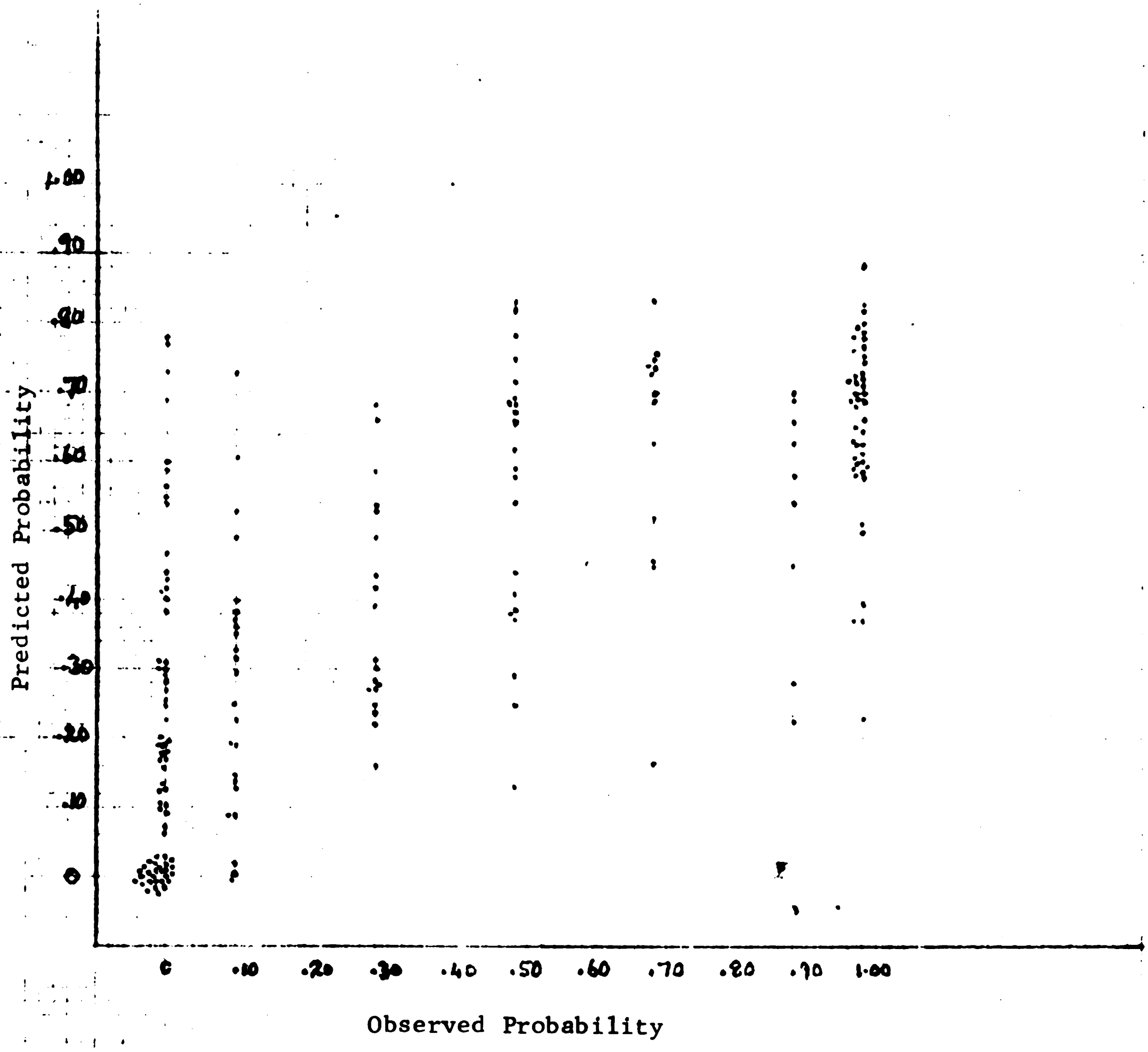


Figure 6.2.1 Scatter Diagram Showing the Relationship Between the "Predicted" and "Observed" Probabilities.

