An economic-attitude model for career choice in medicine

by

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INTRODUCTION

Since the initial Bane report, Physicians for a Growing America (63), there has been a deep interest in expanding the educational resources necessary to increase the number of medical school graduates. Related to this has been the proliferation of specialties within medicine. Yet due to an accelerating population growth, demand for qualified physicians exceeds supply. As a result there is increasing competition among the specialties for the qualified graduate. Consequently an understanding of the dynamics of the status heirarchy exhibited in career choice is essential to the problems of recruitment and distribution of manpower resources across available medical graduates. It is toward such an understanding that this research is directed with particular focus upon an integrated economic-attitude model for career choice in medicine.

It has been stated (20, 55) that as long as the population grows there will always be a greater demand for medical services than available supply. According to the Surgeon General's report (63), to meet projected national demand for medical services in 1975 the average annual output of medical graduates would have to be increased by more than 3,000 if the minimum ratio of physicians to population necessary to protect the national health is to be maintained.

With immigrant physicians constituting less than 20% of annual supply, (63) the United States must rely upon its own medical school graduates as the primary source of supply for physicians. While the projected need for new graduates in 1965 was 9,500, only 7,409 students graduated from the 88 schools of medicine (55). Since 1965 it has been projected that the number of physicians graduated from American medical colleges will grow to only between 10,200 (28) and 11,100 (55) in 1975, with 11,000 graduates needed simply to maintain the 1959 ratio of physicians to population. That is to say, the present supply of medical graduates is inadequate but apparently fixed by the number and capacity of the institutions.

It seems that an obvious long-run solution to the shortage of physician supply might be increases in physician productivity accompanied by increases in institutional capacity. However some (18) feel that increasing productivity through advances in medical technology and administrative organization may not resolve the shortage since as the population grows in size and affluence, the "desire" to be healthier and the "desire" for closer personal attention in medical services will offset any strides in physician productivity. Furthermore, the acquisition of more doctors through greater institutional capacity requires more medical schools and associated with this is a five to ten year lag in preparation (15). In addition, current projections have already absorbed

institutional planning into their estimates. Long-run solutions of this type are indeed a long way off.

In the short-run the problem is not one of increasing aggregate demand for physicians, but rather one of optimally distributing available supply across the profession. In a collectivist economy optimal distribution may be obtained through state planning by: (a) altering rates of pay for various fields within the profession, (b) coersive manpower distribution, and (c) varying prestige and socio-economic factors associated with various career alternatives (16). However, operating within a competitive economy and allowing freedom of choice, direct action on the part of the State in employing these alternatives is infeasible. Yet it is conceivable that specialties within the medical profession might profitably employ alternative (c) if information were available concerning the factors involved in career choice decision making. Hence the problem translates into that of determining the constituents of career choice decisions in a free choice environment.

Specifically, for medical students entering the medical profession, the research question seeks to determine what factors are involved in the choice of; medical specialty, type of career planned, and type of practice entered. The research model to be presented explores this question from an economic-attitude frame of reference. In general, however, there are

many approaches to occupational choice. For completeness and subsequent model genesis an overview of these approaches is worthwhile.

OCCUPATIONAL CHOICE: AN OVERVIEW OF RESEARCH

With any choice process it is possible to distinguish at least two approaches to its study (67). The "normative" approach prescribes how choices ought to be made while the descriptive or "empirical" approach investigates how choices are actually made. While this may appear an oversimplification in practice, for expository purposes two scientific disciplines primarily associated with occupational choice fit this designation particularly well. The economist's approach to occupational choice is strongly normative while the phychologist's approach is more empirically oriented. There is also some research combining the two approaches from which the subsequent economic-attitude model has evolved.

Economist's approach to occupational choice

As Blau et al. (11) point out, the economic considerations in occupational choice are traditionally investigated assuming social-psychological factors as given. The occupational choice from an economic framework, as reflected in published research, amounts to choosing an occupation with the highest rate of return attainable or with the greatest income stream under considerations of risk. The former is most closely associated with human capital and cost-benefit analysis (8) while the latter represents expected utility maximization (23).

A summary of human capital is presented by Wood and Campbell (68) and a theoretical application for occupational choice is presented by Benewitz and Zucker (10). In their normative model it is assumed that an individual selects a rate of discount in conjunction with his own "time-preference" function. This rate is then employed to arrive at a present value of the expected income stream for all occupations under consideration. The individual chooses that occupation for which the present value is a maximum. In a slightly different approach to account for occupational choice after-the-fact, Mincer (45) assumes that a rational choice of occupation implies an equalization of present values at the time of choice. Differences in occupations under consideration are then a function of the length and cost of training necessary to enter alternative occupations. Such an approach closely resembles the traditional cost-benefit analysis.

Wood and Campbell (68) provide an excellent annotated bibliography of cost-benefit research. When applied to occupational choice the procedure is no more than assigning quantitative figures to all benefits (usually income) and costs (usually acquisition costs) associated with each occupation under consideration. The occupation selected is the one with the greatest benefit to cost ratio, or if a rate of discount is available, the occupation selected is the one exhibiting the greatest present value. Alternatively one may

equate future income stream to costs and select the occupation with the greatest internal rate of return. Some theoretical formulation accounting for the costs of choice among job alternatives has been presented by Kaldor (41) as initial steps for subsequent cost-benefit analysis.

It should be clear that what has been discussed to this point involves comparisons of income streams (benefits) across occupational alternatives with the associated decision of selecting the maximum. However, as Friedman (21) points out, in an economic model other factors should be considered, to the point that the rational economic choice may not be that of selecting the occupation with the maximum income stream.

Friedman (21) characterizes distribution of income as a primary focus of economists and suggests that individual (occupational) choice can affect this distribution in two rather different ways. First of all differences in money income may compensate for nonpecuniary advantages or disadvantages attached to the receipt of those incomes. Secondly, alternatives open to an individual differ in possible income probability distributions. That is, an individual's choice among occupational alternatives depends in part upon his taste for risk associated with probabilities of obtaining a projected income stream. Research into the first area mentioned has not been considered within the domain of economics (21), although the second area is characteristic of expected utility

maximization.

Still concentrating upon income as the primary criterion for occupational choice, Friedman and Savage (24) deal with utility toward occupational income under conditions of risk. Under their expected utility maximization hypothesis they propose that a consumer unit (family or individual) behaves as if:

> "(1) It had a consistent set of preferences.
> (2) These preferences could be completely described by attaching a numerical value - (utility) to alternatives each of which is regarded as certain.
> (3) It choses among alternatives not involving risk, that one which has the largest utility.
> (4) It choses among alternatives involving risk, that one for which the expected utility (as contrasted with the utility of the expected income) is largest." (24)

Under these conditions Friedmen and Savage graph (see Figure 1) the utility function associated with occupational income to demonstrate the differences in incremental utility with increasing income to the risk lover and risk averter. Such a formulation implies the possibility of interpreting socio-economic variables into the utility function. In that regard Blau et al. (11) implicitly consider more than one criteria of occupational choice.

In their conceptual framework, Blau et al. maintain that "A choice between various possible courses of action can be conceptualized as motivated by two interrelated sets of factors: the individual's valuation of the rewards offered by different alternatives and his appraisal of his chances of being able to

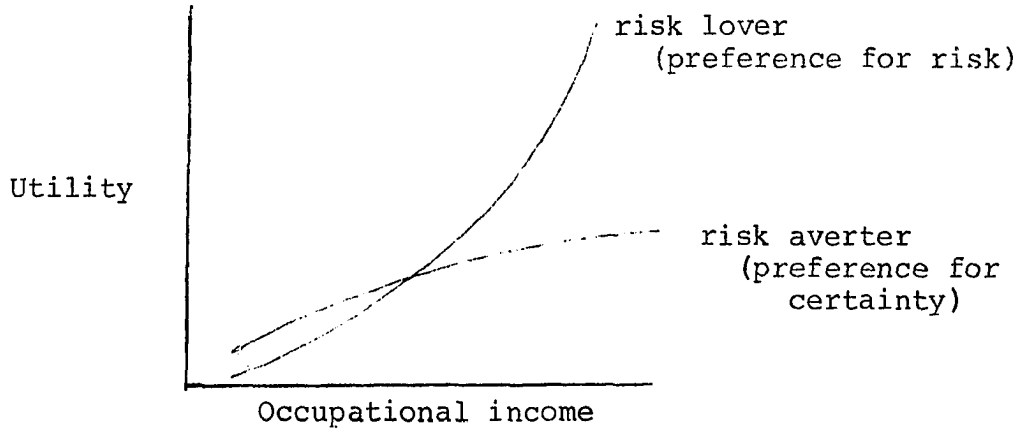

Figure 1. Utility as a function of occupational income under conditions of risk

realize each of the alternatives." (11) They suggest that valuations and appraisals are acquired and modified by social experience and both are conceived to be ordered into a hierarchy of preferences (valuations) and a hierarchy of expectancies (appraisals). The individual's choice will reflect a compromise between his preferences and his expectancies in an attempt to maximize expected utility. Such a conceptualization is at the fringe of the strictly economic approach to occupational choice. As Friedman suggests and as Blau et al. imply, a model of occupational choice must also embrace the psychological realm of the nonpecuniary aspects of occupational decision-making.

Psychologist's approach to occupational choice

From a review of the literature it is apparent that the bulk of research in vocational choice has been conducted by psychologists. Although much of this research is concerned with the process and development of vocational behavior (61, 26, 31), there is increasing emphasis upon determinants of occupational choice. Since it is in this latter direction that the decision-making concept of occupational choice is situated, a review of psychological determinants of career choice is pertinent. In that regard, Vroom (67), Hewer (32) and in particular Zytowski (70) present rather extensive summaries of research in this area. Following Zytowski's format, most determinants of occupational choice can be categorized into six major somewhat overlapping areas: self-expression, childhood experience, need reduction, social determinants, psychoanalytic factors, and the decision-making concept of occupational determinants.

It is the contention of research indicating self-expression as an occupational determinant, that the degree of correlation between a person's self and occupational concept predicts occupational preference and success. While Super (62) provides the most elaborate review and integration of self-concept research to career choice, others (48, 5, 37) tested his propositions with parallel conclusions. For example, Starishevsky (59) develops "metadimensions" of self-constructs,

in order to translate self-concepts into vocational terms, while Oppenheimer (49) examines the relationship between particular constructs and occupational preference.

A second category of occupational determinants is childhood experiences. In her paper "Early Determinants of Vocational Choice" (54), Roe develops the general theory that early child-parent interactions determine or are later reflected in occupational choice. While Roe concedes that her analysis is only speculative, other investigators (27, 51, 64a) directly tested the theory. In none of these studies was her theory substantially upheld although partial hypothesis verification was achieved in each. For example, the test that parental attitudes are a factor in the child's subsequent career choice did not confirm the hypothesis although it was found that magnitude of the difference between attitudes of parents was predictive of occupational choice. In another test (27), specific parent-child relationships appeared to affect boys and girls differently. Other studies of this type are referenced in Zytowski's book (70).

Holland's theory of vocational choice (34) is most representative of need reduction as an occupational determinant. In a theoretical presentation Holland suggests that the satisfaction of interest, values, or needs is achieved through choice of occupation. Corresponding to postulated needs such as intellectual, motoric, esthetic, and persuasive, Holland specifies satisfaction-providing occupational environments.

Under the assumption that the level of occupation chosen is a function of the chooser's evaluation of his ability a need-reduction model of career choice is constructed and its corollaries tested (35, 36). Other research in this area (13, 44, 60) generally differs primarily in sematics and experimental technique. Of particular significance is the work of Vroom (67) in investigating career choice as a function of differing motivational states of the individual.

As mentioned in connection with the economists approach to occupational choice (9, 58), occupational valuations (appraisals) are often acquired and modified by social experience. As opposed to previous psychological approaches, research into the social determinants of career choice is not introspective but rather explores social influences on the level or status of choices. A sociologist (17) suggests that direct occupational "inheritance" is much greater for the siblings of the self-employed professional than other members of a similar socio-economic level. Orenstein and Sewell (50) demonstrate that boys from rural areas exhibit lower occupational aspirations than boys from larger towns or cities. While no theoretical formulation links only social factors to occupational choice, and although evidence of social determinants in career choice are scattered and vary in quality, Zytowski (70) does present a sample of studies to support their instrumentality.

Quite distinct from the social factors in career choice is research focusing upon a psychoanalytic conception of occupational determinants. Analogous to need reduction with emphasis upon the mechanism of sublimation, infantile conflict, and resolution of libino energy, the psychoanalytic approach implies that vocational choice is to some degree instrumental in resolving personality drives and conflicts. Other research (12) in this area is abundant (1, 25, 56) but due to its inheritly subjective nature it is not of significance for this paper and is mentioned only for completeness.

An area of psychological research that does have bearing upon subsequent model development is that of the decision-making approach to occupational choice. It is in the decision-making context that psychological theory and economic approaches to career choice begin to merge. Economists discuss decisions in terms of maximizing preferences (utility) given the probability and costs of alternatives while psychologists quite similarly build theories of choice embracing value attainment and expectancy. For example, Vroom (67) advances a theory of occupational choice similar to Atkinson's (6) theory of achievement motivation wherein the net attractivness of an occupational alternative is hypothesized to be multiplicative function of the valence (reward) of that choice and the subjective expectancy of achieving it. Morris (46) extends the theory of achievement motivation by considering the

propensity for risk taking as a determinant of vocational choice. Utilizing economic terminology Ziller (69) investigated vocational choice and utility for risk and found that risk-taking tendencies determine, in part, occupational choice. Other research (33, 46, 65) and even applications of game theory (57) seem to suggest that the decision-making orientation is particularly appropriate for integrating psychological and economic approaches to career choice.

Integrated approach to occupational choice

As research has indicated (11, 21) neither "economic man" choosing occupations solely from monetary considerations nor an occupational choice model constructed of singular psychological determinants seems adequate for predicting career choice. The logical extension is some type of combination or integrated approach. Kaldor and Zytowski (42) have proposed such a model. Their formulation is not one of linearly combining economic maximization of discounted income streams with the psychological determinants of vocational choice but rather a model of economic utility maximization constructed on psychological determinants. Since the economic-attitude model to be presented shortly was developed as an extension of the Kaldor-Zytowski conceptualization, their model will be presented in greater depth here.

As an extension of the traditional model of economic decision-making based upon choices between goods, the authors

propose a maximizing model of occupational decision-making based upon choices between both economic and psychological determinants. As a consequence of an individual's value system the model assumes each individual possesses an occupational utility function, analogous to "job satisfaction", which the individual tries to maximize by judicious choice of occupation.

The occupational utility function is a hypothetical subjective function comprised of all variables relevant to the occupational choice process. Borrowing from tenents of economic preference orderings, Kaldor and Zytowski describe the function as an everywhere dense function with universal diminishing marginal utility. That is, with respect to any variable in the set relevant to occupational choice, the partial derivative of the occupational utility function is always positive but continually decreasing. The set of variables constituting the utility function includes both economic factors such as beginning wages, rate of increase in earnings, and investment potential, as well as all relevant psychological factors such as job status and prestige, contact with people, intellectual challenge, and physical or mental ability. While Kaldor and Zytowski simply treat these variables as examples, Vroom's (67) occupational choices are made on the basis of 5 primary decision variables: wages, mental or physical energy expenditure, production of goods or service, social status, and social interaction. In any case the utility

function serves as the hypothetical bridge connecting these variables or others to the individual's subjective value or preference ordering. A graphical representation of such an occupational utility function displayed as contours corresponding to increasing levels of utility is presented in Figure 2. All points on a given contour represent the same level of occupational utility. Consequently the individual is assumed to be indifferent between all points on a given contour. For that reason, contours are labeled in economic jargon as "indifference curves" (19, 30).

