Seminar on Consumer Preferences and Market Development for Farm Products

Center for Agricultural and Economic Adjustment, Iowa State College

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Seminar on
CONSUMER PREFERENCES and MARKET DEVELOPMENT for FARM PRODUCTS

Winter Quarter, 1960

Sponsored by
THE CENTER FOR AGRICULTURAL AND ECONOMIC ADJUSTMENT
College of Agriculture
Iowa State University of Science and Technology
Ames, Iowa

CAEA REPORT 5
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FOREWORD

The papers in this publication are those presented in a seminar on consumer preferences and market development for farm and food products. The seminar was sponsored by the Center for Agricultural and Economic Adjustment and was held during the winter quarter of 1960. Seminar membership included mainly staff personnel of Iowa State University. Papers were presented both by staff members of the University and specialists from other research and educational institutions and organizations. The seminar met weekly and included presentation of the papers which follow and their discussion by members of the seminar. The papers were then revised and were published in the form which follows.

Seminar members included persons from several departments at Iowa State University, named by the seminar committee. The seminar committee which planned the program included: Wilbur Maki, chairman, Economics; John Ayres, Dairy and Food Industries; Gordon E. Bivens, Home Management; Darrell Deane, Dairy and Food Industries; John Harp, Sociology; Bob Holdren, Economics; George W. Ladd, Economics; William Kenkel, Sociology; and Lee Kolmer, Economics.

The seminar was developed to summarize existing knowledge and suggest further hypotheses for research and education in respect to consumer preferences and market development for farm products. The income and adjustment problems of American agriculture stem largely from national economic growth and development. Given the level and rate of growth of per capita income in the United States, the demand elasticities for quantity aspects of food in aggregate are extremely low. The demand elasticities for the quality characteristics for food products, including the services which can be incorporated with them, are of much greater magnitude. Hence, to the extent that research, education and developmental activities directed towards farm and food products have farmer and consumer benefit as their focus, increased emphasis on the quality and service aspects of food is important. Historically, major emphasis in research and education for farm products has been on quantity characteristics--obtaining greater crop output from a given land area or a greater livestock output from a given flow of feed resources. However, the income elasticity of demand for food in physical form is approximately zero. As national and per capita income grow further, with continued economic development, the per capita physical intake of food in aggregate is not likely to grow. However, increased per capita consumer expenditures on the quality and service aspects of food can do so. Hence, there is basis for suggesting that income elasticities of demand can serve appropriately in suggesting how, under continued national economic growth, research on farm products should be ordered if gain to consumers is to be maximized and returns to farm producers, reflected through consumer preferences in the market, are to be increased. These criteria would suggest that research and education on the quality-service aspects of farm and food products should be increased relative to that of the quantity aspect.

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This seminar was organized accordingly. It examines demand potentials and research possibilities relating to consumer and family characteristics, product development, advertising and promotion, family incomes, social change, quality identification, market structure and performance and retailing methods. The papers not only summarize some previous findings but also touch upon problems of methodology which may be involved in further research relating to consumer preferences and market development for farm products.

Wilbur Maki, Chairman
Seminar Committee
Earl O. Heady, Director
Center for Agricultural and Economic Adjustment
SUMMARY

CONSUMER PREFERENCES AND MARKET DEVELOPMENT FOR FARM PRODUCTS

The Center for Agricultural and Economic Adjustment sponsored this seminar on Consumer Preferences and Market Development for Farm Products as part of a broader program of activities dealing with agricultural adjustment problems. This seminar was concerned especially with the development of domestic consumer markets for farm products.

The possibilities of expanding the domestic consumption of farm products through industry-wide promotional programs have been discussed in earlier programs sponsored by the Center. In this seminar, a somewhat greater emphasis was placed on understanding consumer and market behavior as a basis for market development programs.

Commodity advertising programs of farmers' cooperatives and industry councils already incur a total cost of $70 million or more. Another $1 billion are spent in private advertising of individual firms in the food industries. If recent experience can serve as a guide, substantial further increases in expenditures for advertising, personal selling and other promotional activities can be expected. Additional expenditures on new product development are related furthermore to the outlays on product promotion. These items are cited to indicate the practical orientation of the topics discussed in this seminar.

Studies on consumer behavior and preferences were discussed by several seminar participants in terms of their implications for market development programs. More than half of the presentations, however, indicated some concern with market structures and the relationship of market structures to both price and non-price performance. Most of the presentations referred to food products. The 11 papers are developed quite systematically beginning with a review of literature on consumer behavior, including several reports of empirical findings on demand and market structure, and concluding with a discussion of the price and demand effects of recent developments in marketing and consumption.