(Doctoral Students)

to assess his subjective probability of attendance in the absence of financial aid, his answers may differ over a period of time and what he might have done under the actual circumstances might be different from what he said. When there is so much variation within an individual, how can one expect the model to be that accurate? Even if the prediction were good, a lot of information used in this model may not be known to the administrator well in advance. Further it is assumed that the variables are independent. Thus in reality may not be true. The justification for using the multiple regression without being sure of the validity of the independence assumption is that students may not perceive the variables to be interrelated. It is their perceptions that are relevant here rather than the 'true state'. However, the variables x_{1t} [(rating of financial aid as perceived by the t^{th} individual) (Importance to the financial aid in the choice of university by the t^{th} individual)] and x_{2t} (comparability of other financial aid offers with that of MSU) are obviously not independent.

The above criticism, however, does not mean that the regression model is useless - it is intended to describe the relationships between different variables which may aid to understand some of the interrelationships between the variables influencing the graduate education purchase behavior.

The probabilistic model and the regression model describe the probable behavior of an individual graduate consumer with known characteristics to variations in the financial aid. Does the variation in the amount of financial aid (or for that matter, any other variable) affect the other sectors of the educational system? An answer to the above question necessitates a detailed discussion of the systems model developed by Koenig et al at Michigan State University.[1]

[1] Herman E. Koenig, M.G. Keeney and Rita Zemach (1968): A Systems Model for Management, Planning and Resource Allocation in Institutions of Higher Education. Final report, Division of Engineering Research, Michigan State University, East Lansing, Michigan.

APPENDIX 6.3

SYSTEMS MODEL

Herman E. Koenig, M.G. Keeney and Rita Zemach developed a theoretical systems model to predict the resource requirements at an institution of higher education for various administrative policies and enrollments.[2] They considered financial aids as one of the control variables in an institution of higher education and predicted the enrollment as the sum of three components: transition enrollment, new enrollment and the enrollment induced by the financial aids. The present study is a part of the author's participation in the project to empirically validate part of the theoretical model.

The total university system is viewed as a collection of interacting subsystems or sectors. The characteristics of each sector, in terms of input and output, are modeled independently and then the model of their interrelation is developed.[3] The university system is considered as consisting of five major sectors or subsystems designated as Student Sector, Academic and Non-academic Production, Personnel, and Phsyical Facilities. These five major operational components are governed by the "Administrative Control" component which is the source of policy and human decision. The

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[2] Koenig, H.E., Kenney, M.G. and Zemach, R. (1968). Ibid.

[3] Rita Zemach (1967). "A State-Space Model for Resource Allocation in Higher Education" IEEE Systems Science and Cybernetics Conference, Boston.

basic structure of the model with above components is schematically represented in Figure 6.3.1. The variables included under each of these sectors are briefly mentioned.