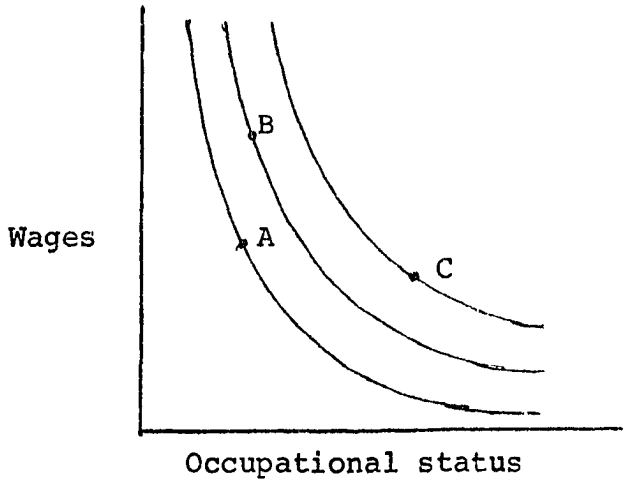

Figure 2. Contours (indifference curves) associated with various levels of occupational utility

Since a subjective utility function is hypothesized for each individual, and since the precise functional is unknown, all that can be assured is that the contours of any occupational utility function constructed from the given assumptions will be concave to the origin. In addition, it is clear that as one moves farther away from the origin, one is moving in the direction of increasing utility. As such, maximizing occupational utility simply implies moving to that attainable contour farthest from the origin. A contour is attainable if some occupational opportunity exists such that its vector value in terms of the relevant set of decision variables places it on the contour in question. As an example, in Figure 2 three different occupations are represented as 3 unique points A, B and C in the decision vector space, wherein the utility map ascribes to each occupation a different level of utility. That is, each occupational alternative falls on a different contour (indifference curve). The rational individual, with indifference curves as illustrated, should clearly choose occupation C since it represents the greatest level of utility (job satisfaction).

In their article Kaldor and Zytowski (42) point out that although there are other facets to consider, occupational utility maximization is the crux of the theory. For example, the effect of individual differences on the exact slopes of the indifference curves must be considered. Since no two

preference mappings are alike this accounts for the fact that two occupations located consistently in the decision space may be reversed in preference by different individuals. In addition, differing individual resources and abilities must also be considered in the context of constraining the occupations attainable by different persons. Finally Kaldor and Zytowski mention, but do not develop, the influence of risk in a decision-making model. Essentially their aim was to integrate psychological decision variables with the tenents of economic decision-making, omitting rigorous development of preference orderings, decision variables, and so forth.

The model to be presented shortly in this paper may be regarded as an extension of the Kaldor-Zytowski presentation, but reoriented to apply directly to career choice in medicine. Essentially the same principles of occupationaly utility maximization, individual occupational utility functions, decision variables, and restraints on attainable careers, apply but in a revised manner and in a different context. In particular, the decision variables are no longer goods as in the purely economic formulation, nor a mixture of psychological and economic factors such as wages and social status. Rather, the model to be discussed focuses upon attitudes toward careers in medicine as the decision variables which are to be maximized according to the individual's utility function. In that respect, the Kaldor-Zytowski formulation serves as a point of

departure for construction of an economic-attitude model of career choice in medicine.

AN ECONOMIC-ATTITUDE MODEL

From the previous remarks and demand-supply considerations it is apparent that a conceptualization of career choice in medicine is needed which is both consistent within a decision-making frame of reference and embraces as many factors determining career choice as possible. Such a conceptualization must of course be predicated on the assumption that career choice is the result of a rational decision as opposed to habitual action unpreceded by a deliberate decision (43). If such an assumption is tenable, Kaldor and Zytowski's (42) maximizing model of occupational utility can be revised in its decision variables to treat the underlying determinants of career choice.

The review of the literature would seem to indicate that an attempt to incorporate all factors influencing career choice into a single finite model is virtually impossible. However, that difficulty can be circumvented by focusing not on all factors per se but rather on these factors indirectly through beliefs and values governing predispositions toward potential careers. That is, assuming an individual's belief and value system to be a foundation for the more observable factors influencing choice. There would certainly be operational advantages in working directly with a more concise set of beliefs and values or some function thereof. Since an attitude can be defined as the multiplicative function of a

belief and a value (40), the rationale for using attitudes as decision variables in a maximizing model should be clear. Obviously such a formulation demands attitude information bearing directly on careers in medicine.

A career attitudes instrument designed specifically to measure attitudes towards careers in medicine has been developed by Hutchins (38). The instrument, composed of 38 Likert scale items, yields 5 factors in a factor analysis. These are: prestige-recognition-reward, intellectual challenge, patient contact, desire for pressure, and teamwork. Although they exhibit a striking similarity to Vroom's (67) five determinants of occupational choice previously mentioned, these factors were constructed and named entirely from the factor analysis. Since without a priori manipulation these factors reflect theoretically postulated career determinants some evidence for their validity is suggested.

Substantial justification for their use however, is provided by the reliability and cross-cultural stability of these career attitude factors. When the instrument was translated and administered to American medical students, English-speaking Canadian medical students, and French-speaking Canadian medical students, subsequent analysis revealed the same factors for each group (64b). Reliabilities for the first four factors ranged from .70 to .82 within each group and although the "teamwork" factor was less reliable, it also exhibited

consistent reliability from .47 to .59 across the three groups (see Table 1). In any case the instrument provides stable, reasonably reliable factors valid in a model of career choice. What follows then is a theoretical development of an economic maximizing model employing these career attitude factors as decision variables.

Theoretical development

Central to a maximizing model is the entity being maximized and it is essential if not crucial to accurately define this entity. Analogous to Kaldor and Zytowski's occupational utility maximization, the economic-attitude model maximizes attitude-orientated utility. Since attitudes are a function of beliefs and values, attitude-orientated utility might be described as the satisfaction derived from the value placed on beliefs concerning occupational alternatives. Although this interpretation of utility is not traditional in the sense of utility representing quantitative preference ordering, it is defendable. As Friedman points out:

> "Utility is used as if its meaning were self-evident and did not depend on the context in which and the purpose for which it is used, itself, I believe, a reflection of a failure to recognize that a concept used in the interpretation of observable phenomena has no meaning independently of the operations specified for measuring it...Utility is that property of a thing for a person to which a number is assigned by one or another set of operations. The relevant questions are: (1) whether a particular definition of utility is useful, and (2) what the properties are of the set of numbers (or other identifying marks) which the operations embodied in that definition generate." (22)

Table 1. Descriptive item content and loadings for five major factors obtained from the career attitudes questionnaire

Item no.	Item	Factor loadings		
		U.S.	English Canadian	French Canadian
	Factor I - Prestige, recognition and reward			
14.	ample recognition for what you do	+.75	+.70	+.67
13.	high prestige in medical profession	+.70	+.67	+.68
7.	standard of living above average for M.D.	+.46	+.45	+.16
11.	patients really appreciate effort	+.40	+.44	+.35
39.	not receive recognition for efforts	-.52	-.58	-.43
40.	only average prestige in medical profession	-.52	-.53	-.62
34.	only moderate financial rewards	-.47	-.49	-.29
38.	seldom know if efforts appreciated	-.49	-.50	-.60
	Factor II - Intellectual challenge			
19.	uncertainties in diagnosis and therapy	+.57	+.51	+.56
35.	many opportunities to contribute to knowledge	+.57	+.45	+.36
41.	extensive reading and study	+.56	+.40	+.42
5.	difficult diagnostic problems	+.53	+.52	+.37
45.	develop new treatment procedures	+.50	+.50	+.44
32.	straightforward diagnostic problems	-.69	-.68	-.54
46.	few uncertainties in diagnosis or therapy	-.67	-.60	-.62
20.	treatment procedures well established	-.57	-.57	-.60
10.	few opportunities to contribute to knowledge	-.49	-.38	-.25
16.	minimum amount of reading and study	-.47	-.44	-.13
33.	effects of treatments assessed immediately	-.38	-.36	-.44

	Factor III - Patient contact			
29.	work closely with patient and family	+.70	+.70	+.69
51.	see patients many times	+.65	+.64	+.67
1.	know patients well	+.63	+.56	+.50
28.	close relations with patients not required	-.72	-.71	-.77
26.	rarely see patient more than once or twice	-.61	-.55	-.60
4.	little contact with patient's family	-.57	-.54	-.53
	Factor IV - Pressure desirable			
42.	frequently required to meet emergencies	+.76	+.82	+.79
49.	important decisions made rapidly	+.66	+.65	+.75
21.	frequently have patient's life in hands	+.60	+.62	+.64
17.	considerable degree of manual skill required	+.42	+.31	+.45
30.	"on call" at all hours	+.41	+.38	+.49
48.	rarely have patient's life in hands	-.58	-.50	-.61
15.	rarely meet emergency situations	-.52	-.51	-.67
44.	little manual skill required	-.43	-.34	-.49
24.	ample time before important decisions	-.36	-.45	-.38
	Factor V - Teamwork			
37.	teamwork essential	+.60	+.66	+.76
2.	share responsibility for patient care	+.55	+.50	+.47
27.	sole responsibility for patient care	-.44	-.42	-.03
12.	rarely work with others	-.26	-.48	-.45

In the context of an economic-attitude model, a subjective hypothetical utility function is postulated for each individual making a career choice decision. The utility construct so specified is a function of the five career attitude factors.

As with the Kaldor-Zytowski model this attitude-based utility function will be assumed an everywhere dense function, deviating however from the customarily assumed convexity assumptions. The utility function may be thought of as a mapping from five dimension attitude space into a satisfaction or preference ordering space. With attitude measures then defining the domain, values inherent in these attitude measures inevitably impute general restrictions on the utility function. The restrictions are the consequence of a Likert scale of measurement. Since the Likert scale is discrete thus making raw scores based on Likert items discrete, rigorously one is not justified in assuming an everywhere dense utility function. The particular scale used ranges from highly desirable, to neutral, to highly undesirable with desirable and undesirable taking intermediate positions in the 5 point measure. It seems reasonable that although an individual's actual score for a given factor will be an integer, had he the opportunity to refine the scale mentally, real numbers between integers would also map into his preference (utility) ordering, thus providing rationale for the everywhere dense assumption. The Likert scale however, does fundamentally alter the contours

of the utility mapping.

The indifference curves (utility contours) are no longer necessarily concave to the origin but are now convex to a given point in attitude space. The reason is straightforward. An individual's response to each item on a Likert scale designates not an arbitrary but the best response consistent with his value system. Likewise a factor score constructed from a summation of item responses represents the optimal valuation of that attitude factor. Given five attitude factors, an individual's attitude score can be represented as a point in five space. That point represents the person's optimal evaluation of attitudes toward a career in medicine. Consequently all points other than the optimal point (his attitude score) must be assumed less than optimal since the individual had the opportunity to choose them but did not. When mapped into a utility function, the optimal point becomes the point of maximum utility and all points of equal but less utility are represented as contours convex to the attitude score. This is depicted for two attitude factors in Figure 3. Theoretically these contours may have any convex shape but for illustrative purposes they are ellipsoidal. To be sure, no two individuals will necessarily have the same indifference contours, nor will these contours be expressible cardinally due to their inheriently subjective nature. Theoretically all that can be assured is that an infinite set of contours convex

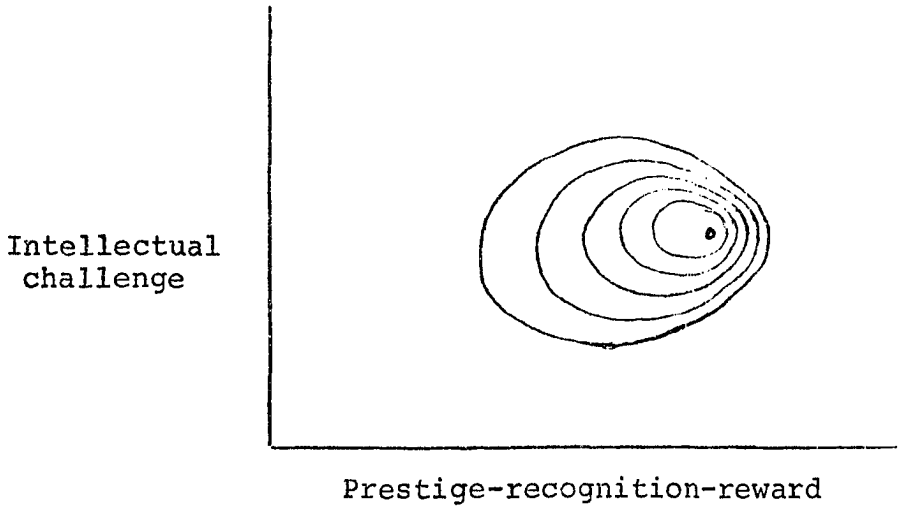

Figure 3. Contours (indifference ellipses) associated with various levels of attitude-based utility

to an individual's attitude score exists for each individual, reflecting decreasing levels of utility as one moves farther from the attitude score.

It is postulated then, that a rational individual attempts to maximize this attitude-based utility in a manner analogous to traditional utility maximization. That is, an individual will seek a career which he values the most from those available, and from those in which he is qualified. Such a career would be represented as a point on a contour closer to his optimal point (attitude score) than any other choice. More clearly, the point representing his career choice would lie on a contour closer to the attitude score than any other contour containing a career choice alternative. Of course much is concealed in this simplified maximization procedure.

First of all, unlike Kaldor and Zytowski's model it is not clear that occupational alternatives can be represented as points in attitude space. An attitude toward an occupation is associated with an individual and not the occupation. Within the context of the career attitudes instrument, an individual's score expresses his attitude toward an optimal career along five dimensions. While he may subjectively discriminate actual career alternatives along the five dimensions, it seems unlikely that alternative careers are conceptualized as points distributed in attitude space. It seems more plausible that career alternatives are perceived as falling in some bounded region of attitude space since the subjective evaluation of any career alternative is necessarily based upon a perception of that career. It is reasonable to assume that attitudes of many individuals entering a particular career would serve a composite characterization or informed on source for perception of that career. That is, assuming people eventually choose a career as close to optimal as possible, the career attitude profile distribution of all individuals choosing the same career should appropriately stereotype that career by locating it in a specific region in attitude space.

Secondly, concealed in the maximization model is the assumption that one in fact maximizes utility by choosing the career with the greatest attitude-based utility. Two reasons for this utility maximization might be speculated. An obvious

reason is suggested by Varoom (63) and the theory of motivation. The attitude score reflects a subjective valuation of career aspirations, which when cast in need reduction terms would suggest that people choose a career closest to their optimal attitude to satisfy their needs. Evidence from research by Newcomb, Festinger, and others (40) would also suggest that people select a career in order to reinforce their own attitudes through the attitude similarity of other members of that career.

Finally, the maximization technique requires that the career be chosen which lies on the highest indifference contour. However, if career alternatives are represented as regions rather than points in attitude space it is clear that a region will lie on more than one contour. The difficulty becomes that of defining which part of a region must lie on the greatest indifference contour. Whether an individual subjectively considers in his choice, that part of the region which might be called the centroid, or the boundary points of each region, or both, or any other portions, is open to hypothesis. If both the centroid and the distribution about this point are evaluated in choosing a career, risk considerations would substantially improve the theory. If only the centroid is considered, Kaldor and Zytowski's model, or a slight refinement of it, would suffice. For the present model the former conceptualization is too refined and the latter is too elementary.

What is needed is an empirically-based conceptualization which transforms regions into more operational terms compatible with the maximization procedure. Discriminant analysis serves this purpose (47, 66). In effect discriminant analysis takes centroids and dispersions into account by estimating a hyperplane which best separates all career choice regions in attitude space. Points in any region can then be described as falling on hyperplanes (projected discriminants) parallel to the first. For illustrative purposes consider a two-dimensional attitude system, a utility function defined as before, and only two career alternative regions in attitude space. Discriminant analysis maps each of the two-dimensional points in each region into a one-dimensional discriminant score computed simply as a linear function of the two attitude variables. This is graphically depicted in Figure 4. For ease in understanding, the distribution of points in the discriminant space (abscissa I) are presented rather than the points themselves.

