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Toward a Theory of Segmentation by Objectives in Social Marketing*

SEYMOUR H. FINE**

Two consumer characteristics—objectives (goals) and strategies (decision rules)—are investigated as possible criteria in market segmentation, and a method is proposed for inferring them from behavior. A decision-rule model and an ensuing decision-process model are specified and then empirically estimated with data from a nutrition survey in a developing society. Segments based on decision rules were found to have between-group heterogeneity, which was substantiated by the decision-process, an econometric model.

This paper investigates a method of market segmentation based on the objectives and choice strategies of target consumption units. It is suggested that consumers' objectives and choice strategies are precursory to other variables typically employed as segmenting criteria, and, hence, their use may result in more meaningful segmentation studies than have previously been common. The product studied in this paper is a social cause—malnutrition amelioration in a developing country.

The social marketing approach to nutrition intervention and the importance of segmentation research in that approach are presented. Consumers' objectives and choice strategies are then discussed and methodology is considered, where two models are specified in terms of the sample data. Both models are tested, and threats to validity and reliability are taken into account. The paper concludes with a brief summary and some implications of the investigation.

Social products (Fine 1979) increasingly appear as

foci of marketing thought, in keeping with marketing's broadened scope (Kotler 1971) and the position that many forms of human exchange belong within the domain of marketing (Bagozzi 1975). It is particularly appropriate to exemplify an abstract concept, such as segmentation by objectives, with a correspondingly impalpable social product, rather than with a conventional good or service. When considering the adoption of an idea as important as family nutrition, the consumer's decision process addresses internal psychic factors, including very basic goals. By contrast, ordinary purchases are likely performed in a more surface manner.

Although nutrition intervention is employed in this paper as an example of a product, the idea plays more than a passing role in the study's development. Inter-twining illustrative cases with subject matter is common in social marketing (Kotler 1971), probably because writers experience a high degree of involvement with social products. For example, a recent inquiry into the marketing of zoos (Kovach 1978) was dominated by animal lore, but this in no way detracted from the interest generated by that paper. The phenomenon of overemphasis on illustrations imparts to social marketing an interdisciplinary flavor, which, by its very definition, it deserves. Moreover, real world examples hold an especially important place in a new and abstract discipline like social marketing, if only to facilitate familiarity with its precepts.

In a sense, social marketing is more inclusive and generalizable than traditional marketing, for ideas underlie all goods and services, but the converse is not necessarily true. Virtually every conventional product is associated with ideas or attributes (Lancaster 1966) perceived as desirable by consumers, but not every idea is linked to a tangible good. In fact, if product

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marketing is tied to underlying ideas, whereas idea marketing is relatively independent of products, then one may take the stance that social marketing is indeed the *ultimate* marketing (Fine 1980).

Background

In 1970, the United States Agency for International Development sponsored a major project, "An Operations Oriented Study of Nutrition as an Integrated System in the State of Tamil Nadu." The state of Tamil Nadu is situated at the southern tip of the Indian subcontinent and occupies an area of 50,000 square miles with a population (1971) of 43 million. For various reasons, primarily political (e.g., the outbreak of the Bangladesh War), work on the Tamil Nadu study was truncated shortly after data collection.

The problem of malnutrition, plaguing two-thirds of the world's inhabitants, may be viewed from two vantage points. The first concerns actual food products—innovative enriched or fortified foods, modernization of food warehouses and distribution systems to reduce spoilage, and lowering of prices through more efficient operations (Sheth and Sudman 1974). The second, which is highlighted in this paper, deals with educative aspects of nutrition. It is aimed at strengthening nutrition programs through the diffusion of awareness about food/health relationships among target consumers and by disseminating information regarding particular foods that should be consumed for maximum nutritive benefits.

A (social) marketing approach to this problem considers malnourished individuals as comprising a market, and malnutrition amelioration as a product to be marketed to satisfy the needs of the ill-fed. As with conventional product marketing, this approach would take into account such factors as price, promotion, and distribution in planning for the dissemination of nutrition programs, factors that comprise the well-known Four P's marketing model. Because markets are heterogeneous, an early step in marketing strategy is to segment the market so that product design and campaign planning may be better individualized.

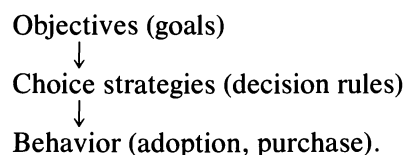
The need for segmentation in nutrition planning has been stressed by nutrition advocates (Berg, Scrimshaw, and Call 1973). Nutrition intervention must be preceded by identification of vulnerable target subgroups and isolation of the most important determinants of malnutrition. Such variables comprise a vector that Berg and Muscat (1972) suggest calling "an economic or *eco-nutritional profile* which would characterize the group . . . (and) serve as a kind of litmus paper against which any of the standard nutrition intervention programs could be tested" (p. 947).

Having selected the Tamil Nadu nutrition data with which to demonstrate the concept of segmentation by objectives, it seemed natural to designate the family as the unit of analysis. The family, and especially the

extended family, is the focus in most sociological studies of preindustrial societies.

OBJECTIVES AND CHOICE STRATEGIES OF THE CONSUMER

Theoretical conceptualization stems from Granger's (1964) "Hierarchy of Objectives." Although he admitted: "In reality we know very little about the nature of objectives" (p. 74), Granger's model demonstrated that objectives (goals) underlie choice strategies (decision rules) which, in turn, determine tactics (behavior).¹ The concept is schematized below:



Subscribing to the logic of the Granger model, one would propose that marketers' concern with consumer behavior should be broadened to include consumer objectives and choice strategies, as these are hierarchically superordinate to behavior. Even if goal setting does not occur first, it might be coincident with other decision processes that are of interest to marketers.