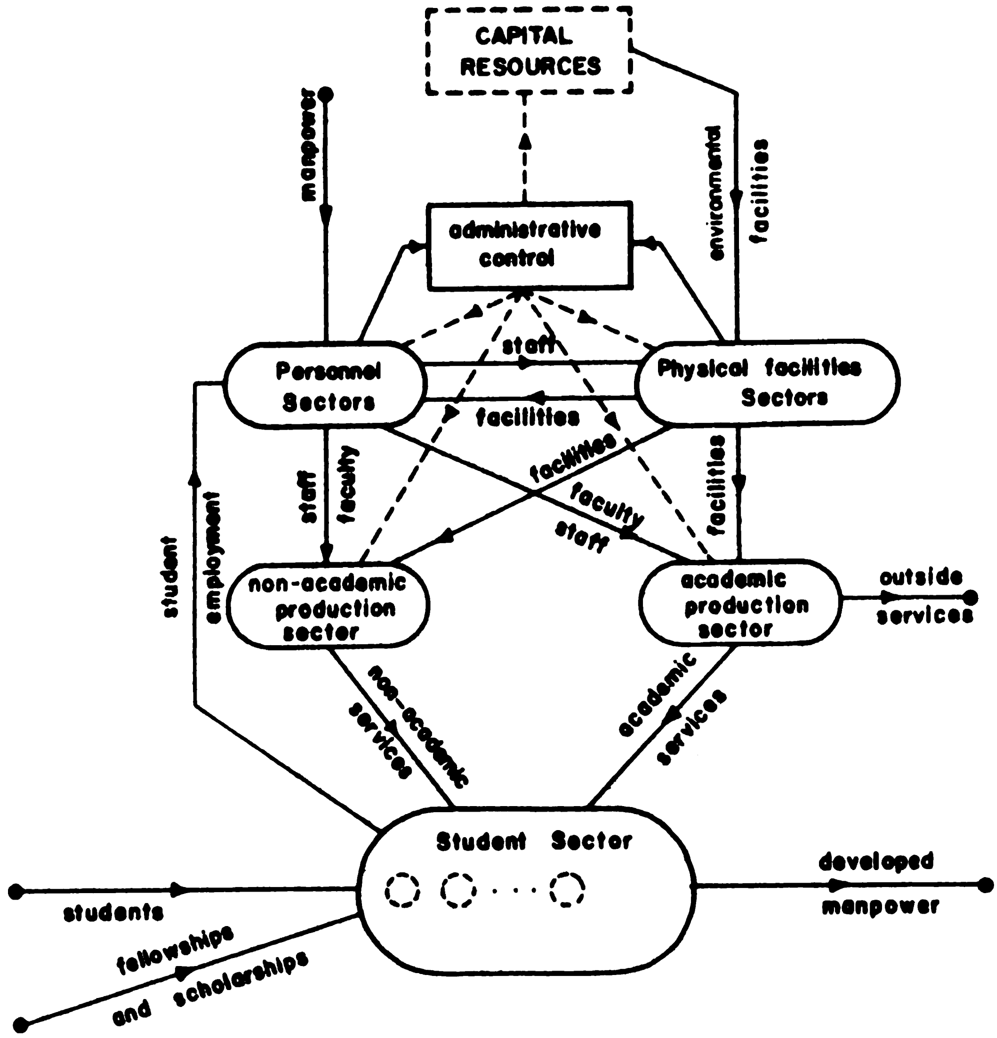
Personnel Sector: Units of manpower expended by the faculty, staff and student employees are devoted to academic and non-academic production, administration, and maintenance of physical facilities. Part of this staff effort is utilized for organization and internal support of the personnel sector.

Physical Facilities Sector: This sector includes variables like building space, library and computer facilities, supplies, and equipment. Flows of these units are utilized in production, administration and support of personnel.

Academic Production Sector: The academic production sector takes-in the resources of personnel effort and environmental facilities and produces academic services such as credit hours which are demanded for consumption within the university and outside services like sponsored research and consultations.

Non-academic Production Sector: The non-academic production sector includes secondary functions like registration, housing, medical service, food service and non-academic counseling.

Student Sector: The student sector generates internal demand for academic and non-academic production, takes in new students and converts them to an output designated as "developed manpower". The student sector has a second output of student labor and services, constituting an important internal flow to the personnel sector. The flows of units or outputs of the other sectors depend on the internal demand generated by the student sector. In this sense,



—— vector flows of people and services with associated imputed values per unit

- - - - administrative policy controls

● interfaces with remaining socio-economic process (terminals)

◌ population groups and their imputed values (internal states)

Figure 6.3.1: Basic Structure of a Typical Institution of Education as a Socio-Economic Process

Source: Herman E. Koenig, M.G. Keeney and Rita Zemach (1968): Ibid the purchase behavior of the student sector and the variables influencing such selective demand are of prime importance. One of the major foci of the present study is to identify such variables which are termed as "control variables" and demonstrate their effect on demand for education.