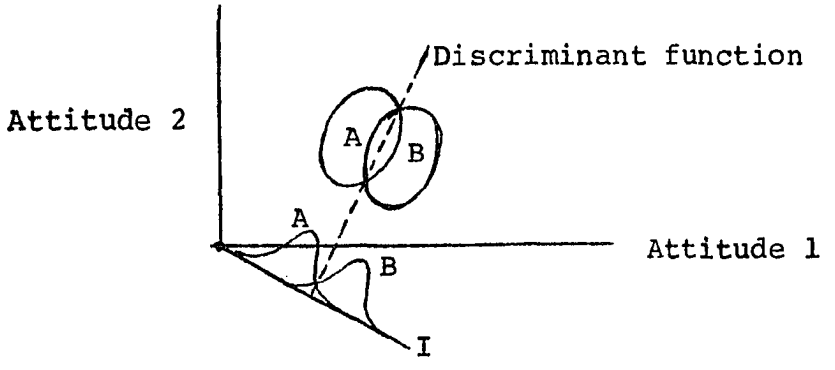

Figure 4. Discriminant function representing the best differentiation of two career alternative regions in attitude space

Essentially, discriminant analysis provides empirically determined linear function of the attitude variates whereby career alternative regions can be transformed into one dimensional distributions (for the two variable case), with minimum overlap. Under regularity assumptions to be discussed later, the maximization scheme translates into selecting that career whose projected discriminant (projected from the mean of that distribution) is tangent to the greater indifference contour. Introducing a preference ordering exhibited as indifference contours, this procedure can be graphically illustrated for the two variable case in Figure 5. In the diagram presented,

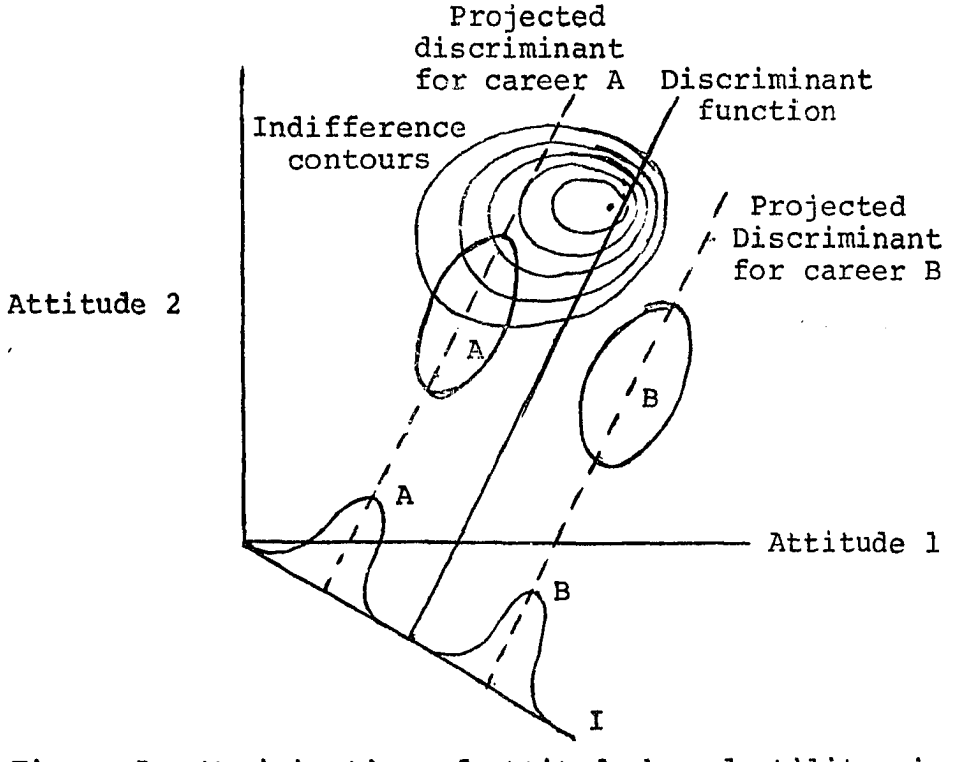

Figure 5. Maximization of attitude-based utility via discriminant projections from career alternative means

the rational individual would choose career A since its projected discriminant is tangent to a greater indifference contour (representing greater utility) than that of career B.

Extending this model to five dimension attitude space, with greater than five career alternatives, the single discriminant function is replaced by a maximum of five orthogonal discriminant functions and the indifference contours become indifference hyperellipsoids. The maximization procedure requires that the career selected is the one whose discriminant projection (hyperplane) is tangent to the greatest hyperellipsoid. Clearly this is simply an extension of the two dimension graphical argument. Perhaps however, a mathematical argument would clarify the extension of the model as well as reveal the economic analogy implicit in the discriminant function.

Consider first the attitude-based utility function $U(x,y)$, where for simplicity x and y represent only two attitude factors. As stated previously, indifference contours represent a given level of utility and the slope of any contour can be derived as follows:

Let $U(x,y) = \text{constant}$

then, $dU = \frac{\partial U}{\partial x} dx + \frac{\partial U}{\partial y} dy = 0$

hence, $$\frac{dy}{dx} = -\frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial y}} = -\frac{\text{marginal utility of attitude x}}{\text{marginal utility of attitude y}}$$

Secondly consider the discriminant function D(x,y), which was defined as that linear function which best separates alternative career regions in attitude space. Empirically this function is computed as the vector associated with the latent root of the determinantal equation $|WA^{-1} - \lambda I| = 0$ where I is a 2x2 identity matrix, W is the inverse of the 2x2 error matrix formed from residuals after fitting the 2x2 matrix A of between group (career alternative groups) sum of squares. As such, the discriminant function is an empirically constructed weighting of the two career attitudes which reflects the relative contributions of each attitude factor in separating the career alternatives. Since the matrices mentioned would have to be constructed from attitudes of individuals entering (or members of) the alternative careers, the discriminant function weights could be interpreted as some measure of the intrinsic value of each attitude factor perceived by the entire population of medical practioners. Such an interpretation is analogous to the role of prices in the strictly economic model.

The analogy is clearly suggested by the mathematical maximization as follows:

Let G be the objective function to be maximized.

$$G = U(x,y) + \lambda(ax + by - c)$$

where $D(x,y) = ax + by = c$ is any one discriminant projection, and a and b are the discriminant function weights. For a maximum, the first order conditions require:

$$\frac{\partial U}{\partial x} + \lambda a = 0, \qquad \frac{\partial U}{\partial y} + \lambda b = 0, \qquad ax + by = c$$

such that,

$$\frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial y}} = \frac{a}{b} .$$

From the previous algebra the following equality holds:

$$\frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial y}} = - \frac{dy}{dx} .$$

Hence the first order maximization conditions require only that,

$$\frac{dy}{dx} = - \frac{a}{b}$$

which is the slope of the discriminant projection. To be sure, for a maximum each discriminant projection (varying only in c) would have to be tested to find the actual maximum value but the first order condition which remains invariant is analogous to

$$- \frac{\text{Price 1}}{\text{Price 2}} = \frac{\text{marginal utility of 1}}{\text{marginal utility of 2}}$$

fundamental to demand theory. That is:

$$\frac{\text{marginal utility of attitude x}}{\text{marginal utility of attitude y}} = -\frac{a}{b} =$$

as valued by individual choosing

$$-\frac{\text{intrinsic value of attitude x}}{\text{intrinsic value of attitude y}} \cdot$$

as valued by entire population

Quite simply, the discriminant projections play the role of budget constraints with discriminant weights serving as prices (i.e. a collectively determined valuation of attitudes). For an optimal career choice from those available, it is necessary that the ratio of an individual's marginal utility toward career attitudes mirror the ratio of the intrinsic values of these attitudes to the physicians in general. While this condition will be met at several points on the indifference contours, the maximization procedure requires that the career selected will exhibit a discriminant projection tangent to the indifference contour representing the greatest utility.

Hopefully the mathematical treatment has underscored the significance of the discriminant function in linking the tenents of economic decision-making to career choice based on career attitudes. Within that framework, the traditional utility construct has been redefined to embrace values implicit in career attitudes. Correspondingly, the traditional budget constraint has been replaced by discriminant projections. Yet

with these modifications the resultant maximization scheme closely resembles that employed in elementary demand theory. However, this presentation has been essentially theoretical with many unstated implicit assumptions. For an adequate theory these must be explicit, and for an operational model, additional simplifying assumptions are necessary.

Assumptions for an operational model

The assumptions necessary for an operational model can be conveniently organized into behavorial and quantitative categories. For the most part the behavorial assumptions are those implicit in the theoretical model while the quantitative assumptions specify mathematical regularities necessary for making the model operational.

With regard to a crucial behavorial assumption, for the model to have validity it must be assumed that the individual making a career choice is rational and that his choice is the result of a deliberate decision rather than some habitual action unpreceded by explicit choice. That is, the phenomenon of simply drifting into careers without specifically choosing them is ruled out by this conceptualization. In addition, it is assumed that the individual has the freedom to choose and is constrained only by the career alternatives available to him.

Reynolds (53) points out that the latter assumptions are applicable only if the individual has complete information

about career alternatives. It is his contention that those who do not have sufficient information about alternatives open to them tend to drift into careers rather than actually choosing them. Credibility for this assumption may also be found in economist's insistence that complete information regarding alternatives is necessary for an economy to be considered perfectly competitive. Viewing the economic-attitude model as a quasi-economic model and considering Reynold's contention, the assumption of sufficient information regarding career alternatives is important. Specifically, sufficient information in the context of the economic-attitude model, means that every individual is aware of the location of each career alternative in attitude space and of the relative significance (discriminant weightings) as applied to each of the five attitude factors by the general population of physicians in distinguishing career alternatives.

Assuming then, rational decision-making behavior of an individual in a free choice environment with sufficient information concerning alternatives does not guarantee that that individual can achieve his optimal choice. Another behavorial assumption aimed specifically at medical students is necessary. Although the validity of this assumption may be questioned it is essential in operationalizing the model. That is, it will be assumed that all M.D. graduates choosing a career in medicine have equal resources and equal potential for success

in any career alternative. Partial justification for assuming equal potential is that unqualified candidates for the MD degree are screened before entering medical school as well as throughout the program as verified by the attrition rate (39). One primary reason for assuming equal resources is to rule out the possibility that one individual for instance is so far in debt that his career choice is determined solely by income considerations. Alternatively it could be assumed that indebtedness is unrelated to career choice. The purpose of these assumptions is to equalize as much as possible, extraneous factors in the decision process so that the actual determinants of career choice are the propensities of each individual toward the five career attitude factors. For example, assuming away extreme indebtedness, any income considerations should be reflected in an individual's propensity for prestige, recognition, and reward (factor 1). Assuming equal potential, a given career alternative would be rejected not because the individual was unqualified, but rather because the composite characterization of that alternative represented by attitudes of physicians entering that career did not align with the individual's attitudes toward a career in medicine. To be sure, these assumptions might be validly criticized but they and other assumptions to follow, serve to operationalize the model.

Although theoretically unnecessary, any practical applications of the economic-attitude model require some regularity assumptions on the utility function. Theoretically it was only necessary to assume contours (hyperellipsoids) convex to an individual's attitude score. The exact utility function was assumed a subjectively determined entity varying with each individual, and as such needed not be specified. Clearly, whether in fact, an individual actually selected an optimal career could only be known to the individual, since the shape of his indifference contours in relation to career alternative regions could not be specified. This was sufficient for the theoretical development. However to test or predict career selection, some regularity with regard to indifference contours must be assumed. Any specific shape could be consistently assumed for all contours for all individuals, but the simplest and yet the shape which on the whole would do the least violation is probably a circular (spherical) one. In addition to its simplicity and consistency, the assumption of a universal utility function exhibiting spherical contours has optimal characteristics for prediction as will be pointed out shortly.

Another regularity condition implicit in the theoretical development and necessary for an operational model is equal dispersion in all career alternative regions. Assuming equal dispersion matrices for each career alternative in attitude

space is equivalent to assuming the same variance for each career alternative on the discriminant axis. As such, a discriminant projection through the mean of each distribution sufficiently captures or describes that region in comparison with all other regions. Hence the discriminant projections can be employed as quasi-budget constraints. Furthermore, this particular assumption also simplifies the predictive capabilities of the model.

Recapitulating the maximization scheme under these operational assumptions reveals a much simplier procedure with implications for prediction. Again, the actual model contains five attitude factors and more than five career alternatives depending upon which category of career choice is under scrutiny, (i.e. type of career, type of practice, area of specialization). For illustrative purposes the conventional example of two factors and two unspecified career alternatives will be used since it can be illustrated graphically. Consider Figure 6. Under the assumptions of equal dispersions for each career region and circular indifference contours around the individual's attitude score, the maximization procedure degenerates into selecting the career whose discriminant projection is closest to the attitude score. Clearly this results from the symmetry of the indifference contours in all directions from the attitude score. In fact, the same result could be obtained by selecting that career whose region mean

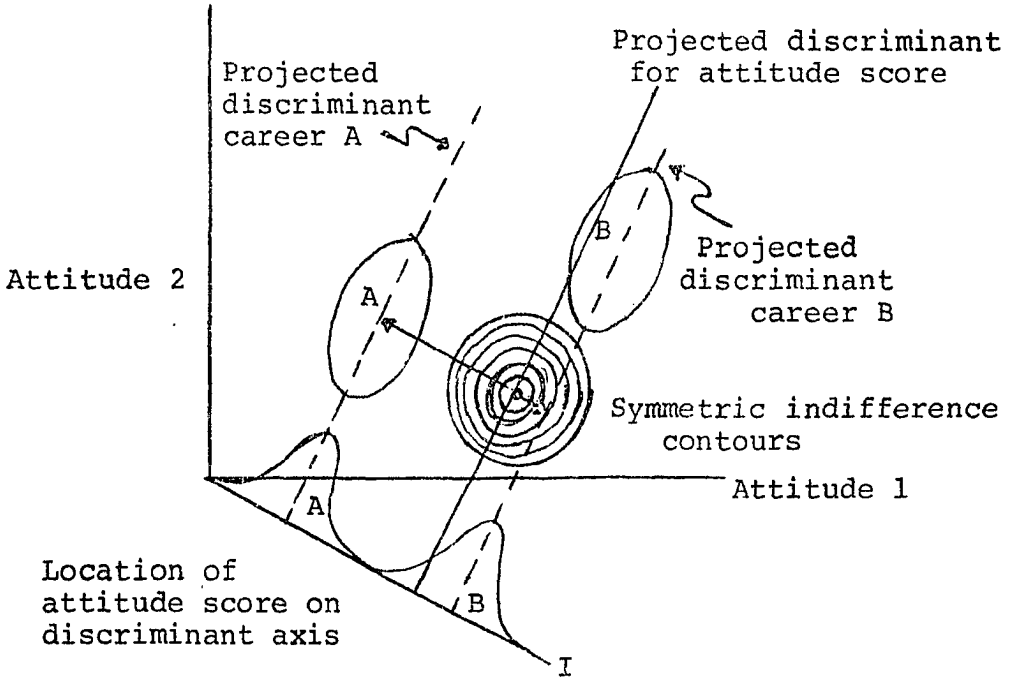

Figure 6. Maximization procedure under assumed regularity conditions for career regions and indifference contours

(centroid) is closest to the attitude score. Alternatively, a discriminant projection through the attitude score would locate that score in the discriminant axis somewhere in the distribution of each career alternative, thereby suggesting the probability attitude similarity in one or the other career. It is these latter two alternatives that provide an operational model with predictive implications.

Predictive implications

Under the assumed regularity conditions, the theoretical economic-attitude model can be reduced to a simplier

discriminant model capable of empirically predicting career choice. Operationally, the individual's utility contours are of little importance in predicting career choice assuming that they are concentric circles, and can be replaced by the distance of the career attitude score from alternative career regions. For prediction then, emphasis then is shifted toward the career regions and their statistical properties.