The aim in this section is to show that consumer objectives might constitute a useful characteristic to consider in the continuing effort to understand consumption decision making and behavior. That thesis, central to this paper, has relevance whether the unit of analysis is the individual, the dyad, the household, or any other social group. The suggestion applies particularly to market segmentation studies in which a first step must necessarily involve selection of a segmentation criterion. Typically, criteria are selected from among demographics, socioeconomic characteristics, consumption patterns, personality traits, attitudes, and preferences of the consumption unit (Frank, Massy, and Wind 1972).

Objectives Neglected in Marketing. The family as a decision-making unit is widely discussed in consumer research, and has been reviewed in well-known works of Davis, Ferber, Hempel, Sheth, and others; most of these studies are based on husband-wife interaction in purchase decisions. Bagozzi and Van Loo (1978) review decision-process models that also consider household behavior as social exchange or based on social judgment theory. However, Sheth (1979, p. 6) notes "more research and theory are clearly needed" in household decision making. In particular, household objectives have not been explored in spite of Ferber's

¹ Words in parentheses will be taken as synonymous and interchangeable with Granger's terms.

(1977, p. 82) observation that family goals are a "major determinant of family marketing decisions."

This is no less true at the level of the individual consumer, where marketers have explored a full gamut of demographics, as well as consumer activities, interests, and opinions [the psychographics (Wells 1975)], values, attitudes, and even the very structure of the decision process (Bettman 1971). Indeed, Krugman (1971) has gone so far as to examine different roles played in the purchase decision by the right and left lobes of the brain. Yet, the fundamental objectives consumers set for themselves do not appear to have been examined as factors having impact on purchase behavior. This is surprising because objectives must affect decision making as well as actions.

Not to recognize goals as antecedent to behavior overlooks rationality in the choice process—a process that begins with objectives. People have goals and use these goals to determine the decision rules they adopt (Stratmann 1975). With particular emphasis on developing society settings, Adams and Havens (1966, p. 281) point out that an early step in strategy formulation for the marketing of social change is to identify the objectives of the target people. So it is curious that, although most theories of social choice stem from such reasoning (Downs 1957), it does not seem to be more popular in the study of consumer behavior.

Choice Strategies. While neglecting objectives, consumer researchers have not overlooked choice strategies, the link in the chain between objectives and behavior (Bettman 1971; Hansen 1972). Wright (1975, p. 60) observed:

Different choice strategies can imply different marketing tactics. Once the likely choice strategy is predicted, marketing activity can (1) accept that as a given and adjust to accommodate it . . . , (2) try directly persuading the consumer to use another strategy more favorable to ultimate selection of the advocated product, or (3) try to help the consumer restructure his decision problem (e.g., reduce it to a simpler task) which in turn induces him into using a different choice rule.

Nutrition. Choice strategies (as well as their underlying objectives) regarding intrafamily distribution of inadequate food supplies must occupy a critical position in households of developing societies. Moreover, intrafamily food distribution behavior does not appear to be a widely explored area of nutrition study (Berg and Muscat 1972, p. 941). In a comprehensive report on the progress of third world development, the World Bank (1978, p. 35) called for a program to increase "people's awareness of the nutrient need of various family members (for example, the importance of breast feeding, and of introducing supplementary foods at the appropriate age), . . . to help improve their diets."

Toward a Theory

It is doubtful that families formally enunciate objectives or the decision rules by which they hope to attain those objectives. However, it seems reasonable to assume that the existence of goals are implicit in household structure and behavior—where the family resides, its size, religion, the amount of education members obtain, value orientations, and so on. Even if people do not consciously follow a thoroughly rational choice process, it may be useful to assume that they behave as though they do. This follows from "economic man" theory that individuals are utility maximizers, a concept also implicit in the rational choice model. For example, Bagozzi and Van Loo (1978) have explored fertility behavior as resulting directly from family choice processes "wherein overall household satisfaction is maximized subject to the constraints of income and prices" (p. 199). People seem to maximize perceived utilities of money, time convenience, form, and quality of products purchased. Earlier, Wright (1975) examined the ways in which consumers select among alternative choice strategies. He assumed:

. . . the output of a consumer's cognitive averaging of data on an option is his estimate of its global "utility" or "affect." Given that output, a common assumption has been that he picks the option offering highest utility, a BEST rule. Another plausible assumption is that he sets up a cutoff on his global utility dimension and uses this to discriminate "acceptable" options (via an ALL or FIRST rule). He is seen performing something akin to a mental discriminant analysis (p. 61).

Wright also studied individuals' perceptions about outcomes that might result from choices of particular decision rules without those rules being executed.

In contrast, this study examines observed behavior and posits inferences from that behavior about the decision rules that precede it. Statistical discriminant analysis is performed and the selected decision rules are investigated by multiple regression analysis.

METHOD

The Study Design

The purpose of this inquiry is to consider how consumer objectives and decision rules can be employed in segmentation research, and to investigate how such research may be useful in programming nutrition intervention. To carry out that purpose, an eclectic approach to segmentation modeling is developed. The first stage is an inquiry into the goals families implicitly set for themselves—goals that govern behavior patterns, including food distribution habits. In this stage, three decision rules are postulated a priori, and families are segmented according to how closely they seem to follow these rules. This is the decision-rule model.

The second stage examines the family as a decision-making system, and identifies a set of criteria as dependent variables. Characteristics of nutritional behavior are posited as influencing these criteria, and an econometric decision-process model is structured. Where the decision-rule model describes the family's behavior, the decision-process model attempts to explain that behavior.