The development of the total systems model consists of developing equations for each sector describing the relationships between inputs and outputs for each sector and then aggregating them, taking into consideration the constraints or restrictions which sectors may impose on one another. The focus of the present investigation has been the behavior of the student sector. Thus one can start with the description of the variables in that sector. The internal state of the university system is described in terms of the distribution of students among various levels and fields of education. The state vector is a composite of a vector $\underset{\sim}{s}(t)$ and a vector $\underset{\sim}{\hat{s}}(t)$ whose coordinates describe student distribution among the various areas of study at various levels, and the attributed average unit cost of education respectively, during the t^{th} time interval. The t^{th} time interval may refer to a term, semester, or a school year.

The model describes the changes in the state of the system from one time period to the next as a function of the state itself.

Let

$$\underset{\sim}{s}(t) = [s_1(t), s_2(t), \ldots, s_N(t)]^T$$

be a subvector of the state vector, where $s_i(t)$ represents the number of students in category i during the t^{th} time interval, the superscript T indicates the transpose of the vector.

If $p_{ij}(t)$ represents the proportion of those students in the j^{th} category during time $(t-1)$ who are in category i during the time t, the $N \times N$ matrix

$$P(t) = [p_{ij}(t)], \; i = 1,\ldots,N; \; j = 1,\ldots,N$$

describes the transitions between categories for those students who are in the university during the time periods $(t-1)$ and t.

Let $n(t)$ represent the number of new students arriving at the university at time t and let

$$\underset{\sim}{a}(t) = [a_1(t),\ldots,a_N(t)]^T$$

be the distribution vector for the arrivers, where $a_i(t)$ represents the proportion of the new students who enter category i. The product

$$\underset{\sim}{a}(t)n(t)$$

is an N-vector whose components represent the number of new arrivals entering the respective categories.

A difference equation representing the transition in student population distribution from time period $(t-1)$ to time period t may then be written

$$\underset{\sim}{s}(t) = P(t)\underset{\sim}{s}(t-1) + \underset{\sim}{a}(t)n(t) \tag{3}$$

where the N-vector $\underset{\sim}{s}(t)$ gives the student distribution in the N categories during period t.

The equation (3) describes the change in state as a natural progression from one time period to the next. The matrix $P(t)$ and the vector $\underset{\sim}{a}(t)$ represent the aggregate decisions or behavior of students. It may be possible to isolate variables that affect the proportion of students moving from one category to another or even the new arrival rates of the students. If it is possible to do so, then such variables might be regarded as control variables of the system.

As a first step in identifying control variables, it was assumed that the number of graduate assistantships and fellowships, scholarships or tuition scholarships will affect the number of students in a category or level. Therefore two vectors of "financial aids" are introduced into the model which may be considered as control variables:

$$\underset{\sim}{g}(t) = [g_1(t),\ldots,g_G(t)]^T$$

$$\underset{\sim}{h}(t) = [h_1(t),\ldots,h_H(t)]^T$$

where $g_i(t)$ and $h_i(t)$ represent the number of graduate assistantships and fellowships (or scholarships) in i^{th} category respectively. Both $g_i(t)$ and $h_i(t)$ must be measured in some standard units (say full-time equivalent units) to meaningfully incorporate them in any analysis.

With the above control variables, the state equation (3) may be modified as:

$$\underset{\sim}{s}(t) = P(t)\underset{\sim}{s}(t-1) + \underset{\sim}{a}(t)n(t) + K_1\underset{\sim}{g}(t) + K_2\underset{\sim}{h}(t) \qquad (4)$$

In equation (4) the matrices K_1 and K_2 attribute part of the enrollment in each student category to the number of financial aids available.