Focusing upon two dimensional attitude space, a career region has been defined as the bivariate distribution of attitudes of physicians entering that career. Such a bivariate distribution can be described as a set of ellipses, each of which is the locus of points of a specified frequency. Assuming a bivariate normal distribution, the size of an ellipse is determined by the value of the quadratic, $\chi^2=X'D^{-1}X$, where D^{-1} is the inverse of the dispersion (variance-covariance) matrix and X is a two dimension vector of deviation scores from the region centroid. The larger the values of χ^2 the lesser the density at that point X. Hence ellipses farthest from the centroid represent the least density but the greatest χ^2. When the probability of obtaining a χ^2 greater than that of a given ellipse is associated with that ellipse, the ellipse can be thought of as a centile contour (centour). Centours then indicate the probability of obtaining a point farther from the centroid than any point on the centour.

In choosing a career the centours of each career alternative would be inspected to determine the centour in each region upon which the attitude score of the individual lies. The highest of the centours upon which the attitude score falls would designate to the best choice of career. That would be the centroid whose χ^2 is smallest. In five dimensions the centours become hyperellipsoids but the χ^2 criterion is still appropriate. Mathematically a χ^2 is computed with the attitude score for each career possibility and the decision rule is to select that career with the smallest χ^2.

As indicated in the last section, the same results could be obtained by working in discriminant space rather than attitude space. Often in the construction of discriminant functions, statistical testing will reveal that, say, only three out of five possible discriminant functions are applicable. As such, the attitude score of an individual could be transformed into an equivalent score in three dimensional discriminant space. Assuming equal group dispersion matrices, an attitude score lying in a particular area of attitude space will be orientated in an equivalent area in discriminant space, as will the transformed dispersion matrices (14). A transformation into discriminant space reduces the dimensionality of the analysis while preserving aspects of the original model and still yields identical conclusions. That is, such a transformation takes advantage of the intrinsic values of

the original attitude factors in separating the career alternatives by basing the decision rule in discriminant space. In addition, the latter procedure saves quite a bit of computing time if the discriminant space is substantially smaller than the attitude space.

It should be clear that utilizing the procedures outlined, an individual's choice of career could be predicted a priori Given career dispersion matrices or distributions, individual attitude scores, and assuming the specified regularity conditions, the decision rules should reveal which career alternative most closely resembles the attitudes specified by the individual as most desirable. It should be remembered however that the convenient predictions are at the expense of greatly simplified assumptions concerning the utility function of each individual. The consequences of these assumptions can best be determined empirically.

However prior to this, a more fundamental analysis is necessary. This entire theory and its predictive implications are predicated on the implicit assumption that career alternatives do in fact exist as distinct regions or distributions in attitude space. Clearly if such distributions are not distinct but are essentially the same, then there is nothing to choose among, and the theory is worthless for career choice in medicine. The assumption can be tested as the hypotheses that career alternative centroids differ in attitude space. This

can only be done empirically, and it is to that end that the remainder of this dissertation is directed.

EMPIRICAL INVESTIGATION

As suggested, this empirical investigation is being conducted to determine if the economic-attitude is at all appropriate for career choice in medicine. In particular the analyses are designed to investigate the model's applicability for specific career choice categories. Three major categories will be examined, the first analysis will reveal if the model could be useful in predicting type of career chosen among alternatives such as general practice, specialty practice, research and/or teaching, as well as combinations of the latter. The other two analyses will investigate respectively, the medical specialty chosen, and the types of practice (private, partnership, government, etc.) in which the prospective physician might plan to engage.

For the model to be applicable in any of these categories, the distribution of attitudes for alternative choices within each category must not all be the same. That is, the analysis will test the hypothesis that within each career choice category, attitude centroids of alternative choices differ. Significance of the hypothesis would indicate that the economic-attitude model is theoretically appropriate. Subsequent assumption of regularity conditions could then transform the theoretical model to an operational model potentially capable of predicting career choice in that category. In

addition, as a by-product of the statistical hypothesis testing, discriminant functions are also computed thereby providing estimates of the relative contribution of each attitude factor in separating the career alternative choices. The theoretical implications of the discriminant weights have already been discussed.

In addition to these major considerations, there are secondary aspects of the model to be investigated. For example, mentioned earlier was the tentative behavorial assumption that individuals making career choices were not so far in debt that this overwhelmingly affected their choice. Under this assumption, predispositions toward monetary rewards would be the consequence of the individual's preference (utility) function rather than of necessity and hence the model would not be violated. Income considerations such as these will also be empirically investigated.

There is another aspect of the model which has been deliberately overlooked in its formulation but for which data is available to investigate. It was assumed that in the aggregate, that potential physicians choosing a career they would most like to enter, were consistent in evaluating alternatives and that this consistency was reflected in the intrinsic values (discriminant weights) assigned to each attitude factor for the purpose of separating the career alternatives. The aspect to consider is the converse of

selecting the optimal career. That is, is the same subjective evaluative procedure used both for ranking careers on a least-preferred as well as a most-preferred dimension? Evidence for an affirmative answer would exist if discriminant weights, estimated in determining the discriminant function which best separates the least-liked career, were the same (or relatively the same) as those weights for the most-preferred choices. This can be tested for the area of specialization career category.

Implications of the latter analysis could be immense. Determination of which attitudes contribute the most to differentiating these groups on a most-preferred and conversely on a least-preferred scale achieved through discriminant analysis should provide useful insight into recruitment. As mentioned in the introduction, determining which factors have the greatest significance, has the potential for effecting the medical manpower distribution across the specialties strictly through competition.

In all honesty most of these analyses and much of the theory has evolved in conjunction with the collection of a large piece of data. To be sure, no statistics have influenced the hypotheses, the theory, or the operationalized concept of the model. The data has simply spawned a model to explain it. Hypotheses were then limited to the data available.

Description of data

Data pertinent to testing hypotheses concerning the model was abstracted from an intern survey conducted by Dr. Edwin Hutchins in 1967. In an attempt to collect follow-up information on the medical school graduates of 1966, questionnaires were mailed to 7,005 MD graduates completing their internships. The six page questionnaires (see Appendix) were mailed to the entire sample in May, 1967. After five weeks, an identical "follow-up" questionnaire was sent to those interns not returning the initial one. A final response of 3,539 questionnaires represented 51% of the original sample. Clearly the questionnaire was extensive and not all the data was applicable.

The questionnaire contained four types of information, of which only two were pertinent for testing hypotheses described above. The first portion of the questionnaire was designed to collect biographical and career choice information such as marital status, type of practice, and amount of indebtedness. The question #14 indicating the specialty one would least like to enter could also be included in this category. The second portion of the questionnaire contained open-ended response questions which although subsequently coded, were not deemed applicable in this investigation. The third portion of the questionnaire was a Medical School Environment Inventory (MSEI) composed of 69 items measuring

the intern's perception of his medical school environment. This instrument was also inapplicable since previous research has indicated that the six constructs measured by this instrument exhibit greater reliability across schools than among students. The final portion of the questionnaire was the career attitude instrument described earlier as the core of the economic-attitude model.

Recapitulating, the 38 items comprising the career attitudes instrument were designed to allow the respondent a five point (Likert) scale from which to indicate the desirability of specified characteristics of career within medicine. Previous factor analyses revealed that the 69 items could be condensed into 5 attitude factors independently measuring the following five medical career traits: (1) prestige, recognition, and reward, (2) intellectual challenge, (3) patient contact, (4) desire for pressure, and (5) teamwork. The reliability and cross-cultural validity of the instrument have previously been discussed.

To be precise, the career attitudes instrument in conjunction to responses to questions 1a, 2, 3a, 4b and 14 comprise the subset of data abstracted from the entire questionnaire. Since not all interns answered all questions, the sample size will vary depending upon which question is being examined. In all cases however a sufficient number of interns answered the questions to make statistical assumptions

quite valid.

Method of analysis

With the exception of income considerations, all the hypothesis to be tested can be accomplished with multivariate analysis of variance. Income considerations will be examined primarily from a correlational viewpoint. In all other investigations, the research question involves determining if career group centroids differ. Letting u_i represent the attitude centroid of career alternative i, multivariate analysis of variance tests the hypothesis H_o: $u_1 = u_2 = u_3 = \ldots = u_k$ assuming there are k career alternatives in that particular career category. If the test is statistically significant, the hypothesis is rejected and the conclusion is that at least two groups do not exhibit the same centroid. That is, assuming equal dispersion matrices, at least two groups have distinct locations in 5 dimensional attitude space. Multiple comparison techniques should then reveal which of the k groups are distinct.

A general multivariate analysis of variance can be described mathematically as a special case of the multivariate general linear hypothesis adequately presented in multivariate texts (4, 47). However, an abbreviated explaination is necessary here.

Consider a simple one-way analysis of variance model, for example a one-way analysis on the prestige factor alone. Assume that there are k career alternatives and the hypothesis to be tested is that there are no differences in prestige across the k careers alternatives. The reparametrized analysis of variance model would be written as

$$y_{ij} = u_j + e_{ij} \quad \text{or in matrix terms as} \quad Y = XU + E$$

where y_{ij} is the prestige measure on person i choosing career j and u_j is the mean of career j, with e_{ij} indicating the error. In matrix notation $U' = (u_1, u_2, \ldots, u_k)$ and the design matrix has the form:

$$X = \begin{bmatrix} 1 & 0 & \ldots & 0 \\ . & . & \ldots & . \\ 1 & 0 & \ldots & 0 \\ 0 & 1 & \ldots & 0 \\ . & . & \ldots & . \\ 0 & 1 & \ldots & 0 \\ . & . & \ldots & . \\ 0 & 0 & \ldots & 1 \\ . & . & \ldots & . \\ 0 & 0 & \ldots & 1 \end{bmatrix}$$

Clearly the same design matrix would hold no matter which attitude factor was investigated. The only difference would be a different U vector, one for each factor under consideration, and of course, a Y vector for each different attitude

factor. Using subscripts to indicate the five different attitude factors, five separate singular one-way models could be written as:

$$Y_p = XU_p + E,\ Y_{IC} = XU_{IC} + E,\ Y_{PC} = XU_{PC} + E,$$

$$Y_{PD} = XU_{PD} + E,\ Y_T = XU_T + E.$$

The multivariate model essentially combines these models into one augmented matrix representation as follows:

$$(Y_P, Y_{IC}, Y_{PC}, Y_{PD}, Y_T) = X(U_P, U_{IC}, U_{PC}, U_{PD}, U_T) + E$$

Following a consistent notation the augmented matrices can then be expressed simply as; $Y = X\ U + E$ where now the Y and U notation refer to matrices rather than vectors.

The multivariate extension of the simple linear hypothesis $H_o: u_1 = u_2 = \ldots u_k$ becomes, $H_o: CU = 0$ where for the model specified C is an identity matrix. In general however, C is a matrix describing the hypothesis on q of the k components of the kx5 parameter matrix. The multivariate hypothesis is true if, and only if, the univariate hypotheses $H_o: CUa = 0$ holds for <u>all</u> non-null five-component vectors a. The test statistic F(a) for any one of these univariate hypotheses is presented in Morrison (47) as a function of the non-null arbitrary vector a. Under certain mathematical constraints upon that statistic, $\max_a F(a)$ can be shown to be proportional

to the greatest root of the determinantal equation

$$|H - \lambda E| = 0$$

where

$$H = Y'X(X'X^{-1})\ C'[C(X'X^{-1})\ C']\ C(X'X^{-1})\ X'Y$$

and

$$E = Y'[I - X(X'X^{-1})X]Y.$$

The hypothesis of equal centroids would be accepted if the greatest root of $|H - \lambda E| = 0$ is less than the appropriate percentage point in the Heck charts of the greatest root distribution (29).

For completeness two other tests based upon these H and E matrices should also be mentioned. Wilks Λ statistic is the reciprocal of the product of all the characteristic roots (eigenvalues) of $|HE^{-1} + I| = 0$ and based upon large-sample properties of likelihood-ratio statistics $-[N - k + \frac{1}{2}(k-6)]\ln\Lambda$ is distributed as a chi-squared variate with 5k degrees of freedom. Lawley's test statistic is the sum of the roots of HE^{-1}. When the null hypothesis is true N times that test statistic is also distributed as a chi-squared variate with 5k degrees of freedom. In the analyses to follow, at least one of these tests will be used to test the hypotheses of equal centroids across career alternatives.

Closer scrunity of the statistical procedure would reveal that discriminant functions could be easily computed in the

analysis. Multiple discriminant functions could be computed from the vectors associated with the eigenvalues of the determintal equation $|H - \lambda E| = 0$ or equivalently from $|H^{-1} - \lambda I| = 0$. Since the rank of these matrices is five, a maximum of five orthogonal discriminants could be computed for the three primary career categories. Specifically, the computed eigenvectors become the coefficients of the discriminant functions. In the context of the economic-attitude model, these coefficients or discriminant weights demonstrate the relative contributions of each attitude factor in separating the career alternatives. They may be interpreted as the intrinsic values of these factors as determined by the aggregate group of interns.

Since multiple discriminants are possible, a problem in discriminant analysis is deciding how many discriminant functions to use in interpreting group differences and in subsequent prediction models. An approximate test of significance based upon large-sample properties for a particular discriminant is provided by Rao (52). However, it is also possible and often practical to simply select a subset of the computed functions that accounts for a majority of the discriminating power. For example, the percentage of the total discriminating power contained in the ith discriminant is given by

$$100 \left\{ \frac{\lambda_i}{\sum_{j=1}^{5} \lambda_j} \right\} .$$

If one can be satisfied with the discriminating power of say the first two discriminant functions, then the discriminant weights of both functions would be interpreted as intrinsically valued by the population of interns. However, the weights associated with the greater discriminant would have greater significance than those of the second discriminant. Since these discriminants would be relatively orthogonal, the interpretation would be meaningful.

To this point, tests have been presented to determine if centroids of career alternatives in attitude space differ as well as procedures for examining the relative contributions of the attitude factors in discriminating these differences. Yet nothing has been stated which would indicate exactly which of the career alternatives do differ and which do not. The multivariate analysis of variance test only specifies whether in fact there are differences but not where these differences occur. To determine which of the career alternatives do exhibit different centroids multiple comparisons are necessary.

The multiple comparison procedures in the multivariate analysis of variance differ somewhat from the usual multiple comparison procedures in the univariate case. Stated briefly, in the multivariate case, confidence intervals are constructed as the multiple comparison tests. If the confidence interval contains zero, one must conclude that there are no significant differences between the centroids tested.

Since for unequal frequencies formulas for both the one-way and two-way analysis of variance multiple comparisons do not differ substantially only one will be presented here.

For testing the hypothesis that two particular centroids from a previous one-way multivariate analysis of variance differ, the following formula is appropriate:

$$\sum_{j=1}^{5} (x_{ij} - x_{i+1,j}) - \sqrt{\frac{x_\alpha}{1 - x_\alpha} a' Ea \left(\frac{1}{N_i} + \frac{1}{N_{i+1}} \right)}$$

$$\leq \sum_{j=1}^{5} (u_{ij} - u_{i+1,j}) \leq \sum_{j=1}^{5} (x_{ij} - x_{i+1,j})$$

$$+ \sqrt{\frac{x_\alpha}{1 - x_\alpha} a' Ea \left(\frac{1}{N_i} + \frac{1}{N_{i+1}} \right)}$$

where x_α = critical value determined by Heck charts

x_{ij} = mean of attitude factor j in career alternative i

u_{ij} = true mean of attitude factor j in career alternative i

N_i = number of interns entering career alternative i

E = error matrix from the multivariate analysis of variance

a = five dimensional vector of ones.

The same formula can be used for testing specific main effect differences in the two-way multivariate analysis of variance only if no interaction is demonstrated. Under that condition, the previous formula can be used separately for constructing confidence intervals for contrasts of the row effects or column effects.