The Market

Like those of many emerging societies, individuals in Tamil Nadu are "tradition directed" (Reisman 1950), in that they have low social mobility and adhere to conduct dictated by religion, fate, and social class. They place their greatest trust in opinion leaders whom they know personally and who live in their own villages. Forces outside the local setting encounter considerable difficulty in imposing social change (witness failures of the Indian government's vasectomy program). The family is typically "joint" or "extended," with elders and other relatives participating in decision making. The Tamil belief system does not relate food to health. Instead, eating has ritual, caste, symbolic, and religious implications. Thus, white foods—eggs, milk, finely ground rice—assume high status and acceptance only because of their whiteness; any nutritive value is coincidental (indeed, unpolished rice is more nutritious). Many Indians believe that a full stomach implies a well-fed person; they do not understand the concept of nutrition (Sheth and Sudman 1974, p. 162).

Data

The data used were obtained in a food-habits survey questionnaire administered to a two-stage, stratified random sample of 2,800 families in Tamil Nadu in 1972. The first stage of sampling was village and urban blocks and the second stage was the household (Cantor 1973). From the databank generated by this study, a purposive subsample of 668 cases was selected for reanalysis on the criterion that each family include an infant, a weaning child, and a lactating mother. Table 1 lists determinants of intrafamily food distribution patterns used in the model-building procedure. Although most measurements were taken directly from the questionnaire, some result from recalculations or were drawn from secondary sources. In addition, the following indices were constructed not only to reduce the data, but also because multiple measures tend to cancel out errors that may be inherent in single items.

Family health status—a weighted composite of several illness and health items appearing in the survey instrument. These include symptoms of nutritional deficiencies in key family members, mortality and morbidity, as well as interviewers' general impressions.

Food expenditure pattern—the proportion of total

expenses allocated to food purchases. This variable has been shown to have analytic importance in nutrition studies (Nicol 1974, p. 76).

Nutrition practice—combined data on breast feeding, weaning practices, and birth spacings in keeping with the Knowledge, Attitude, and Practice model (KAP) often seen in nutrition and population studies.

Family wealth—a weighted composite of the value of the house, the source of water supply, and the value of family owned land, combined similarly to Levinson (1972, p. 108).

Nutrition status—calculated for four key household members—household head, lactating mother, infant, and weaning child—as the quotient of the percent caloric needs met for the member, divided by that for the entire household. Each indicates, relatively, how the individual member fares nutritionally within the home.²

Specification of the Decision-Rule Model

How may goals be postulated for a household? Intuitively, one can imagine a family in which a primary goal is the physical well being of its members. In another, a harmonious home life is all important. One household seems to work toward the achievement of high status, another toward amassing wealth, friends, or knowledge, and so forth. But model specification requires a more formal framework than that provided by heuristics alone. The concept that a household is a social system homologous to friendship groups, business organizations, and churches (Levy and Zaltman 1975, p. 40) suggests other disciplines. This led to Ansoff (1976, p. 38), whose three organizational objectives provided a point of departure for the present analysis. These objectives are:

- Equal responsibility to all members
- Negotiated consensus among members
- Survival of some members.

Although Ansoff's focus is on the corporation, these objectives should be generalizable to any social system. Extrapolating Ansoff's objectives to the case of intrafamily food distribution, the following decision rules are postulated corresponding to those objectives:

1. *Equality*—food is distributed in equal proportion to need.
2. *Proportionality*—allotments vary proportionally according to status within the household.
3. *Triage*—needs are fulfilled hierarchically until supplies are exhausted.

² The four nutrition status measures are listed in Table 1, but were excluded from the discriminant and multiple regression analyses because their numerators were involved in calculations of the three decision-rule distance measures in Equation 1.

TABLE 1

WITHIN-GROUP MEAN SCORES, UNIVARIATE *F* VALUES, AND STANDARDIZED DISCRIMINANT COEFFICIENTS (WEIGHTS)

Variables and units of measurement	Within-group means					Discriminant	
	ALL CASES	DEQU	DPRO	DIAG	ENDOWED	<i>F</i>	Weights
Family health status (index 1 to 100)	44.75	44.09	46.06	47.06	44.37	1.46	.149
Food expenditure pattern (percent of income)	73.29	73.58	72.14	73.13	73.67	0.67	.071
Nutrition practice (index 0 to 50)	13.57	13.50	13.58	13.20	13.97	0.28	.061
Percent caloric needs met	78.01	63.60	81.70	89.76	117.69	152.99	.925
Food purchases per caloric need (rupees)	39.26	41.52	31.86	43.67	37.74	0.98	.033
Vegetarianism (percent)	28.83	28.76	29.52	27.96	28.73	2.40	.029
Weaned child's food cost (rupees)	15.49	15.33	14.13	15.98	17.32	0.46	.044
Nutrition information sought (percent)	14.82	16.36	12.00	9.26	15.45	1.42	.133
Distance to nearest medical aid (kilometers)	2.93	2.93	2.77	2.64	3.23	0.19	.021
District food-output per capita (pounds)	238.68	220.54	234.82	263.59	293.37	3.61	.007
Village electrified (percent)	94.16	95.51	96.80	96.30	85.45	0.21	.076
Land value (1,000 rupees)	4.11	3.39	3.06	4.54	7.58	0.58	.002
Village water source (quality category)	1.71	1.73	1.70	1.70	1.69	0.13	.038
District population growth rate (percent)	7.27	6.68	7.38	7.35	9.10	1.69	.005
District literacy rate (percent)	40.58	41.42	40.10	38.37	39.29	2.60	.122
Family wealth (index)	60.13	57.97	58.83	63.56	67.37	0.33	.142
Religion is Hindu (percent)	88.47	86.81	92.00	90.74	89.09	1.40	.119
Family caste (index)	2.09	2.13	2.02	1.96	2.13	1.74	.226
Age of infant (months)	8.34	8.47	8.33	7.41	8.37	0.82	.120
Infant is female (percent)	51.80	53.83	52.80	51.85	43.64	0.05	.062
Per capita income (rupees)	29.09	26.96	29.58	33.22	33.84	2.76	.019
Family income in kind (percent)	12.52	11.00	16.16	12.78	13.45	2.54	.051
Family size	6.76	7.06	6.49	5.81	6.49	10.79	.226
Household head's age	39.83	39.78	39.37	38.24	41.32	0.49	.065
Household head's occupation (index)	3.23	3.26	3.26	3.22	3.09	0.03	.017
Spouses' education difference (years)	1.05	1.01	1.07	1.04	1.18	0.10	.074
Spouses' age difference (years)	8.44	8.39	8.28	9.11	8.48	0.34	.070
Mother's age	27.87	27.91	27.55	26.96	28.55	0.74	.098
Mother's age at marriage	17.76	17.68	17.46	18.30	18.12	1.83	.018
Weaned child's age (years)	4.55	4.46	4.69	4.80	4.56	3.16	.131
Weaned child is female (percent)	49.10	49.34	43.20	55.56	51.82	1.29	.001
Mother employed, hours weekly	5.21	5.11	5.17	3.81	6.25	0.22	.019
Household help (1 if yes)	.38	.40	.38	.24	.42	2.43	.030
Family education (years for highest)	3.67	3.72	3.59	3.59	3.65	0.51	.212
Household head's nutrition status	116.88	114.60	127.96	115.33	112.89	—	—
Mother's nutrition status	86.32	89.65	81.89	74.46	85.68	—	—
Weaned child's nutrition status	99.88	98.07	89.26	114.28	111.09	—	—
Infant's nutrition status	101.91	114.63	89.22	92.89	76.90	—	—