In practice, it is almost impossible to estimate the effects of two types of financial aids separately on enrollment. So, in this study the net effect of financial aid is estimated and no attempt is made to decompose it into the effects of two types of financial aids. Further, for simplicity as well as lack of adequate data on true transition portions, in this study, no distinction is made between transition students from time periods (t-1) to t and the new arrivers at time t.

Estimation of the Effect of Financial Aids on Enrollment in Different Levels and Categories of Higher Education: In the present study, an attempt was made to

i) Assess whether the control variables are different for different levels of higher education;

ii) Estimate the effect of financial aid on the total enrollment and the student incoming quality.

The approach taken to answer (i) and (ii) employs a survey design to collect the necessary information through the questionnaires in the Appendix 3. (i) and (ii) are discussed in the same order as presented below.

Students were asked (question 17) to rank the five most influential factors (according to importance) in the choice of a university. The summary of rankings of the variables that were considered as most influential by the students in their choice of a university was presented in the Chapter four (Table 4.6). The table is being repeated here (Table 6.3.1) because of its relevance to the identification of the control variables.

Table 6.3.1: Ranking of University Variables According to the Amount of Influence on the Choice of a University.

Level Variable	Rank assigned by Doctoral	 Master	 Senior
Curriculum in the major field	1	1	2
Faculty reputation in the major field	2	3	7
General reputation of the university	3	2	1
Financial aid through the university	4	6	9
Off campus job opportunities for self and wife	10	10	10
Campus job opportunities for self and wife	9	11	11
Educational facilities	6	8	5
Location of campus	5	4	3
Appearance of campus	11	9	6
Employment opportunities after completion of degree	7	5	8
Low costs	8	7	4
Loan facilities	12	12	12

The above table has important implications. It is obvious that in all the three levels, curriculum in the major field is considered to be a major influential factor in the choice of a university. Financial aid only occupies the fourth rank in importance at the doctoral level, sixth rank at the master's level and ninth rank at the senior level. The study by Pace and McFee concluded that even though people list "faculty, scholastic standards, curriculum, reputation and facilities" as the most important factors, "in actual choice of college, financial and practical factors were of substantial influence, academic factors playing a more moderate, secondary role."[4] An in depth analysis of the no-shows (master's and doctoral applicants) indicate (Appendix 4) that for about one third of the no-shows who were offered financial aid by MSU, the main reason for non acceptance was a higher offer elsewhere. This single reason accounted for the highest percentage of no-shows. Beach also reports that financial assistance is the most influential factor in choosing an institution at the graduate level.[5] From this analysis it appears that without financial aid able students may not be attracted but at the same time good students may not be bought by financial aid alone! More specifically students look for a cluster of value satisfactions and the best university is the one which has an "optimum mix" of various factors that the students consider as important in the choice of a university.

The finding that the general reputation is the most influential factor at the senior level is in agreement with Astin's study which was based on an undergraduate population.[6] An important implication derived from the evidence of differences between levels in the ranking of the most influential factors in the choice of a university is that buyers of education at different levels are looking for different sets of value satisfactions. This factor has to be taken into consideration in communications and promotional programs aimed at different levels of the student population.

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[4] Robert C. Pace and Anne McFee (1960). Op cit., p. 315

[5] Leonard B. Beach (1965). Op cit.

[6] Alexander W. Astin (1965). Op cit.

The analysis indicates that there is a set of control variables rather than a single variable that determines the educational buying behavior. However, certain factors like campus location cannot be manipulated by the administrator whereas most other factors like financial aid, campus job opportunities for students, curriculum and educational facilities may be monitored subject to the budget constraints. Here again, factors like general reputation, faculty reputation, curriculum development are all long-run control variables. Under normal circumstances, the administrator may not have perceptible influence in the enhancement of these variables. It requires continuous efforts over a sufficiently long period of time to build either good general reputation of the institution or recruit and maintain a team of well known faculty or the modernization of curriculum. One of the variables that could be varied by the administrator in the short-run subject to meeting the teaching and research commitments of the department is the amount of financial aid per student receiving aid. Therefore, financial aid is considered as a control variable in the present study though it is not external to the system. The effect of this control variable in any level is directly proportional to the amount of importance students place on financial aid in the choice of a university. This implies that it is not fair to assume a uniform set of control variables or parameters for all levels of higher education. This point has not been mentioned in the literature, though most administrators appreciate the logic of such a distinction.