With this, the essential statistical groundwork has been laid. All that remains are the actual results of the proposed analyses and their interpretations. The presentation of those results will be prefaced however by some empirical results concerning income and the career attitude factors.

Income considerations

One behavioral assumption employed in operationalizing the model was concerned with the effect of strictly monetary factors and the ultimate career choice. It was tentatively assumed that the desire for careers providing high monetary rewards would be exhibited as a high score on the prestige-recognition-reward component of the career attitude score. The effect of indebtedness as a major contributor to the desire for monetary reward (income) was ruled out in favor of assuming the propensity for income, prestige, and the like as the more important determinant. In testing this assumption, some rather interesting results were obtained.

To test the assumption, income data was needed for career choice categories which would be consistent with interns'

perceptions of incomes expected from various career alternatives. The best available data was supplied by a very recent survey of the American Medical Association (7). This data, shown in Table 2 provides the average net taxable income for selected medical specialties based upon a sample of 3,400 physicians in 1968. Of particular significance, is a standard deviation of 17,000 and an overall mean income of this group of $35,500. The importance of this latter statement will be demonstrated in the correlations of this data with indebtedness.

Table 2. Gross income receipts after deduction for practice expenses of selected medical specialties in 1968 (N = 3,400)

General practice	$32,300	General surgery	$40,700
Internal medicine	34,500	Obstetrics/Gyn	38,500
Pediatrics	30,700	Psychiatry	33,200
Radiology	46,400	Anesthesiology	36,000
Other specialties	31,100		

To test the effect of indebtedness in confounding the conclusions based upon the career attitude factors alone, two correlations were computed. Under the a priori assumption that interns highly in debt might choose medical specialties expected to provide them with high incomes, a correlation between indebtedness and average income of specialty chosen was computed. If such a correlation was significant then the

desire to overcome indebtedness should be reflected somewhat in the prestige-recognition-reward scale of the attitude factors and hence a correlation between indebtedness and this scale was computed.

Specifically, these correlations were computed using two discrete dimensions. First of all, the index of indebtedness was represented as a five point discrete scale (see Appendix). Secondly it seemed unrealistic to assume interns would conceptually assign specific average income figures to career choice alternatives. It seemed more logical that their reasoning would be more accurately approximated by ranking the specific specialties with regard to expected income. This was supported by the large standard deviation in income and the comparatively small range of means exhibited in the data obtained from the AMA.

It was hoped that the correlations with indebtedness described previously would be small, thus indicating that degree of indebtedness, while not the same for all interns, would not be a major factor in career choice. Hence interns could be considered as a homogeneous group with the five career attitude factors serving as the major career choice determinants. The correlations however suggest another possible interpretation.

From the 1952 interns indicating degree of indebtedness, a correlation of .20 was obtained between indebtedness and prestige-recognition-reward. Being positive and significantly different from zero, this correlation would suggest that the propensity for prestige-recognition-reward is differentially effected by the degree of indebtedness. Yet the relatively small magnitude would also suggest that this effect is not so pronounced as to negate the operational assumption of a homogeneous group of interns basing their career decisions primarily on their propensities toward five career attitude factors. That is, the correlation would seem to suggest a homogeneous group of interns in the sense that indebtedness does not substantially effect their predispositions (attitudes) toward career choice, with the attitude factors as the decision variables.

The interpretation of the correlation between indebtedness and average income of specialty chosen however, could be open to more than one conclusion. Based on a sample of 1348, the specific correlation was computed to be -.49. Considering the high standard deviation of the incomes of respective specialties, one might be tempted to conclude that this is a rather unreliable correlation. Arguing that with such high standard deviation, the specialties could not adequately be ranked in such a way that the ranking reflected the perception

interns of the various income streams expected from alternative specialties. Under this interpretation, the specialties with incomes in the intermediate range could possibly be reranked and yield a different correlation. This interpretation, however tempting, is clearly insufficient. A computed correlation of -.49 based on a sample of size 1348 is definitely not unreliable. Regardless of the apparent similarity of specialty incomes reflected in the comparative means and high standard deviations, such a correlation would indicate that income streams are perceived distinctly. Moreover, such a correlation would suggest that specialties are ranked consistently by interns on the income dimension. The correlation, then demands an alternative explanation.

Accepting the correlation as meaningful, an alternative interpretation might be speculated. As perceived by the intern, the negative relation between specialty income and indebtedness might not be due to income aspirations directly, but rather to the investment required to attain alternative specialties. Considering the costs already sustained in medical school it is not unlikely that interns highly in debt would shy away from specialties requiring extensive investment and residency time. Generally those specialties

requiring the longest residency are also those offering the highest potential income. Under this interpretation, it would not be surprising to find a negative correlation of indebtedness with specialty income and yet a positive correlation of indebtedness with prestige-recognition-reward. That is, while indebtedness might influence the propensity for prestige-recognition-reward to a slight degree (witness the small correlation .20), high indebtedness does not translate directly into a great desire for selecting a specialty on the basis of potential income. Rather, the correlations suggest that length of residency should be considered jointly with indebtedness as a factor independent of the five career attitude factors. Under this interpretation, the assumption of a homogeneous group in the sense that career attitude propensities are unaffected by the degree of indebtedness appear applicable.

Although such an interpretation may support theoretical assumptions, the particular interpretation is immaterial for the statistical testing necessary to determine if attitude centroids of alternative career choices differ. As stated previously, there are three major career categories to be analyzed; type of career, type of practice, and area of

specialization. It is convenient to begin the analyses with the first of these, type of career.

Type of career

The career category designated "type of career" refers to the type of medical career which the intern believes will ultimately consume most of his professional time. Specifically, this is question 1a on the intern questionnaire. Within this category there are 6 possible alternative career choices: (1) general practice, (2) specialty practice, (3) research and/or teaching, (4) combination of specialty practice, research and/or teaching, (5) other medical fields, and (6) other non-medical fields. The intent of this analysis is to determine if these six alternatives can be distinguished on the basis of the five career attitude factors.

In particular, it is necessary to know if the attitude centroids of interns selecting these various types of career are at least partially distinct. For the economic-attitude model to be applicable, at least two of these alternatives must be distinguishable in attitude space.

The statistical hypothesis to be tested states that all attitude centroids are the same. A significant result would mean that at least two of the types of career exhibit different centroids. Subsequent multiple comparison procedures would then specify which types of career exhibit different

centroids. As a by-product of the analysis, discriminant weights are computed which reveal the relative contribution of each attitude factor in distinguishing these career alternatives. Also with each set of discriminant weights (the eigenvector) there corresponds a particular eigenvalue. Three functions of these eigenvalues (47) constitute the test statistics with particular eigenvalues useful in describing the percentage of total discriminating power contained in a given set of discriminant weights.

The previous remarks imply a one-way multivariate analysis of variance with five dependent variables (attitude factors) and six levels for the design matrix (types of career). The precise theoretical procedure involved has been presented earlier. All that remains is a presentation of the results and their interpretation.

According to Table 3, the generalized, multivariate, null hypothesis that the six career alternatives representing types of career had similar attitude orientations, can now be regarded as not tenable. Since not much is currently known concerning the relative merits of the three test statistics, all were computed and all were significant. Such significance indicates that at least two attitude centroids differ, thus implying that the economic-attitude model is potentially appropriate. Before determining which of the six career alternatives differ in attitude space, it is useful to know

Table 3. Multivariate analysis of variance for type of career

	DF	Test statistics Lawly	Wilks	Heck (θ_s)
H_o: $u_1=...=u_6$	30	366**	357**	.058**

*Significant at .01 level.

**Significant at >> .01 level where θ_s is a function of the greatest root.

Table 4. Centroid components (means) for type of career alternatives

Centroid	Component description (attitude factors) PRP	IC	PC	PD	T	Sample size
1. General practice	29.85	33.97	25.43	28.80	14.06	325
2. Specialty practice	30.77	36.22	22.67	27.66	14.04	1684
3. Research and/or teaching	29.64	44.85	21.18	25.78	14.75	104
4. Combination of specialty prac. research and/or teaching	30.65	40.83	23.16	27.62	14.31	1333
5. Other medical fields	28.04	36.49	22.16	25.82	14.20	55
6. Other non-medical fields	29.18	35.64	19.45	24.73	12.91	11

which attitude factors contributed the most in differentiating the groups. For that purpose, discriminant functions must be considered.

Table 6 indicates that of the five possible discriminant functions, only the first three are of significance for interpretation. The discriminant weights for all five functions are presented as the eigenvectors in Table 5. The attitude factors which contribute the most to career group separation along the first discriminant function are the patient contact and desire for pressure factors. High scores on these factors result in low scores on the first discriminant. For the second discriminant function, prestige-recognition-reward appears to dominate for separating types of career. That is high score on the PRR factor tends to yield a high score on the second discriminant. The third discriminant is rather difficult to interpret relative to the first two, and since the first two functions account for approximately 82% of the discriminating power, not too much is lost by discounting this third function even though it is statistically significant.

If these discriminant weights can be interpreted according to the theoretical model, as intrinsic values somewhat analogous to prices in a competitive economy, then patient contact, desire for pressure, and prestige-recognition-reward, exhibit the greatest values in distinguishing types of career.

Table 5. Discriminant weights and eigenvalues for TYPE OF CAREER, demonstrating the relative importance of the attitude factors in separating the career alternatives

Attitude factors	Eigenvectors I	II	III	IV	V
Prestige, recognition, reward (PRR)	.332111	.924466	.885961	-.428954	.224066
Intellectual challenge (IC)	.125786	-.153037	.160500	.018919	-.069289
Patient contact (PC)	-.891785	-.285502	.387727	-.443734	.132964
Desire for pressure (PD)	-.279478	.171959	.172730	.745006	-.289852
Teamwork (T)	.022182	-.104225	.095628	.252404	.918314
Eigenvalues	.062237	.024122	.017612	.000312	.000009

Table 6. Significance of the discriminant functions for TYPE OF CAREER, Rao's χ^2 approximations

Function	Eigenvalue	DF	% total	χ^2	P
I	.062237	9	58.92	203.0	**
II	.024122	7	23.53	66.9	**
III	.017612	5	16.45	57.7	**
IV	.000312	3	.29	1.0	
V	.000009	1	<.01	<.01	

*Significant at .01.

**Significant at > .01.

In the aggregate, interns discriminate types of practice primarily on the basis of patient contact and desire for pressure, and secondarily on the basis of prestige-recognition and reward. This interpretation, of course, is within a framework of five specific attitude factors and must be recognized as such. Since there may be other bases for discrimination, the previous statements are appropriate only within this attitude context.

On the basis of these discriminant functions, types of career perceived as having high patient contact and desire for pressure and perceived as low in prestige, recognition and reward would be quite distinguishable from those perceived

just the reverse. Table 4 provides the centroids for the six alternative career types and a comparison on the previous basis would suggest "eyeball" separation at least, with regard to general practice and the other career types. A statistical procedure involving confidence intervals described earlier, functions as multiple comparisons to indicate just which types of career are distinguishable from other types in the attitude space. Table 7 illustrates the results of these comparisons.

Table 7. Multiple comparisons of TYPE OF CAREER centroids

Identification	Type of career identification 1	2	3	4	5	6
1						
2	*					
3	*	NS				
4	*	*	NS			
5	*	NS	NS	*		
6	NS	NS	NS	NS	NS	

*Significant at the .05 level.

NS - signifies not significant.

From the multiple comparison procedure, it should be clear (Table 7) that only one type of career is indistinguishable from the test on an attitude basis. Partly due to small sample size and also quite probably to the nature of the career type, "other non-medical fields" is indistinguishable from all the other types of medical career. This is evident from the non-significance associated with alternative 6 when compared with each of the other possible alternatives. Disregarding alternative 6, then quite the opposite is true of general practice. General practice is quite distinguishable from each of the remaining alternatives. In addition, straight specialty practice can be distinguished from a combination of specialty practice with research and/or teaching. Also, the combination of specialty practice with research and/or teaching differs from the alternative other medical fields, to be sure, these results are obtained within the context of attitudes towards careers in medicine and interpretations must be limited to that context.

While the latter results have been concerned with which types of career differ in attitude space, it might be interesting to conclude the analysis of career types with a negative result. It is interesting to note that while straight specialty practice can be distinguished from a combination of specialty practice with research and/or teaching, nevertheless straight specialty practice is not significantly different

from straight research and/or teaching. Viewing Table 4 would lead one to suspect otherwise. The point to be made rests in the size of the respective samples, and the fact that the statistical multiple comparison procedure takes this into account, thus providing a much more accurate comparison than direct "eyeballing" on the means.

The format followed in presenting the analysis of type of career, is essentially the same that will be used in the remaining analyses. Because of this, it will be convenient to dispense with the laborious description and rationale for constructing various tables. Their purpose should be clear from the preceding remarks so that presentations of subsequent analyses will focus primarily upon the interpretation of the of the results rather than their evolution.

Type of practice

This category refers to question 2 on the intern questionnaire and, as the name implies, indicates the type of practice in which the intern intends to engage. The ten career alternatives are listed in question 2 in the Appendix, and in Table 9, and need not be repeated here. For the economic-attitude model to be applicable, at least two of these ten alternatives must have different centroids in attitude space. As in the previous analysis, the purpose of this analysis is to determine if any of the alternatives concerning type of practice can be distinguished in the five dimension attitude space.

To test the null hypothesis that no differences exist, a one-way multivariate analysis of variance was employed. The ten career alternatives served as the independent (design) variates, with the five attitude factors as the dependent variables. The results are presented in the tables which follow.

The results of the multivariate analysis of variance are presented in Table 8. All three test statistics concur in indicating the null hypothesis as not tenable, the implication being that at least two types of practice exhibit distinctly different centroids in attitude space. That is, the average attitude profile of interns selecting types of practice are different for at least two alternative choices of practice.

The discriminant weights (Table 10) indicate the largest contributor to type of practice separation along the first discriminant function was intellectual challenge. For the second discriminant, teamwork is the predominant attitude factor in distinguishing types of practice. While function III was just significant at the .01 level (Table 11), it only accounts for approximately 5% of the discriminating power (the previous two functions account for 92%) and as such is not so important for interpreting the relative contributions of attitude factors. However, the significance and particular weightings for the first two functions suggest that high scores on intellectual challenge and low scores on the remaining

Table 8. Multivariate analysis of variance for TYPE OF PRACTICE

Hypothesis	DF	Test statistics Lawly	Wilks	Heck (θ_s)
H_o: $u_1=...=u_{10}$	50	1150**	1053**	.192**

*Significant at .01 level.

**Significant at >> .01 level where θ_s is a function of the greatest root.

factors, teamwork in particular, would be greatly separated from just the reverse, high scores on teamwork and low scores elsewhere. Translated scores into types of practice centroids, these results would indicate that types of practice exhibiting centroids as suggested above would be distinguishable in attitude space.