The aim of this analysis is to determine how closely each family in the sample appears to be following a decision rule dictated by one of the three objectives, and then to establish characteristics that identify groups of families following each rule. The following notation is used in developing the formulation:

N_i = caloric needs of member i in units, where one unit equals the average daily caloric requirements of an adult,

$D = \sum_{i=1}^k N_i$ = total caloric needs for a family of k members,

M_i = percent caloric needs being met for member i ,

F = percent caloric needs being met for the entire household,

$Q_i = M_i N_i$ = observed caloric intake for member i in units,

$T = DF$ = observed total caloric intake for the household,

X_i = allotment under the Equality decision rule,
 Y_i = allotment under the Proportionality decision rule,

Z_i = allotment under the Triage decision rule,
 R^{i-1} = the proportionality rate for member i .

By definition,

$$\sum_{i=1}^k X_i = \sum_{i=1}^k Y_i = \sum_{i=1}^k Z_i = T.$$

The Equality Decision Rule. This is conceptually rooted in the work of Pollay (1968), who stressed dis-

EXHIBIT

PRIORITY RANKING OF FAMILY MEMBERS^a USED IN PROPORTIONALITY AND TRIAGE RULES

Rank	Member
1	Male, head of household
2	Male, not head of household, aged 13 to 60 years
3	Single female aged 13 to 25 years
4	Infant aged less than 2 years
5	Elders, not head of household
6	Children aged 2 to 13 years
7	Single female aged 26 to 60 years; married female aged 13 to 60 years
8	Others

^a Adapted from Montgomery (1972, pp. 3, 150).

tributive justice in family decision making. Equality occurs where $X_i = N_i F$.

The Proportionality Decision Rule. “Negotiated consensus among participants” might involve intra-family negotiation based on the presumption that some members are more “important” than others and, hence, should be favored nutritionally. To define importance, a rank ordering was constructed of status priorities for members in the family using norms prevailing in the Tamil culture (Exhibit). Given the estimated priority ranking, this decision rule says that the highest ranking member will be able to fulfill 100% of his/her caloric requirements. The second ranking member will be allotted a lesser proportion of needs and so on for all members with the rate diminishing geometrically by powers of the rate R , where R is a proportionality rate estimated for each family:³

$$\begin{aligned} Y_1 &= N_1 \text{ units} \\ Y_2 &= RN_2 \text{ units} \\ &\vdots \\ Y_k &= R^{k-1}N_k \text{ units,} \end{aligned}$$

and

$$\sum_{i=1}^k Y_i = \sum_{i=1}^k (R^{i-1}N_i) = T.$$

The Triage Decision Rule. A “survival” rule might

maximize the chance that at least some members (probably the most “important”) survive, although at the expense of other members. Under this rule, the more important members receive their full requirements until the supply is exhausted, and the remaining members go without. Heller (1976) has argued that the probability of nutritional survival of some family members “is itself parentally influenced, if not determined” (Heller and Drake 1979, p. 206). Employing the notation listed earlier, the Triage rule is formulated as follows:

$$\begin{aligned} Z_i &= N_i \text{ units} \\ &\vdots \\ Z_j &= N_j \text{ units} \\ &\vdots \\ Z_{j+1} &= T - \sum_{i=1}^k N_i \text{ units} \\ Z_{j+2} &= 0 \text{ units} \\ &\vdots \\ Z_k &= 0 \text{ units.} \end{aligned}$$

“Conformity” to each rule is defined for each family in terms of deviation for each member between actual reported food distribution and predicted distribution under the rule. Summing squared deviations over family members and taking square roots yields a Euclidean distance measure for each rule for each family. Euclidean distance is appropriate here because the data are assumed to be intervally scaled:

Deviation from Equality rule:

$$DEQU = \left(\sum_{i=1}^k (Q_i - X_i)^2 \right)^{1/2}$$

Deviation from Proportionality rule: (1)

$$DPRO = \left(\sum_{i=1}^k (Q_i - Y_i)^2 \right)^{1/2}$$

Deviation from Triage rule:

$$DIAG = \left(\sum_{i=1}^k (Q_i - Z_i)^2 \right)^{1/2}$$

These three distance measures (*DEQU*, *DPRO*, and *DIAG*), whose acronyms also identify their respective food distribution strategies (the postulated decision rules), were calculated for each household, and a new (trichotomized) measure was constructed indicating which of the three distances has lowest value for each household. It, thus, tells whether the family most closely follows the Equality, the Proportionality, or