The conclusion that financial aid does not uniformly stimulate demand (as a control variable) could also be partially validated from a different point of view. The students attending MSU with financial aid were asked to assess their own (subjective) probability that they would have attended MSU without financial aid. The responses received are presented in Table 6.3.2 below by level and entrance GPA.

Table 6.3.2: Average Probability of Attendance Without Financial Aid as Estimated by Students Receiving Financial Aid by Level and Entrance GPA.

	Entrance GPA			
Level	≥ 3.5	3.0 ≤ GPA < 3.5	2.5 ≤ GPA < 3.0	2.0 ≤ GPA < 2.5
(1)	(2)	(3)	(4)	(5)
Senior	.6370	.6020	.6702	.7620
Master	.3381	.5614	.5771	-
Doctoral	.3184	.4265	.5694	-

It is fairly evident that financial aid plays an increasingly important role at higher levels than at the lower levels of college education. Further, within any level, its effect is positively correlated with the entrance GPA.

The inducement due to financial aid, besides varying by level and entrance GPA class, may also vary by college, depending on the manpower needs (employment situation) and the proportion of student population in that specific field. Table 6.3.3 presents the average probability that a student receiving financial aid would attend MSU without the financial aid by level and college. This is computed on the basis of the responses to question 29 (Appendix 3-1) and averaging the aggregates of such responses by level and college.

Table 6.3.3: Average Probability that a Student Receiving Financial Aid Would Attend MSU if No Aid Had Been Received, by Level and College.

	Business	Engineering	Social Sciences	Other Colleges
Senior	.689	.583	.688	.651
Master	.607	.515	.498	.461
Doctoral	.399	.279	.496	.402

These probabilities may be influenced by various factors such as curriculum, faculty reputation, general reputation and the number (and/or amount) of financial aids available, competitive environment in the industry, empolyment situation as well as change in the tastes of people. In the short-run (when the above factors are held fairly constant) the probabilities are likely to be stable. Periodically, these probabilities could be re-evaluated and it should be possible to explain the significant deviations in terms of changes in one or more of the above mentioned variables.

Likewise, it may be of interest to know the proportion of total enrollment attributed to financial aids by level and college. This is computed by estimating the enrollment due to financial aid (enrollment in the presence of financial aid minus estimated enrollment in the absence of financial aid) and then taking the ratio to the total enrollment.

Table 6.3.4: Proportion of Total Enrollment Attributed to the Influence of Financial Aid by Level and College.*

	Business	Engineering	Social Sciences	Other Colleges
Senior	.0343+	.1105	.0548	.0680
Master	.1904	.1637	.2990	.1877
Doctoral	.4156	.5100	.3645	.3991

* These figures take into account the number of students attending without financial aid and the fact that financial aid is only partly responsible for the presence of those receiving aid.

\+ Increase in enrollment due to financial aid/total enrollment.

Proper interpretation of Table 6.3.4 requires knowledge of the fraction of the student population on financial aid by college and level. This is presented in Table 6.3.5.

Table 6.3.5: Fraction of Student Population on Financial Aid by College and Level.

	Business	Engineering	Social Science	Other Colleges	Pooled Estimate
Senior	.1089	.2663	.1651	.1949	.1808
Master	.4829	.3362	.5956	.3486	.3961
Doctoral	.6901	.7046	.7213	.6672	.6777

The above table, however, does not imply that the amount of financial aid is the same at any level between colleges. This point is important to interpret the differences, if any, in input quality at different levels between colleges. Table 6.3.5 indicates that there are better chances for financial aid in Engineering at the senior level; however, at the graduate level, the college of Social Science seems to be better.