Of the forty-five possible comparisons, the multiple comparison procedure indicates that only five types of practice exhibit centroids distinct from at least one other type of practice centroid. According to Table 12, full-time teaching and research in medical school hospitals can be distinguished from private practice, group practice, and hospital consultant. In addition, group practice exhibits a centroid distinguishable from part-time teaching and research with part-time private or partnership practice. Considering

Table 9. Centroid components (means) for TYPE OF PRACTICE alternatives

Centroid	Component description (attitude factors) PRR	IC	PC	PD	T	Sample size
1. Private practice	30.76	35.81	23.94	27.58	12.96	382
2. Partnership practice	30.85	35.48	23.27	28.65	14.22	604
3. Group practice	30.55	36.12	23.06	27.63	14.48	535
4. Hospital consultant	29.69	37.53	19.45	23.96	15.14	58
5. Full-time teaching and research in medical school hospitals	30.03	44.01	21.83	27.14	15.10	237
6. Part-time teaching and research with part-time private or partnership practice	30.74	40.49	23.41	27.71	13.73	661
7. Part-time teaching and research with part-time group practice	30.65	40.36	23.20	27.43	14.81	262
8. Federal Government service	29.46	37.85	22.69	27.88	14.28	110
9. Public health	29.60	39.07	23.32	26.49	14.81	57
10. Other	30.54	37.50	22.62	27.52	14.20	517

Table 10. Discriminant weights and eigenvalues for TYPE OF PRACTICE demonstrating the relative importance of the attitude factors in separating the career alternatives

Attitude factors	Eigenvectors I	II	III	IV	V
Prestige, recognition, reward (PRR)	.159146	-.126363	.185000	.049095	.963439
Intellectual challenge (IC)	-.850154	-.138508	.070441	-.025581	.004178
Patient contact (PC)	.378916	-.238765	.420672	.686276	-.203406
Desire for pressure (PD)	.192051	.027215	.565516	-.510902	-.163333
Teamwork (T)	-.267300	.952417	.681205	.514724	.060971
Eigenvalues	.239250	.070855	.016831	.005202	.004971

Table 11. Significance of the discriminant functions for TYPE OF PRACTICE, Rao's χ^2 approximations

Function	Eigenvalue	DF	% total	χ^2	p
I	.239250	13	70.88	754.8	**
II	.070855	11	21.09	226.8	**
III	.016831	9	5.01	51.8	*
IV	.005202	7	1.55	17.0	
V	.004971	5	1.46	15.0	

*Significant at .01.

**Significant at > .01.

Table 12. Multiple comparisons of TYPE OF PRACTICE centroids

	Type of practice identification									
Identification	1	2	3	4	5	6	7	8	9	10
1										
2	NS									
3	NS	NS								
4	NS	NS	NS							
5	*	NS	*	*						
6	NS	NS	*	NS	NS					
7	NS	NS	NS	NS	NS	NS				
8	NS	NS	NS	NS	NS	NS	NS			
9	NS	NS	NS	NS	NS	NS	NS	NS		
10	NS	NS	NS	NS	NS	NS	NS	NS	NS	

*Significant at the .05 level.

NS signifies not significant.

Table 9 and the primary discriminant, it is evident that these differences are the result of the desire for high intellectual challenge of interns choosing full-time teaching and research in medical school hospitals compared with the relative low intellectual challenge aspirations of interns entering private practice, group practice, or hospital consultant. Secondarily the same conclusion in the same direction would also be due to the high aspirations for teamwork of interns entering full-time research and teaching. Finally it should be noted that part-time teaching and research with part-time private or partnership practice can also be distinguished from group practice.

For purposes of the economic-attitude model, the ten possible types of practice alternatives could be condensed to the five described above. Consistent with Table 9 only alternatives 1,3,4,5 and 6 can be distinguished from at least one other alternative in attitude space, with the distinction resting on the basis of intellectual challenge first, and teamwork second. As such, the economic-attitude model has rather limited potential for predicting the particular type of practice in which an intern might plan to engage. The model's potential is not quite so bleak, however, when the medical specialty is considered.

Medical specialty

The medical specialty, as suggested in the method of analysis, requires a slightly different approach. From the

questionnaire, two types of information are available: (1) the area of specialization chosen, and (2) the area specified by interns as the medical specialty they would least like to enter. The research question concerns both types of information, and is reflected in a joint statistical analysis.

In particular, the analysis will reveal if least-liked specialties as well as specialties chosen are distributed distinctly in attitude space. Furthermore, the discriminant weights should indicate the relative contributions of the attitude factors for distinguishing specialty alternatives in the least-liked category and also in the most preferred category (area of specialization category). If the discriminant weights (intrinsic values) associated with each of the respective categories point to substantially different contributions of the attitude factors, then different evaluative preference functions are suggested, depending upon whether the intern is considering a positive choice of medical specialty or alternatively, considering a negative choice of which specialty dislikes the most.

Associated with these latter comments is the necessary consideration of interaction between most and least preferred medical specialties in attitude space. If interaction exists, then comparisons across centroids of either category, least-liked or most-preferred, must be carried out at a specific

level of the other category. That is, for example, if interaction exists, and one is concerned with just how much contribution each of the career attitude factors have in discriminating area of specialization, the actual comparisons would have to be made among only those interns designating a certain specialty as least-liked. Due to interaction, or dependence between most and least preferred areas of specialization, such comparisons would change depending upon which least-liked specialty was considered. The same reasoning would also hold, of course, if the roles of most- and least-preferred were switched in the latter example. Without belaboring the point further, if interaction were found to be significant, then comparisons within the least-liked category could not be made independently of the area of specialization. In terms of the predictive implications of the economic-attitude model, both least and most liked specialty data would be necessary for predicting career choice in the specialties, if interaction were found to be significant.

It should be clear that the analysis implied is a two-way multivariate analysis of variance with interaction, with least-liked specialty serving as one hypotheses, area of specialization serving as another, and interaction serving as the third. However, the data obtained directly from the questionnaire is not amenable to the analysis since it contains a substantial amount of missing data in the form of empty cells

(Table 13).

In order to accomodate the analysis, the various specialties were jointly regrouped into 81 cells on the basis of within cell similarity and across cell dissimilarity. Specialties were so grouped on the basis of the joint frequency distribution (Table 13), under the assumption that the relative frequencies provide some information regarding the status hierarchy of the specialties. Consequently, the resultant grouping was expected to exhibit within group attitude similarity and between group attitude dissimilarity. The area of specialization category was regrouped into 9 alternatives and the least-liked specialty into also 9 alternatives (Table 15 and Table 19), although the groupings were not exactly symmetrical.

Of the 9 x 9 or 81 cells so constructed, two contained no interns. Specifically, there were no interns who concurrently selected anesthesiology as their area of specialization and also as the specialty they would least like to enter. Similarly there were no interns who designated public health and preventive medicine as their least-liked specialty, and who at the same time chose either physical medicine and rehabilitation, proctology, or the alternative labeled, other specialty, as their area of specialization. All other potential missing data cells were filled primarily due to the asymmetrical regrouping. Contrived data had to be supplied

Table 13. Joint frequency distribution of responses to questions 3a and 14

Area of specialization (chosen)	Specialty you would least like to enter																				
	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
06 Anesthesiology			8	4	1	7	1		9	3	7	5	12	4		3	5				3	
07 Basic medical sciences	3		1	1							1	2		1		1						
08 Dermatology	7	5		1	2	5				1	7	4	2	2		7	3	4		1	1	
09 Internal medicine	90	48	21	2	9	56	10	16	45	16	61	61	60	49	12	43	16	18	5	1	21	
10 Neurology	13	2	1			8		3	2	2	8	8	2	3		10		1		1	1	
11 Obstetrics/gynecology	12	40	13	4	9		1	3	27	10	26	8	20	16	2	5	8	1			3	
12 Ophthalmology	15	18	5	5	1	17			9	3	16	11	24	15	1	7	6	4		1	1	
13 Otoloryngology	11	14	6	4	5	6			5	4	10	5	17	16	2	1		1			1	
14 Pathology/clinical pathology	14	4	9	2	5	10				3	12	10	13	2	2	15	5	2			2	
15 Pediatrics	29	24	10	6	11	14	2	3	21		23	32	28	9	5	35	8	2	1	4	6	
16 Physical med. & rehabilitation	2					1			2						1	2						
17 Proctology		2																				
18 Psychiatry/neuropsychiatry	40	36	10	1		23	3	5	28	3	15	35		8	8	55	1	11	1	1	4	
19 Public health & preventive med.	3	2			3	3		4			2	5	1		1	4	2			2	1	
20 Radiology	16	10	8	8	4	14	1	2	6	11	20	11	19	9	1	18	5	2	1	2	3	
21 Surgery...general	13	30	29	3	21	8	5	1	14	11	32	5	57	40	5		3				3	
22 Surgery...neurological	4	2	8	1		6			5	3	7	7	7	10	1							1
23 Surgery...orthopedic	12	22	29	8	8	9	2	1	8	6	3	8	42	21	2	3					1	
24 Surgery...plastic	1	9	4		3				4	5	8	5	13	7	1						3	
25 Surgery...thoracic	1		7				1		2	1	5	1	13	6								
26 Urology	9	8	8	7	8	4			6	1	11		17	9	2	1	1		1			
27 Other (specify)	16	5	3	2	1	5					4	9	4		1	6	1				3	1

for the two cells mentioned to complete the design. To do so, means for the respective missing alternatives were averaged across the two classifications and used to fill the missing data. According to Afifi (2, 3) this would do no major damage to the statistical results obtained in the two-way cross-classification model.

Rather than one hypothesis, three hypotheses can be tested with the same error matrix in the cross-classification model described. Specifically the analysis requires a two-way multivariate analysis of variance with interaction providing the third hypothesis. The results of such an analysis are presented in Table 14. The test statistics indicate that no interaction is present (hypothesis III). The statistics also indicate however that both main effects are significant. That is, at least two area of specialization centroids differ in attitude space (hypothesis I), and at least two least-liked specialty groups differ in attitude space. Since no interaction is present, the area of specialization and least-liked categories can be independently analyzed. That is, discriminant weights falling out of the two-way analysis of variance can be interpreted independently in each category. Likewise, multiple comparisons within one category can be carried out independently of the other crossed category.

Table 14. Two-way multivariate analysis of variance with interaction for area of specialization and least-liked medical specialty

Source	DF	Test statistics Lawly	Wilks	Heck (θ_s)
Hypothesis I Area of specialization	40	1595.0**	1405.6**	0.20**
Hypothesis II Least-liked specialty	40	189.2**	181.7**	0.36**
Hypothesis III Interaction	320	384.8	372.5	0.04

*Significant at .01 level.

**Significant at > .01 level where θ_s is a function of the greatest root.

Essentially, a format equivalent to the previous analyses can be employed in presenting the results for the two medical specialty sub-categories. Although the same error matrix was used to get discriminant functions and also to compute multiple comparisons within each sub-category, due to insignificant interaction the format for interpreting the results is quite similar to that used for type of practice and type of career.

Beginning with area of specialization, the multivariate analysis of variance clearly demonstrates that at least two of the nine specialty groups exhibit different centroids in attitude space (Table 14). All three test statistics are extremely significant in this conclusion. Which of the

attitude factors have the greatest relevance in separating areas of specialization is demonstrated by the discriminant functions (Table 16).

Being consistent with previous interpretations, although the first four discriminant functions are statistically significant, (Table 17), the first two represent 88% of the discriminating power. Consequently most substantial interpretations will be formulated on these two alone. From Table 16, patient contact clearly contributes the most to the first discriminant in distinguishing areas of specialization. For the second discriminant, high desire for pressure coupled with low intellectual challenge distinguish some areas of specialization. To be sure, functions III and IV emphasize prestige-recognition-reward positively and teamwork negatively, but the primary contributors are those described respectively in the first and second discriminant functions.

While the analysis of variance demonstrated the potential applicability of the economic-attitude model for area of specialization, it did not designate which area of specialization groups differed in attitude space. Table 18 serves this function by presenting the significance of the multiple comparisons of each group compared with all the others. Clearly every group is statistically different from at least one other area of specialization group in attitude space. Future selection of an area of specialization, then, can be potentially

Table 15. Centroid components (means) for AREA OF SPECIALIZATION under a nine level regrouping scheme

Area of specialization groups	Component description (attitude factors) PRR	IC	PC	PD	T	Sample size
1. Anesthesiology	29.34	34.96	16.80	31.23	15.11	79
2. Basic medical science Pathology Clinical pathology Radiology Urology	30.14	38.68	18.90	24.57	15.00	406
3. Dermatology Neurology Psychiatry Neuropsychiatry	30.04	40.55	24.85	23.13	13.48	423
4. Internal medicine	30.69	41.02	24.22	27.62	14.39	695
5. Pediatrics	29.62	38.11	25.26	26.84	14.41	283
6. Obstetrics Gynecology	30.51	34.41	24.10	30.11	13.87	216
7. Physical medicine and Rehabilitation Proctology and other specialties	29.44	40.18	22.23	26.64	14.37	78
8. Ophthalmology Otoloryngology	32.05	35.68	21.85	26.70	13.60	276
9. General surgery Neurological surgery Orthopedic surgery Plastic surgery Thoracic surgery	33.36	37.41	22.50	32.14	27.46	646

Table 16. Discriminant weight and eigenvalues for AREA OF SPECIALIZATION demonstrating the relative importance of the attitude factors in separating the nine career alternatives for this category alone

	Eigenvectors				
Attitude factors	I	II	III	IV	V
Prestige, recognition, reward (PRR)	.01670	.04346	.65240	.70797	.37242
Intellectual challenge (IC)	.02247	-.40589	-.26794	.52713	-.06754
Patient contact (PC)	.92125	.01033	-.08183	-.17508	.12988
Desire for pressure (PD)	-.16084	.90670	-.21315	.22242	-.05842
Teamwork (T)	-.35305	.10565	-.67116	-.37522	.91458
Eigenvalues	.251700	.231260	.038018	.021306	.004530

Table 17. Significance of the discriminant functions for AREA OF SPECIALIZATION Rao's χ^2 approximations

Function	Eigenvalue	DF	% total	χ^2	p
I	.251700	12	46.0	646.0	**
II	.231260	10	42.3	582.0	**
III	.038018	8	6.9	116.0	**
IV	.021306	6	3.9	60.0	**
V	.004530	4	0.8	11.6	

*Significant at .01.

**Significant at > .01.

Table 18. Multiple comparisons of AREA OF SPECIALIZATION centroids

Group identification	Group identification								
	1	2	3	4	5	6	7	8	9
1									
2	NS								
3	NS	*							
4	*	*	*						
5	*	*	NS	*					
6	*	*	NS	*	NS				
7	NS	*	NS	*	NS	NS			
8	NS	NS	NS	*	*	NS	NS		
9	*	*	*	*	*	*	*	*	

*Significant at the .05 level.

NS signifies not significant.

predicted on the basis of the economic-attitude formulation.

It should be pointed out that two of the area of specialization groups exhibit significantly different attitude centroids from all of the remaining area of specialization alternatives. Specifically, internal medicine and all areas of surgery are perceived as be distinct from each other and from all other areas of specialization in terms of career attitudes. This is due partly to the relatively high propensity for patient contact of interns selecting internal medicine and the relatively low propensity for patient contact for interns selecting surgery, Table 15. Although the second discriminant is "secondary" in distinguishing all groups, for these particular two alternatives it appears somewhat more important. Clearly internal medicine interns desire the most intellectual challenge and less than average desire for pressure, while interns entering surgery exhibit just the reverse orientation on these two attitudes. For these two cases then, the second discriminant is very useful in determining which attitudes contribute the most in distinguishing the area of specialization groups.

Turning to the least-liked specialty, the multivariate analysis of variance indicates that at least two least-liked specialty groups differ with respect to their centroids in attitude space (Table 14). All three test statistics are significant, although not quite so strikingly as with the area

of specialization. However, the significance of the least-liked specialty category is much greater than .01 level and deserves an inspection in terms of discriminant functions.

Examination of Table 21 reveals that all five discriminant functions are statistically significant, with the first three accounting for 91% of the total discriminating power. Considering the first two discriminant functions (Table 20), it is clear that least-liked specialties can be distinguished by high desire for pressure along with low propensities for patient contact and prestige, recognition and reward. Interns selecting specialties as least-liked on this basis will be distinguishable from those selecting least-liked specialties on the reverse basis. Function III brings in intellectual challenge positively and teamwork negatively, but these two factors are not quite as important in separating specialties on a least-liked dimension as the other three attitude factors represented in the first two discriminant functions.