³ The Proportionality factor, R , is calculated for each family by the following algorithm: $R^1 = 1$ by construction, as the first member's needs are filled. To determine R for the family (and by implication R^i , $i=2, \dots, k$ for all remaining members), the computation scheme proceeds by assuming each member of the family receives F percent of his/her caloric needs and then iteratively increases or decreases R in increments of 0.002 until the sum of the implied values for various family members is within five percent of the actual T for that family.

the Triage allocation strategy, and also serves as the variable upon which segmentation is based. Because the segmentation criterion is prespecified, discriminant analysis is used in the grouping process. If "natural" groupings were desired, cluster analysis would have been employed.

Specification of the Decision-Process Model

For longer-term considerations and nutritional policy making, it is also useful to amplify the meaning of segment characteristics by assessing their influence on one or more consequences of household behavior. In this section an econometric decision-process model is specified to attempt to explain Tamil nutrition behavior. The model is estimated for each segment, providing deeper understanding of segment differences.

Dependent Variables. An important early step in the design of an econometric investigation is the identification of one or more appropriate dependent variables upon which the impact of explanatory variables may be assessed. The following indices defined earlier were selected:

- Family health status
- Nutrition practice
- Food expenditure pattern.

These are virtually independent of the decision-rule distance measures ($r = 0.03, 0.01$, and 0.05 , respectively), and thus constitute new criteria that are hypothetically explained by exogenous factors. Because they represent unique operating properties of household process, each warrants a position as an endogenous or left-hand variable of an equation, and, because these properties operate simultaneously within the household, a set of equations so formulated comprises a system of simultaneous equations. By assigning y_1 , y_2 , and y_3 to represent health, practice, and expenditure patterns, respectively, the decision-process model takes the structural form:

$$\begin{aligned} y_1 &= b_{11}y_{11} + b_{12}y_{12} + b_{13}y_{13} + c_{11}x_{11} \\ &\quad + c_{12}x_{12} + \cdots c_{1m}x_{1m} + u_1, \\ y_2 &= b_{21}y_{21} + b_{22}y_{22} + b_{23}y_{23} + c_{21}x_{21} \\ &\quad + c_{22}x_{22} + \cdots + c_{2m}x_{2m} + u_2, \\ y_3 &= b_{31}y_{31} + b_{32}y_{32} + b_{33}y_{33} + c_{31}x_{31} \\ &\quad + c_{32}x_{32} + \cdots + c_{3m}x_{3m} + u_3, \end{aligned} \quad (2)$$

and, in matrix notation,

$$y = Yb + Xc + u,$$

in which,

y is a 3×1 regressand vector of observations on endogenous left-hand variables,

Y is a 3×2 matrix of observations on the other endogenous variables,

b is a 3×2 matrix of structural coefficients of the elements of y ,

X is a $3 \times m$ nonstochastic regressor matrix of observations on the exogenous variables where,

m is the number of exogenous variables,

c is a $3 \times m$ matrix of structural coefficients of the elements of x , and

u is a 3×1 vector of independent stochastic disturbance terms assumed to be distributed $N(0, \sigma^2)$.

Some of the elements of matrices b and c will, of course, be zero.

With some Y_i inevitably situated among the X_i , the problem of reverse causality or simultaneity usually introduces bias and inconsistency in the estimation of structural parameters, and this may be dealt with in one of several methods. One method is to employ two-stage least-squares for estimating parameters. In the present study, however, rank and order conditions for econometric identifiability were satisfied. That is, at least $n - 1 = 2$ system variables are absent from each equation ($n = 3 =$ the number of equations) in each system (Blalock 1969, p. 65; Farley 1967, p. 319). As such, ordinary least squares served to estimate the parameters.⁴

RESULTS

Segment Discrimination in the Decision-Rule Model

The postulated decision rules were fit to the Tamil Nadu data empirically by discriminant analysis, to determine statistical uniqueness of the three segments and to develop consumer profiles in terms of the descriptive variables listed in Table 1. Of the 668 households, 558 (83.5 percent of the sample) were found to be in measured deficit in terms of calories, and were assigned to the segments as follows:

Rule used (segment)	Families in caloric deficit
Equality (DEQU)	379 (67.9%)
Proportionality (DPRO)	125 (22.4)
Triage (DIAG)	54 (9.6)

The remaining 110 households (16.5 percent of the sample) received as much, or more, calories as they required. These comprise a special case, the "Endowed" group, and were omitted from the analyses

⁴ Bagozzi (1977) presents an illuminating explication of the causality issue.

because malnutrition should not be a problem in homes receiving sufficient food. But their characteristics and behavior are nevertheless of some interest, and they are included in Table 1. For example, some of these families distribute excessive amounts to some members while depriving others, a situation that cannot go unnoticed by the nutrition advocate. The entire subsample of 558 families was used in the discriminant analysis because the objective was to identify the variables that best discriminate among the groups. Had the primary purpose been to determine the effectiveness of classification, more nearly equal group sizes would have been appropriate (Morrison 1969). Thus, prior probabilities were proportional to the actual number of families in each segment.

The discriminating variables seem to have done an effective job of separating the groups, as evidenced by a high value for Wilks' Lambda (0.955) achieved by the first of two discriminating functions, and the only one on which analysis was based. Its eigenvalue indicated 94 percent explained variation. The function correctly assigned 79 percent of the sample to the three decision-rule segments, compared with 57 percent and 68 percent, respectively, which would have been assigned employing the proportional chance criterion and maximum chance criterion (by predicting all Equality households), as formulated by Morrison (1969). These differences are both significant at the 0.01 level.