The analysis has demonstrated a method of estimating the effect of a control variable on the selective demand for education. However, the problem of estimating the independent effects on demand of more than one control variable as well as their interactions is a complex problem.

Estimation of total enrollment in each level for varying policies of financial aid allocation:

Estimation of enrollment in each level for varying number of financial aids may be obtained by using Tables 3.2 and 6.3.3 as presented below:

a) Enrollment in Doctoral level: If there were no financial aids, the enrollment in the Doctoral program would have been

$$[176\ 105\ 277\ 1528]\begin{bmatrix}0.399\\0.279\\0.496\\0.402\end{bmatrix} + [79\ 44\ 107\ 762]\begin{bmatrix}1\\1\\1\\1\end{bmatrix}$$

$$= 851 + 992 = 1843.$$

With 2086 financial aids (all financial aids assumed to have been measured in units of half time equivalents) the enrollment =

$$[176\ 105\ 277\ 1528]\begin{bmatrix}.399\\.279\\.496\\.402\end{bmatrix} + [176\ 105\ 277\ 1528]\begin{bmatrix}.601\\.721\\.504\\.598\end{bmatrix} +$$

$$[79\ 44\ 107\ 762]\begin{bmatrix}1\\1\\1\\1\end{bmatrix}$$

students that would have enrolled even without financial aid	+	enrollment induced by financial aid	+	students without financial aid

$$(851 + 1235 + 992) = 3078$$

Enrollment attributed to financial aid = 3078 - 1843 = 1235.

On the average every financial aid increased enrollment by

$$\frac{1235}{2086} = .5920$$

Estimated incoming student quality (as measured by GPA) = 3.43 (please refer to Table 4.8D).

Increasing the number of financial aids (without changing amount per student) by 25% (say) would increase the enrollment by

$$\left[\frac{25}{100} \times 2086\right][.592] = 308.$$

i.e., with 2394 financial aids the enrollment would be 3078 + 308 = 3386.

It can be shown that the incoming quality is not significantly affected by such a policy.

b) Enrollment in Master's Level: If there were no financial aids, the enrollment in Master's program would have been

$$[312\ 39\ 249\ 973]\begin{bmatrix} .607 \\ .515 \\ .498 \\ .461 \end{bmatrix} + [334\ 77\ 169\ 1818]\begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$= 3180$$

With 1573 financial aids the enrollment = 3971

Enrollment attributed totally to financial aid = 791

On the average, every financial aid increased enrollment by

$$\frac{791}{1573} = 0.5028.$$

Average entrance GPA = 3.11

c) Enrollment in Senior's Level: If there were no financial aids, the enrollment in the Senior's program would have been

$$[108\ 106\ 250\ 839]\begin{bmatrix}.689\\.583\\.668\\.651\end{bmatrix} + [883\ 292\ 1264\ 3464]\begin{bmatrix}1\\1\\1\\1\end{bmatrix}$$

$$= 849 + 5903 = 6752$$

Enrollment attributed to financial aid = 7206 - 6752 = 454

On the average, every financial aid increased enrollment by

$$\frac{454}{1303} = 0.3480.$$

Estimated average GPA = 2.95.

Comments: From the above analysis it is obvious that financial aids are more effective at the higher level (Doctoral) than at the lower level (Senior). This serves as a cross check on the earlier finding (Chapter IV). The above analysis can project the enrollment for varying numbers of financial aids (without changing their value). It can be shown that by increasing the number of financial aids, the enrollment may go up but the incoming quality may not improve. This is in contrast with the probabilistic model presented in Chapter six which shows the improvement in incoming student quality when the amount of financial aid is varied.

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