On the basis of the multiple comparisons (Table 22) only those interns designating surgery as the specialty they would least like to enter could be discerned from all other interns on the least-liked criterion. Examining the centroid means, Table 22 would suggest that interns specifying surgery as their least-liked specialty have much less desire for pressure than their colleagues, as well as somewhat less desire for prestige-recognition and reward. However, even these interns cannot be

Table 19. Centroid components (means) for LEAST-LIKED SPECIALTY, under a nine level regrouping scheme

Least-liked specialty groups	Component description (attitude factors)					Sample size
	PRR	IC	PC	PD	T	
1. Anesthesiology	30.62	39.35	23.83	27.11	14.23	346
2. Basic medical science Pathology Clinical pathology Radiology Urology	30.46	36.79	24.10	28.12	13.95	694
3. Dermatology Neurology Psychiatry Neuropsychiatry	30.60	37.26	22.36	29.45	14.18	672
4. Internal medicine	30.75	35.52	20.55	27.28	14.33	60
5. Pediatrics Obstetrics Gynecology	30.80	38.78	22.41	25.59	14.19	305
6. Public health and preventive medicine	31.07	37.34	22.84	29.09	14.00	253
7. Physical medicine and rehabilitation	31.40	38.53	22.09	28.31	14.16	319
8. Proctology	30.54	39.58	23.25	26.60	14.25	254
9. General surgery Neurological surgery Orthopedic surgery Plastic surgery Thoracic surgery	29.86	38.30	23.20	24.21	14.30	393

Table 20. Discriminant weight and eigenvalues for LEAST-LIKED SPECIALTY, demonstrating the relative importance of the attitude factors in separating the nine career alternatives for this category alone

	Eigenvectors				
Attitude factors	I	II	III	IV	V
Prestige, recognition, reward (PRR)	.35534	-.62406	.24545	.78986	.14537
Intellectual challenge (IC)	.05790	-.32541	.47637	-.38534	-.00752
Patient contact (PC)	-.61665	.44962	.59049	.34462	.19467
Desire for pressure (PD)	.69831	.53650	-.03548	-.01687	.09501
Teamwork (T)	-.49929	-.12116	-.60240	-.32953	.96534
Eigenvalues	.03682	.01425	.00797	.00435	.00146

Table 21. Significance of the discriminant functions for LEAST-LIKED SPECIALTY, Rao's χ^2 approximations

Function	Eigenvalue	DF	% total	χ^2	p
I	.03682	12	56.8	109.1	**
II	.01425	10	22.0	86.1	**
III	.00797	8	12.3	66.0	**
IV	.00435	6	6.7	57.4	**
V	.00146	4	2.3	37.3	**

*Significant at .01.

**Significant at > .01.

Table 22. Multiple comparisons of LEAST-LIKED SPECIALTY centroids

Group identification	Group identification 1	2	3	4	5	6	7	8	9
1									
2	NS								
3	NS	NS							
4	NS	NS	NS						
5	NS	NS	NS	NS					
6	NS	NS	NS	NS	NS				
7	NS	NS	NS	NS	NS	NS			
8	NS	NS	NS	NS	NS	NS	NS		
9	*	*	*	NS	NS	*	*	*	

*Significant at the .05 level.

NS signifies not significant.

distinguished from other interns selecting internal medicine, pediatrics, obstetrics, or gynecology as their least-liked specialty. Obviously these results are not impressive for applications of the economic-attitude model. Deleting group codes 5 and 6, classification by least-liked specialty reduces to surgery versus all other groups combined.

In summarizing the results of the medical specialty category, area of specialization is more readily distinguishable in attitude space than is the medical specialty designated as least-liked. This statement is made for two reasons. First, the multivariate analysis of variance test statistics reflect a much greater significance level for area of specialization, and secondly, all areas of specialization can be distinguished from at least one other in attitude space, while only one area can be consistently distinguished on a least-liked dimension. In terms of relative contributions of attitude factors in separating alternative groups within these two categories, the differences are not quite so pronounced.

Patient contact and desire for pressure are the predominant attitude factors in distinguishing medical specialty groups on a least or most preferred dimension. On the first discriminant, the high weighting on desire for patient contact contributes the most in the separation of areas of specialization. On the first discriminant for least-liked medical specialty, high weighting on desire for pressure accompanied

by a high negative weighting for patient contact dominates the discrimination. At least on the first discriminant, the subjective evaluative procedures for both most and least preferred specialties are based upon the same attitude factors although the weightings are reversed. On the second discriminant desire for pressure is highly weighted for most preferred specialty and to a somewhat lesser extent also for least-liked specialty. It is the relatively high negative weighting on prestige-recognition-reward for the least-liked specialty and the relatively high negative weighting on intellectual challenge for the area of specialization which distinguishes specialties in attitude space.

Under these circumstances, the economic-attitude model would be appropriate for predicting area of specialization, but rather impractical for predicting least-liked medical specialty. However, the two-way multivariate analysis does suggest that, the prediction of area of specialization vis-a-vis discriminant analysis (for practical purposes the content of the operationalized prediction under the economic-attitude formulation) could be aided by knowledge of whether an intern specifies surgery as his least-liked specialty. The proximity of his attitude score to 9x2 = 18 specialty choices (specialty group x least-liked choice of surgery or otherwise) would certainly provide a more accurate forcasting scheme, than the nine areas of specialization alternatives alone.

CONCLUSION

The emphasis of the empirical investigation was to determine if the economic-attitude model might be applied toward career choice in three major career categories. For the model to be applicable, it is necessary that not all career alternatives within each category exhibit identical centroids in attitude space. Utilizing multivariate analysis of variance, the hypothesis of equal attitude centroids within each career category was tested. Significant results were obtained in each category: of career, type of practice, and medical specialty.

Of the six career choice alternatives under the category, type of career, five were found to be significantly different from at least one other alternative in attitude space. General practice was distinguished from all other alternatives except the alternative described as other non-medical fields, which was insignificant and indistinguishable from all other alternatives. With respect to the attitude factors, the patient contact and desire for pressure factors contributed the most in distinguishing these alternatives. In a secondary capacity, prestige, recognition, and reward also contributed in the separation. Interpreted in terms of the economic-attitude model's theoretical foundation, these last three attitude factors would be perceived by interns, when faced with a choice of type of practice, as exhibiting the greatest

intrinsic values (absolute values of discriminant weights) in distinguishing alternatives based upon career attitudes. It can be concluded then that the economic-attitude model when operationalized would be potentially capable of predicting interns' choice of type of career.

With respect to type of practice, the multivariate analysis of variance indicated that at least two types of practice were perceived by interns as differing in attitude space. Subsequent multiple comparisons revealed however, that only full-time teaching and research in medical school hospitals, exhibited a centroid different from private practice, from group practice, and from hospital consultant. In addition, group practice was statistically different from part-time teaching and research with part-time private or partnership practice. The major attitude factors contributing to these differences were intellectual challenge primarily and teamwork to a lesser degree. The economic-attitude model could be legitimately applied to the subset just discussed of the ten possible types of practice. However, since private practice, group practice, and the hospital consultant alternatives could not be distinguished from one another, the model could only have limited potential in predicting the type of career in which an intern might plan to engage.

The third major category investigated was the medical specialty. Data was available and tested in a two-way multi-

variate analysis of variance that both the area of specialization and the medical specialty designated as least-liked were dependently linked in attitude space. Tests of significance revealed that these two sub-categories were independent; that is, the interaction term was statistically insignificant. The two main hypotheses were then explored independently, utilizing the error matrix of residuals from the two-way multivariate analysis, for computing the appropriate statistical tests.

Each of the two sub-categories, area of specialization, and least-liked specialty, contained career alternatives groups with distinct centroids in attitude space, but area of specialization was much more significant. All nine career alternatives pertaining to area of specialization were distinguishable from at least one other alternative. In fact, internal medicine and surgery were perceived as distinct from each other and every other alternative specialty. For the entire array of specialty alternatives, patient contact was the primary attitude factor contributing to the interns' aggregate perceptions in distinguishing the alternatives. However, the secondary factors, intellectual challenge and desire for pressure were shown to be substantially more important in distinguishing internal medicine and surgery from other specialty alternatives.

The results for the least-liked specialty were not quite so explicit. Actually only the surgery alternative, designated by interns as least-liked, could be consistently distinguished

from the other specialties on this least-preferred dimension. The factors contributing the most to this discrimination were desire for pressure, patient contact, and prestige, recognition, and reward. It was concluded that the economic-attitude model would have little practical importance for predicting least-liked specialties.

However, it was ascertained that evidently both most-preferred and least-preferred medical specialties were evaluated along similar dimensions. That is, patient contact and desire for pressure were the predominate factors in distinguishing career alternatives in both categories. Consequently, it was concluded that the economic-attitude model would have greater potential in its operationalized state, if interns' attitude scores were compared to (9x2) specialty alternatives. That is, comparisons should be made on the joint basis of whether or not an intern's attitude score resembled those characteristic of physicians entering of a particular specialty who also regarded surgery as their least-preferred medical specialty.

The general conclusion obtained from the investigation was that the model could have potential in all three major career choice categories. Whether it could be an effective instrument in predicting career choice on a new sample of interns would depend upon whether the model is theoretically sufficient and whether its operational assumptions are valid.

Sufficiency implies that interns choose careers on the basis of attitudes from a decision-making standpoint, with the five career attitudes capturing a large percentage of the considerations involved in making the decision. This was more of a theoretical assumption than a hypothesis. Evidence from the income considerations tends to suggest that indebtedness and length of residency might also be integrated into a conceptualization of career choice in medicine. Clearly these and other possible determining factors are outside the present domain of the model. However the influence of these omitted factors could be observed in the failure of the model to adequately describe the choice process.

Assuming the model to be theoretically sufficient, it could also fail to predict career choice, if the operational assumptions are invalid. The questionable assumption of circular (spherical) indifference contours implies that interns are indifferent between more and less of a given attitude factor when compared to their maximum point (actual attitude score). Implicit also, is the assumption that interns are rational and actually choose the career whose centroid in attitude space most closely represents their own attitude score. Finally the assumption of equal potential in career selection is very questionable (particularly for surgeons), and although the model can be revised to consider only those alternatives in which an intern is qualified, the assumption of equal

potential might still be questioned.

In any case the optimum way to determine the potential of the economic-attitude model it to actually employ it in predicting career choice on a new sample of future practitioners. For purposes of this dissertation, such data was not available.

SUMMARY

Due to an increasing population, and expanding affluence, demand for physicians, has been, is, and is expected to continue to exceed supply. As a result, emphasis in physician manpower has shifted from aggregate demand and supply considerations to the optimal distribution of available supply. Characterizing this, is the increasing competition among the specialties for the qualified medical graduate. The purpose of this dissertation has been to develop a model which would help explain career choice within the cohort of medical school graduates. The specific approach was to integrate psychological and economic principles into one conceptualization in an effort to explain, and subsequently predict, career choice patterns of interns.

Nearly all previous research has concentrated on either a normative or an empirical approach to occupational choice. Economists primarily have exemplified the normative approach, which theoretically prescribes the optimal method of occupational selection. Psychologists, on the other hand, concern themselves with investigations describing the actual determinants used by individuals in choosing a career. Consequently two divergent approaches have produced a multitude of specific research but little in the way of general results applicable across disciplines. An exception, is the integrated approach to occupational choice by Kaldor and Zytowski.

In their maximizing model of occupational decision-making, Kaldor and Zytowski propose a theory of occupational choice in which psychological determinants are integrated with tenets of economic decision-making.

The essence of their theory is a occupational utility maximizing scheme, analogous to demand theory, wherein occupational choice is determined by the proximity of given career alternatives to the greatest indifference curve. In their conceptualization, the determinants (goods in demand theory), of occupational choice are both economic and psychological in nature. Rate of increase in earnings, prestige, and autonomy represent a few of these determinants. Varoom, in this regard, specifies five particular determinants of occupational choice. Consequently, due to Kaldor and Zytowski's model and Varoom's determinants, the economic-attitude model for career choice in medicine was formulated.

Founded upon the premise that attitudes toward careers in medicine reflect value systems of the individual, the model was characterized as an extension of Kaldor and Zytowski. Rather than miscellaneous occupational determinants, the economic-attitude model is based upon five specific attitude variables: (1) prestige-recognition-reward, (2) intellectual challenge, (3) patient contact, (4) desire for pressure and (5) teamwork. Hypothesizing that each career alternative would be perceived as a distributional region in attitude 5

space, and that the preference ordering of a potential physician could be represented as concentric hyperellipsoids around his optimal attitude orientation (his actual attitude vector score), a maximizing scheme analogous to Kaldor and Zytowski's was developed. In particular, rather than points representing career alternatives, projected discriminant lines which describe the distribution of career alternatives, served as the maximizing constraints. Where this quasi-budget line (surface) is tangent to the greatest indifference curve, determines the occupational choice.

For the model to have operational significance, additional assumptions were necessary. Specifically, the hyperellipsoids were assumed to be circular, and career alternatives were assumed to exhibit identical dispersion matrices in attitude space. Under these assumptions, discriminant analysis could be employed theoretically for practical prediction. An individual would be expected to choose that career alternative which exhibited an attitude centroid closer to the individual's attitude score than any other alternative. This could be statistically determined using a χ^2 distribution. The implications of such prediction could have particular import for recruitment to medical specialties within the framework of a strictly competitive labor structure.

Implicit in the theoretical formulation, was the hypothesis that career alternatives could be distinguished in

attitude space, and for the model to have any predictive potential, it was necessary that the hypothesis be true. To test this hypothesis, previously obtained data from research by Dr. Edwin Hutchins was available. Career attitude data, career choice categories, and least-liked specialty information was abstracted from questionnaire returns by over 3500 interns of the medical school class of 1966. Multivariate analysis of variance was then used to test the statistical null hypothesis of equal attitude centroids in each of three major career categories: type of career, type of practice, and medical specialty. Subsequent multiple comparisons revealed precisely which centroids differed.

With respect to type of career, all alternative choices presented on the questionnaire exhibited different centroids in attitudes space with the expected exception of the alternative labeled other nonmedical fields. General practice for example, was distinguishable from each of the other five types of career. Patient contact, desire for pressure, and to a lesser degree, prestige-recognition-reward contributed the most in separating these career types. As such, the economic-attitude model was assumed to have potential for predicting type of career.

The hypothesis of equal attitude centroids for type of practice was investigated and found untenable. Full-time teaching and research in medical school hospitals was

essentially the only type of practice that could be consistently distinguished from alternative types of practice in attitude space. In this discrimination, intellectual challenge primarily and teamwork to a lesser degree, were the instrumental attitude factors. Again the economic-attitude model was assumed to have potential, but to a rather limited degree, since five types of practice could not be distinguished as possessing distinct centroids.

The results of a two-way multivariate analysis of variance indicated that area of specialization and least-liked specialty were independently distributed in attitude space. While both were significant in that career alternatives pertaining to either dimension, exhibited different attitude centroids. Area of specialization was deemed more appropriate for an application of the economic-attitude model. After the medical specialties were regrouped into nine alternatives, all nine alternatives of area of specialization exhibited different attitude centroids. Particularly distinguishable were internal medicine and surgery. On the least-preferred dimension, only surgery could be distinguished from the other nine alternatives. In both circumstances, desire for pressure, patient contact and prestige-recognition-reward, were the major contributors in the discriminant separation. It was concluded that the economic-attitude model would have the most potential if the least-liked alternatives were collapsed to

two, surgery and all others, and subsequently crossed with area of specialization alternatives to give 9x2 = 18 career alternatives from which to predict an intern's choice of medical specialty.

To a greater or lesser degree, the general conclusion suggested that the economic-attitude model could be potentially useful in predicting career choice in all three career categories. Its potential however, would necessarily be contingent upon the theoretical sufficiency of the model and the validity of its operational assumptions. The best way to determine the model's potential would be to actually employ it in predicting career choice of a new sample of interns. That however, was beyond the scope of this dissertation.

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To these men I express my sincere appreciation.

APPENDIX

The following pages contain the exact questionnaire distributed to over 7000 interns in 1967 in conjunction with research by Dr. Edwin Hutchins and the Association of American Medical Colleges.