Pearson product moment correlations were calculated between all the discriminators to investigate their independence. Overall, correlations were quite low; all were less than 0.2, but even after data reduction through factor analysis, three correlations between 0.3 and 0.6 remained. Also, two secondary variables relating to growth and literacy rates of districts showed $r = 0.7$; however, both were included as important information. As a consequence, the independence assumption of the analyses was somewhat violated, and results must be viewed in that light. Nonetheless, intergroup F statistics are significant at the 0.01 level. Subject to limitations posed by multicollinearity, the null hypothesis that the vectors of means are equal to one another is rejected; one may conclude that unique and distinct segments do exist.

Examination of the absolute values of the standardized discriminant coefficients⁵ listed in Table 1 reveals that variables contributing most significantly to group separation are the percent caloric needs met, house-

hold size, health status, wealth, caste, search for nutrition information, vegetarianism, and education.

Segment Profiles

Table 1 lists within-group mean values for all four groups. All segments share the characteristic that household heads are, on average, overfed while the lactating or pregnant mother is deprived of adequate caloric sustenance. Also apparent from Table 1 is a hierarchy of financial well-being with the Endowed at the top, followed by the Triage, the Proportionalities, and at the lowest economic level, the Equalities.

Equality segment families, which were postulated to allocate food equitably (according to member needs), are significantly poorest in both per capita income and in food receipts. Yet only in this group are the infants well fed. These families actively seek more nutrition information than those in the other two segments, which should make them more receptive to promotional campaigns (Manoff, Cooke, and Rombower 1977). Further, these families are larger and have more children than the other groups, suggesting that nutritional and family-planning programs have especially common goals for this segment.

The Proportionality segment had as a decision rule that all members participate to some extent in insufficient food supplies, but that certain members receive relatively more than others, provided all receive at least some sustenance. Yet, in this group we find the greatest disparity between benefits received by the household head and the young children. Not surprisingly, profiles of families most closely conforming to this rule lie between the other two groups, because the rule is midway between the two extremes in terms of behavior patterns.

Triage family members hypothetically receive "all or nothing" with the objective of ensuring benefits to at least those members most important for survival of the household. If one could imagine a Triage family in the real world, then, upon the demise of the sacrificed members, supplies would now suffice for those remaining and the family would join the Endowed. In fact, by definition each Triage approaches the Endowed as a limit.⁶

⁵ The usual convention of considering standardized coefficients as measures of importance was followed. Their signs, however, were omitted. Compared with regression coefficients, signs of discriminant function coefficients are relatively unimportant. In fact, changing the sequence of insertion of variables might reverse the function's scale such that signs are exactly reversed, creating a mirror image of the original discriminant score plot.

⁶ A *JCR* reviewer conjectured that this explained why Triage most closely resembled the Endowed economically. It is a reasonable guess, but one for which, alas, no support can be found in the data, from which it appears that even in the poorest families no member is completely starved. In fact, no respondent household perfectly matched any of the three postulated strategies, which were hypothesized only as benchmarks. One may, however, conjure explanations for a Triage/Endowed linkage. Possibly, the most advantaged have the highest aspirations and the highest incentives to achieve survival, whereas the hopelessness of lowest class existence precludes attempts at survival. Perhaps poorer Equalities have become accustomed to despair, including malnourishment. They are

Empirical analysis of the decision-rule model indicates that there appear to be three market segments that follow the postulated family objectives, and they are identified generally by vectors of characteristics listed in Table 1. According to market segmentation theory, differences in profiles of these three submarkets are to be taken into account when designing the product and in planning promotion campaigns. Ideally, one intervention program should be custom tailored to suit the individual needs of each segment.

Estimating the Decision-Process Model

The decision-process model is the second stage in the development of the segmentation modeling strategy evolving in this study. Having shown the existence of distinct segments, a logical next step is to explain the influence that the predictor set exerts on the specified criterion variables—health, practice, and expenditure patterns. Some idea of differential impact of the predictors might be deduced from examination of discriminant function coefficients. But these weight the importance of the variables as discriminators only with respect to food distribution behavior, and to no other criteria. More telling conclusions about the predictors' importance are obtained through multiple regression of the newly specified criteria on the predictors.

In the estimation phase, estimates are found for structural parameters, i.e., coefficients for right-hand variables in the equation. The model contains a simultaneous three-equation system for the entire sample with one such system for each target segment. Although stepwise procedures are often employed in econometric model estimation, the entire variable set was "forced" into the analysis for two reasons: (1) it seemed important to compare the influence of the variables on the three behavioral consequences with their significance as discriminators found earlier, and (2) multicollinearity might cause the stepwise procedure to select the lesser important of a pair of highly correlated variables. Forcing all variables into a "specified" regression mitigates this possibility and tests the theory as formulated, though at a possible loss of some precision in estimation provided by stepwise selection. The sample being large, and degrees of freedom adequate, Johnston's (1972, p. 169) admonition was followed, that "one should err on the side of including variables in the regression analysis rather than excluding them."

In preparing variables for analysis, logarithmic transformations were performed to provide multipli-

cative exponential formulation for the regression equations. By structuring the equations multiplicatively, all predictor variables interact in producing the estimated values of an endogenous criterion. At the same time, the regression coefficients approximate elasticities in that they estimate the percentage change in a dependent variable for every one percent change in a particular independent variable.

Overall, the same (discriminating) variables that proved to be important in assigning families to their respective segments, appeared again as significant regressors (Table 2).⁷ These include interest in nutrition as indicated by eagerness to search for information, family wealth, and size of the household. A notable disappointment was percent caloric needs met, which was so important before, yet only significant in two of 12 possible occasions in the model. This supports findings in an earlier study that nutrition consequences are not based so much on availability of food, as on cultural factors (Fine 1978). On the other hand, the importance of income is consistent with results of investigations in Calcutta (Reutlinger and Selowsky 1976) and Madras (Levinson 1972).

Three environmental factors emerge in this model as having important influence on nutritional outcomes: food output per capita, the type of water source available, and the growth rate of the district. Also, one sees the major role played in the home by the mother, who makes most of the crucial decisions in intrafamily food distribution, and who will thus be an important audience in intervention planning. In fact, it is not uncommon for the mother to secretly put food aside for the child in anticipation of shortages (Tandon 1977).⁸

Goodness-of-Fit. R^2 , the proportion of variability explained by the equations in the decision-process model, was high compared with marketing models in general and nutrition studies in particular. The average R^2 was 0.25 for the entire sample, but rose to 0.45 for the segment models.

Error and Threats to Validity and Reliability

Sampling error is a lesser threat with a stratified random sample as selected in this study than it would have been for a corresponding simple random sample of the same size (Kish 1967) because the dispersion within each stratum is less than that in the entire population. Then, too, the survey instrument was dominated by objective, rather than open-ended, items, which re-

so far away from adequacy that they lack motivation to better themselves. They may prefer an intact undernourished household to the Triage ideal of a healthy majority at the expense of deprived expendibles.

⁷ The relative number of significant estimates declined as sample size dropped across segments (see Table 2), probably reflecting losses in degrees of freedom.

⁸ Head of Gastroenterology and Human Nutrition, All India Institute of Medical Sciences, New Delhi (personal interview).

TABLE 2
ESTIMATION OF SYSTEM EQUATIONS WITH COEFFICIENTS EXPRESSED AS ELASTICITIES

Variables	Entire sample (n = 558)			Equality segment (n = 379)			Proportionality segment (n = 125)			Triage segment (n = 54)		
	Health	Purchase	Practice	Health	Purchase	Practice	Health	Purchase	Practice	Health	Purchase	Practice
Family health status		-.083 ^a	-.058 ^a		-.078 ^a	-.034		-.182 ^a				
Food expenditure pattern	-.264 ^a		.093 ^b	-.261 ^a		.061	-.403 ^a		.121			
Nutrition practice	-.154 ^a	.078 ^b		-.099	.052			.119				
Percent caloric needs met	-.067	-.036		-.172 ^a								.574 ^a
Food purchases per caloric need		.094 ^a	-.054 ^a		.034	-.049 ^a		.216 ^a			.086 ^b	-.095
Vegetarianism	.010	.050	.105 ^a	.115		.099 ^b			.333 ^b		.219 ^b	
Weaned child's food cost	.015	.007	-.033 ^a			-.041 ^a	.055 ^b	.036 ^b				
Nutrition information sought		-.073 ^a			-.068 ^a			-.116 ^b			-.184 ^a	
Distance to nearest medical aid	-.025		.023 ^a	-.042 ^b		.022						.119 ^a
District food output per capita	-.024 ^b	.018 ^a	-.015 ^b	-.016	.019 ^a		-.040	-.023			.036	
Village electrified		.056			.104 ^a			-.153				
Land value	-.016				-.010		-.041				-.028	
Village water source	.092 ^b	.052 ^b	-.072 ^a	.161 ^a	.101 ^a	-.094 ^a				-.559		
District population growth rate	.037	.042 ^a	.040 ^a	.060 ^b	.040 ^a			.077	.092 ^b			
District literacy rate		-.067	-.065				-.178					
Family wealth	-.058 ^a		-.023 ^b	-.080 ^a		-.035 ^a				-.148		
Religion is Hindu	.132 ^a			.143 ^a							.168	
Family caste	-.112				-.095		-.239					
Age of infant			-.020 ^b			-.019			-.045			
Sex of infant is female			-.055 ^b			-.090 ^a						
Per capita income	-.037 ^b	-.013 ^a	.136	-.040 ^b	-.037 ^a	.020		-.061	.070		-.052	
Family income in kind	.046 ^a		.171 ^b	.058 ^a	.021 ^b	.029 ^a					.056	
Family size		.082 ^a	-.134 ^a			-.124 ^a			-.183		.389 ^a	-.672 ^a
Household head's age	-.103		.090 ^b	-.122		.134 ^a					-.584 ^a	
Household head's occupation			-.056 ^b		.048			-.186 ^a		-.386		.191
Spouses' education difference	.023						.050					-.065
Spouses' age difference	.033	.034 ^a		.334 ^a				.074 ^b			.242 ^a	
Mother's age	.389 ^a		.408 ^a			.392 ^a	.594 ^a		.451 ^a	1.091		.606
Mother's age at marriage	-.156 ^a		-.191 ^a			-.188 ^a	-.744 ^a		-.185		.327	1.070 ^a
Weaned child's age			-.075 ^a			.083 ^a					-.135	
Weaned child is female			-.036									
Mother employed, hours weekly		-.010 ^b			-.008	.008					-.045 ^a	.038
Household help	-.060 ^b	-.035 ^b	-.039 ^b	.074 ^b	-.035	.034			.061	.302		
Family education					.049						.291 ^a	
Constant	6.27	4.57	2.39	6.22	4.30	2.37	8.86	5.64	.90	8.89	2.68	.28
Coefficients of determination	.19	.25	.30	.22	.29	.37	.38	.37	.34	.56	.79	.76
Significant coefficients	11	12	20	11	9	12	4	5	4	0	8	4

^a Significant at 0.05.

^b Significant at 0.10.

duced interviewer and response bias, despite the fact that it was personally administered.