ASSOCIATION OF AMERICAN MEDICAL COLLEGES
2530 RIDGE AVENUE EVANSTON, ILLINOIS 60201

EVANSTON: DAVIS 8-0505
CHICAGO: BROADWAY 3-4350
CABLE ADDRESS: AAMC EVANSTON

DIVISION OF EDUCATION -- PAUL J. SANAZARO, M.D., DIRECTOR
EDWIN B. HUTCHINS, PH.D., ASST. DIRECTOR (BASIC RESEARCH)
DAVIS G. JOHNSON, PH.D., ASST. DIRECTOR (STUDENT STUDIES AND SERVICES)

Dear Doctor:

The Office of Basic Research of the Association of American Medical Colleges is asking you to assist in a study of medical careers. We are interested in knowing whether the necessary physicians will be available in the various fields of medicine to meet the future needs of our population. To determine this we need to know the career plans of recent graduates as well as something about their background and the way in which they view their future.

I know that you have recently given considerable thought to these questions regarding your own future and hope very much that you will find the time required to fill out this questionnaire. The study of your graduating class is part of a long-range research effort on the problems of career choice in medicine. This effort has as its objective the improved guidance of the students who follow you.

A postage-paid return envelope is provided for your reply which will be treated as strictly confidential. Your cooperation and assistance are very much appreciated.

Sincerely,

Edwin B. Hutchins

Edwin B. Hutchins, Ph. D.

EBH:lz

ASSOCIATION OF AMERICAN MEDICAL COLLEGES
DIVISION OF EDUCATION

AAMC FOLLOW-UP QUESTIONNAIRE

CLASS OF 1966

1a. Check the type of medical career to which you believe you will ultimately devote all or most of your time. (Check one)

Type of Career

____1. General practice
____2. Specialty practice
____3. Research and/or teaching
____4. Combination of specialty practice, research and/or teaching
____5. Other medical fields (Specify)

_____

____6. Other non-medical fields (Specify)

_____

1b. If you plan to devote most of your time to general practice do you plan this in combination with some specialty? 1.____ Yes; 2.____ No .
If yes, please specify the specialty using the code numbers in question No. 3a.
____Specialty code.

1c.* If you have changed your mind since finishing your internship regarding the type of career you plan to enter, please list the major reason(s) for this change below:

_____

_____

_____

2. Indicate the type of practice in which you are now engaged or in which you plan to engage. (Check one)

____1. Individual private practice
____2. Partnership practice
____3. Group practice
____4. Hospital consultant (except federal hosp.)
____5. Full-time teaching and research (practice confined to medical school hospital(s)
____6. Part-time teaching and research, part-time separate private or partnership practice.
____7. Part-time teaching and research, part-time separate group practice
____8. Federal government service
____9. Public health (with or without teaching and research)
____10. Other (Specify) _____

3a. If you have entered or plan to enter any type of practice career other than general practice, please indicate the area in which you plan to specialize. If your specialty area is not listed below but can be considered a subcategory within one of the fields that is listed, please check that field.
Please check only one field

Area of Specialization

____06. Anesthesiology
____07. Basic medical sciences
____08. Dermatology
____09. Internal medicine
____10. Neurology
____11. Obstetrics/gynecology
____12. Ophthalmology
____13. Otolaryngology
____14. Pathology/clinical pathology
____15. Pediatrics
____16. Physical medicine and rehabilitation
____17. Proctology
____18. Psychiatry/neuropsychiatry
____19. Public health and preventive medicine
____20. Radiology
____21. Surgery - general
____22. Surgery - neurological
____23. Surgery - orthopedic
____24. Surgery - plastic
____25. Surgery - thoracic
____26. Urology
____27. Other (Specify) _____

_____

3b.* If you have changed your mind since finishing your internship regarding the area of specialization you plan to enter please list the major reason(s) for this change below:

_____

_____

_____

4a. Are you now married? 1.____ Yes; 2.____ No;
3.____ Widowed; 4.____ Divorced.
Date of Marriage: ____ ____ _____
Mo. Day Year
Number of children _____
Number born since medical school graduation _____
Number of dependents other than children (spouse, parents, etc.) _____

4b. Are you presently in debt, i.e., do your total liabilities exceed your total assets?
1.____ Yes; 2.____ No.
If yes, how large is your present debt?
1.____ less than $1000
2.____ 1000 - 2999
3.____ 3000 - 4999
4.____ 5000 - 9999
5.____ $10,000 or more

5.* Do you feel that you are or will soon be doing essentially what you want to do in your career?
1.____ Yes; 2.____ No; 3.____ Don't Know.
If you answered "No" or "Don't Know" to question number 5, please explain why:

_____

_____

_____

Use additional sheets if needed

6. Was there any specialty area you felt was inadequately introduced to you in medical school? Please specify this area using the code numbers in question 3a.
_____.

7. Please rate your internship experience in terms of its educational value to you. (Check one)

_____1. Excellent
_____2. Good
_____3. Fair
_____4. Poor

8. Thinking of your undergraduate medical education and your internship, how would these compare as an <u>educational experience</u> for you in light of your future career?

_____1. Medical school better
_____2. Internship better

9. Was your choice of specialty stimulated by any specific experience? ___Yes ___No
If yes, please describe briefly.

_____
_____
_____

10. Was you choice of specialty influenced by any particular person; for example, a family member, a department chairman, a particular teacher or practitioner, etc. ___Yes ___No
If yes, please specify his specialty area using the code numbers in question 3a above_____.

11. Do your own personal qualifications fit the image you have of your chosen area? ___Yes ___No
What are the characteristics you feel to be most important?

_____
_____
_____

12. Whatever your choice of a career within medicine, what do you consider to be the advantages of this specific career?_____

_____
_____

13. What do you regard as the disadvantages?_____

_____
_____

14. Using the code numbers in question 3a above indicate the specialty you would <u>least</u> like to enter._____
What reasons cause you to make this choice?_____

_____
_____

15. How many years of residency do you plan to take?

_____None	_____4 years
_____1 year	_____5 years
_____2 years	_____6 years or more
_____3 years	

16. Which of the following factors had a <u>major</u> influence on your choice of residency or fellowship?

_____1. General reputation of the program
_____2. Convenient geographic location
_____3. Desire to work with a particular person or group
_____4. Nature of laboratory and research facilities
_____5. Amount of stipend or grant
_____6. Other (specify)_____

_____

17. Any comments you may wish to make about your internship experience are most welcome:

The following statements refer to the general environment (facilities, faculty and student body) of your undergraduate medical school. Now that you have had an opportunity to view this experience with some perspective we would like you to describe your school using these statements. The statements may or may not be totally characteristic of your school, but try to decide which statements are most characteristic and which are not.

Please use the following scale in rating each statement:
4 - TRUE, 3 - MORE OFTEN TRUE THAN NOT, 2 - MORE OFTEN FALSE THAN NOT, 1 - FALSE.

Record your answers by circling the appropriate number at the left of each item. Your statements should tell us what you believe your school environment was like rather than what you might have personally preferred. You won't know the answer to many of these statements, because there may not be any really definite information on which to base your answer. Your response will simply mean that in your opinion the statement is to some degree true or false about your medical school. Do not omit any item.

Rating: (Circle one number for each statement)

4 3 2 1 The goals and purposes of the work are clearly defined for the student.
4 3 2 1 This medical school is outstanding for the emphasis it places on student scholarship and research.
4 3 2 1 In many of the basic sciences classes students have an assigned seat.
4 3 2 1 The faculty often seems more interested in the scientific aspects of a case than in the welfare of the patient.
4 3 2 1 Faculty members are very oriented toward practical application in their approach to education.
4 3 2 1 Faculty members frequently discuss topics which have no apparent relation to the total course.
4 3 2 1 Very few instructors try to give the student the kind of practical training he will need for the practice of medicine.
4 3 2 1 Most clinical faculty members are liberal in interpreting regulations and treat violations with understanding and tolerance.
4 3 2 1 Instructors frequently give unannounced quizzes or tests.
4 3 2 1 Departmental advisors seem unaware that a well-rounded program of study includes courses in the behavioral sciences.
4 3 2 1 The academic atmosphere here is not very helpful to the student who wants to get down to the business of practicing medicine.
4 3 2 1 Faculty members frequently go out of their way to establish friendly relations with students.
4 3 2 1 Assignments are usually clear and specific, making it easy for students to plan their studies effectively.
4 3 2 1 Instructors really get students interested in their subjects.
4 3 2 1 Faculty advisors are always available to help the student with the planning of his medical career.
4 3 2 1 The faculty here stresses the study of the patient as a whole person.
4 3 2 1 There are many facilities and opportunities for individual creative activity.
4 3 2 1 Residents and attendings participate enthusiastically in clinical conferences.
4 3 2 1 Most of the courses stress basic science or scholarship and really probe into the fundamentals of their subjects.
4 3 2 1 Faculty members typically exhibit great interest in and enthusiasm for their special fields of interest.
4 3 2 1 Faculty members here really push the students' capacities to the limit.
4 3 2 1 Students quickly learn what is acceptable and what is not acceptable in this school.
4 3 2 1 The faculty here lays great stress on ethical behavior.
4 3 2 1 Instructors generally feel that students should take comprehensive notes in lectures.
4 3 2 1 Examinations here generally provide a good opportunity for the student to display his knowledge and understanding of the course material.
4 3 2 1 Patient responsibility on the part of the student is closely supervised to guard against mistakes.
4 3 2 1 Faculty members rarely eat with students.

Rating: (Circle one number for each statement)
4 - TRUE, 3 - MORE OFTEN TRUE THAN NOT, 2 - MORE OFTEN FALSE THAN NOT, 1 - FALSE.

4 3 2 1 Many of the faculty seem bored with their teaching assignments.
4 3 2 1 The clinical faculty generally expects the student to know a great deal about his patients.
4 3 2 1 In many courses the broad social and historical setting of the material is not discussed.
4 3 2 1 The faculty rarely encourages a student to read in areas of the student's own interest.
4 3 2 1 Many courses stress the speculative or abstract rather than the concrete and tangible.
4 3 2 1 The faculty is very impatient with students who are content just to get by.
4 3 2 1 Frequent tests are given in most courses and oral quizzes are common in the clinical years.
4 3 2 1 Counseling and guidance services here are really personal, considerate, extensive.
4 3 2 1 It is hard to prepare for examinations because students seldom know what will be expected of them.
4 3 2 1 Very few of the professors here try to get students interested in the humanities or in the broad social context of medicine.
4 3 2 1 In many courses besides gross anatomy there are projects or assignments which encourage students to work in small groups.
4 3 2 1 Very little of the instruction here will be useful to students who go into practice.
4 3 2 1 Students with superior academic ability are admired by other students.
4 3 2 1 Student competition facilitates the acquisition of knowledge here.
4 3 2 1 There is a lot of interest in the philosophy and methods of science.
4 3 2 1 The students try to help each other.
4 3 2 1 A lecture by an outstanding behavioral scientist would be poorly attended by the students here.
4 3 2 1 It is hard to find any students in the library on weekends.
4 3 2 1 The environment of the medical school stimulates interest in things other than pure medicine.
4 3 2 1 The problem of comprehensive patient care is given little attention here by the students.
4 3 2 1 There is very little group spirit here.
4 3 2 1 Students are concerned only with the physical aspects of medicine.
4 3 2 1 Students compete actively among themselves.
4 3 2 1 Student attendance at specially organized extracurricular programs related to medicine is good.
4 3 2 1 Students frequently study or prepare for examinations together.
4 3 2 1 A controversial speaker always stirs up a lot of student discussion.
4 3 2 1 Most students are concerned with diagnosing the rare and exotic disease rather than eliciting factual data relevant to the diagnosis and treatment of the patient.
4 3 2 1 The student government is active and outspoken.
4 3 2 1 Most students here have strong intellectual commitments.
4 3 2 1 Hazing, teasing, and practical joking are fairly common.
4 3 2 1 Courses which deal with psychological problems or personal values are resented.
4 3 2 1 The competition for special honors is very rough.
4 3 2 1 Student elections generate a lot of intense campaigning and strong feeling.
4 3 2 1 Students are so preoccupied with their medical studies that they rarely concern themselves with anything else in social or informal discussion groups.
4 3 2 1 Personal hostilities are usually concealed or resolved as quickly as possible.
4 3 2 1 Student government or leadership does not participate in student affairs unless called upon by the administrative authorities on campus.
4 3 2 1 Students who are not ordinarily neat will take extra pains to have a professional bearing when in the presence of patients.
4 3 2 1 There is a recognized group of student leaders at this school.
4 3 2 1 Students who work hard for high grades are likely to be regarded as odd.
4 3 2 1 Students are concerned only with the work at hand and have few interests beyond this area.
4 3 2 1 Many students here are content just to get by.
4 3 2 1 It is usually quite easy to get a group decision here without much discussion.

Please turn to page 5.

The following items are partial descriptions of different medical careers. Please rate each of these in terms of its desirability from your own point of view. There are no "right" or "wrong" answers--we simply wish to obtain your opinions concerning various aspects of medical practice.

Please use the following scale in making your ratings:
5 - HIGHLY DESIRABLE; 4 - DESIRABLE; 3 - NEUTRAL, 2 - UNDESIRABLE, 1 - HIGHLY UNDESIRABLE

No answer sheet is needed--record your ratings by circling the appropriate number at the left of each item. Be sure to answer every item.

5 4 3 2 1	A career in which you must know your patients very well
5 4 3 2 1	A career in which you could share the responsibility for patient care with others
5 4 3 2 1	A career that requires little contact with the patient's family
5 4 3 2 1	A career that involves many difficult diagnostic problems
5 4 3 2 1	A career which will allow you to maintain a standard of living above that of the average physician
5 4 3 2 1	A career in which there are few opportunities to contribute to medical knowledge
5 4 3 2 1	A career in which your patients really appreciate your efforts
5 4 3 2 1	A career in which you would rarely work with other physicians
5 4 3 2 1	A career that has high prestige within the medical profession
5 4 3 2 1	A career which promises ample recognition for what you do
5 4 3 2 1	A career that rarely requires you to meet emergency situations
5 4 3 2 1	A career which would require a minimum amount of reading and study
5 4 3 2 1	A career that requires a considerable degree of manual skill
5 4 3 2 1	A career that requires you to deal with many uncertainties in diagnosis and therapy.
5 4 3 2 1	A career in which treatment procedures are well established
5 4 3 2 1	A career in which you frequently have the life of the patient in your hands
5 4 3 2 1	A career in which there is ample time to consider problems before making important decisions
5 4 3 2 1	A career in which you would rarely see a given patient more than once or twice
5 4 3 2 1	A career in which the sole responsibility for patient care would rest with you
5 4 3 2 1	A career that does not require close relationships with individual patients
5 4 3 2 1	A career that requires working closely with both the patient and his family
5 4 3 2 1	A career in which you are "on call" at all hours of the day or night
5 4 3 2 1	A career in which the diagnostic problems are fairly straightforward
5 4 3 2 1	A career in which the effects of treatment can be assessed almost immediately
5 4 3 2 1	A career which promises only moderate financial rewards
5 4 3 2 1	A career in which there are many opportunities to contribute to medical knowledge
5 4 3 2 1	A career in which teamwork with other physicians is essential
5 4 3 2 1	A career in which you seldom know whether or not your efforts are appreciated by your patients
5 4 3 2 1	A career in which you probably would not receive recognition for your accomplishments
5 4 3 2 1	A career that has only average prestige within the medical profession
5 4 3 2 1	A career which would require extensive reading and study
5 4 3 2 1	A career that frequently requires you to meet emergency situations
5 4 3 2 1	A career that requires relatively little manual skill
5 4 3 2 1	A career in which you would have to develop new treatment procedures
5 4 3 2 1	A career in which there are few uncertainties in diagnosis or therapy
5 4 3 2 1	A career in which you rarely have the life of the patient in your hands
5 4 3 2 1	A career in which important decisions must be made rapidly
5 4 3 2 1	A career in which you could expect to see each patient many times