The important data relating to caloric need fulfillment were obtained by "24-hour-recall." This is standard in nutrition surveys (ARC-MRC 1974), but the reliability of these data must be in serious question. Moreover, preexistence of the data precluded reliability testing by either test-retest or alternative forms methods, and none of the variables in the study was derived from a scale of survey items, thus obviating calculation of reliability coefficients such as Cronbach's alpha. Instead, a modified test of internal consistency reliability was utilized in which the sample was divided into odd and even numbered cases to provide "split-half" samples whose means were compared. Similarity of the two sets of means provided good evidence of stability of the original survey, and strengthened external validity or generalizability of the results.

Discriminant results were subjected to a double crossover validation procedure (Frank et al. 1965, p. 254). One half, the "analysis sample," was used to obtain coefficients of discriminant functions and to generate a classification table. These coefficients were then employed to predict group membership for cases in the other half, the "validation sample." The process was then reversed using the function produced by the validation sample to assign analysis cases to groups.⁹ The percentages of cases correctly classified were 71.5 percent and 66.8 percent, respectively, results that are not significantly different from each other, i.e., whose similarity is not likely to be a chance occurrence (at the 0.01 level).

Harnessing the combined power of two models, each

⁹ The author wishes to thank Professor Benny Barak of Rutgers University for suggesting the cross-validation procedure.

with different endogenous criteria and estimated by different multivariate procedures, constitutes a multi-method testing process, somewhat analogous to the Campbell and Fiske device (1959).

On the other hand, statistical validation notwithstanding, pitfalls mentioned earlier may not be lightly dismissed. Household behavior is inextricably linked with an historically specific social structure and culture; it cannot be presented as having universal applicability in terms of time and geography.

A methodological shortcoming in the decision-rule model stems from the dependency of the mode of intrafamily food allocation (the three decision rules) on the percent of total caloric needs met (F), the respective correlations being $r = 0.35, 0.44$, and 0.12 . For example, the functional relationship for the Equality rule is, from Equation 1:

$$DEQU = \left(\sum (Q_i - X_i)^2 \right)^{1/2}, \\ = \left(\sum (M_i N_i - N_i F)^2 \right)^{1/2}.$$

Indeed, one would have expected even greater dependency because, for example, if an Equality family were to increase its food receipts, it would likely allocate according to one of the other two modes. That the correlations are not still higher indicates that other characteristics of the family account for significant variability in food distribution behavior within the home, as discussed earlier in this paper.

DISCUSSION

Summary

This study examined the concept that the basic objectives consumers set for themselves play a role in consumption decision-making processes. In the same vein, objectives of consumption units should plausibly make appropriate criteria upon which to segment target markets. A social marketing approach was employed; concepts were illustrated with a social product, the idea of nutrition improvement intervention in a developing society. The focus of analysis was the household. Data from a nutrition survey in Tamil Nadu, India, were used for empirical demonstration of one possible method for operationalizing consumer decision rules.

A set of three goals was borrowed from the discipline of organizational behavior and was extrapolated to the case of intrafamily food distribution. Corresponding to these objectives, a set of intrafamily food allocation strategies (or decision rules) was postulated in a model that was then fit to the sample data. Significant differences were found between subgroups of the Indian market for nutrition intervention.

In an eclectic model-testing procedure, segment dif-

ferences were verified, first by discriminant analysis on respondents' deviations from the postulated strategies, and then by multiple regression analysis of three nutrition behavior consequences upon a predictor set.

Implications

How would the analytic processes described here have differed if the sample was partitioned on family food distribution per se and not, as in this paper, on food distribution as a proxy for household objectives? The answer is that the processes would be the same, but the interpretations would be different because purposes differed. In the former instance, the segmentation study could examine heterogeneity only with respect to distribution behavior as the *sine qua non* of the study. In the latter case, findings were immediately extended from behavior, upwards through Granger's hierarchy, into decision rules and goals as a way of assessing the validity of the objectives that were postulated at the outset. Here, behavior is merely an intervening variable between consumer objectives and receptivity to nutrition intervention. Behavior is an indicator in the sense prescribed by Blalock (1969) and employed as a proxy, because goals either are too difficult to measure or simply have not been measured—the situation with the Tamil Nadu data. To study a lower order characteristic of the consumer is to take a narrow view of the market, whereas beginning with higher order objectives affords the marketer a broader look at target consumers.

If it were possible to make direct measurements on household objectives or on consumers' choice strategies, then analysis of such data might be useful in attempting to predict behavior. The converse seems also true: observations made on behavior being followed, reveals something about objectives underlying such behavior. Even if the reader adopts the basic idea that objectives make sense as segmentation criteria, still only the tip of the iceberg has been seen. What remains, among other things, is to find ways of operationalizing people's goals.

Segmentation by Objectives: A Methodology

Research into the basic goals of the consumption unit might begin with some device for measuring these goals. One way could be directly, as with self-report items in a survey instrument. Another way is to plan for inferential quantification as suggested in this paper. Either of these two methods provides a new vista for obtaining bases for segmentation, as well as criteria for multivariate analysis of data. What might result from this line of research is the possibility of forecasting purchase behavior merely from an understand-

ing of goals that consumers set (explicitly or implicitly) for themselves. Alternatively, two or more sets of objectives could be hypothesized and modeled, and the rival models could then be tested to find the most robust in terms of internal reliability, goodness-of-fit, or other appropriate barometers.

With regard to nutrition, although the models structured in this study are still a long way from comprising a practical planning device, they can already serve two useful functions. First, they can help both marketers and development planners to understand the structure of the problem of nutrition segmentation planning—the way in which sociodemographics, population structure, scarce resources, and environmental influences are interrelated in determining family nutrition behavior. For example, analysis of measures with potential for increasing families' caloric intake points to a combination of various social and economic programs as offering promise, including activities to increase food production, to increase per capita income growth, to limit family size, and to help develop social infrastructure in such areas as education and water supply. Second, they provide a basic framework around which to develop specific social marketing strategies.

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