In his presentation, Gordon E. Bivens provides a review of our present knowledge of factors affecting consumer purchases of goods and services. These factors Professor Bivens lists under three main headings: economic, psycho-social and merchandising. Economic factors include income, credit, occupation, number of wage earners, expectations of the future, market structures, price and miscellaneous influences. Of particular interest in market development is the existence of rather sharp differences in the food expenditure patterns among families differentiated on the basis of both income and occupation. Expenditures data for the high income, professional group, for example, suggests that the social and economic requirements of a particular way of life
are satisfied by rising expenditures on entertainment rather than on foods.

Psycho-social characteristics affecting consumer purchases listed by Bivens include the stage in the family life cycle, reference group, resistance to sales pressure and numbers of family members. Finally the review of merchandising techniques includes a discussion of the social importance of advertising.

Victor E. Smith presents a formulation of consumer expenditures in which a consumer attempts to maximize certain consumption goals within the limits of his budget. The utility derived from consumption is shown as a function of the levels of attainment of a set of goals or objectives. Professor Smith relates the fulfillment of these goals to the attributes that comprise the products purchased by consumers, including appearance or convenience of preparation as well as the physical composition of the product. Each goal is shown as a function of the quantity of the various commodities consumed which have attributes that fulfill the specified goal.

Smith has developed a linear programming approach to the study of consumer expenditures. This approach provides a means of integrating the work of psychologists, motivation researchers and institutional students of consumer behavior into the framework of conventional economic theory. Estimates of the functional relationships were derived from consumer and experimental survey data. The specified institutional requirements provide minimum quantities of twelve nutritional elements. These requirements also set a maximum upon caloric content. Other restrictions are specified to take into account various consumer preferences. Together, these relationships and restrictions comprise the goal-achievement functions. The formulation of these functions represents a significant contribution to the methodology of consumer studies and also to institutional management insofar as dieticians are able to use the measures of marginal efficiencies of the added costs or savings by adding or subtracting small quantities of certain foods from the diet.

William F. Kenkel cites certain difficulties when the methodologies of previous research on family decision-making roles and expenditure patterns are studied. Kenkel then sketches the outline of a more adequate study design. Such a design ideally should allow the researcher accurately to ascertain the quantitative and qualitative contributions of the various family members at the different stages of the decision making process. While the research is meager, Kenkel points to some findings indicating that role arrangements in groups affect the outcome of the groups' endeavors. In addition, sociological theory, supported by some research, suggests that family role patterns should vary according to such major and readily measured characteristics as social status, family-life-cycle, rural-urban residence and employ-
ment status of wife. Kenkel concludes that basic research is necessary to determine how much of the variation in family expenditure patterns can be explained by the roles family members take in decision making.

John Harp contends that in order to understand or attempt to understand the behavior of the American consumer, one must view him in his societal context. Harp discusses the major processes of social change, such as industrialization and urbanization and their implications for studies of consumer behavior.

According to Harp, the overview of social change leads to an evaluation of traditional economic assumptions underlying past research on consumer behavior, with special reference to the rationality theory. Early studies of buying motives are discussed and systems of categorization are described and evaluated. The relationship of buying motives to more general value dimensions of society is proposed along with a rationale for the procedure.

In the balance of the paper, Harp cites a research example of the use of an economic typology for categorizing patronage motives. A few solvent findings are offered to illustrate the origin of patronage motives so categorized in social organizations of a membership and non-membership type.

Harp's concluding comments reaffirm the need for a value-system approach to understanding consumer behavior in the market place. Finally, some of the major problems encountered in the research of values are discussed.

John C. Ayres, in a paper on quality identification and control in the food industries, discusses the variations in the determination of quality as influenced by commodity, utility or service. Important food quality attributes discussed by Ayres include convenience, uniformity, size and shape, color, texture or body, absence of defects, performance, utility, keeping quality, wholesomeness, nutritive value and economy. The values and limitations of market surveys and consumer surveys in measuring quality are analyzed. Federal grading of meats is discussed from the grader's, the packer's and the consumer's points of view. Current attitudes regarding quality are cited. Finally, Ayres indicates the role of science in altering the type of quality in demand and stresses problems in communicating with other groups.

Darrell D. Deane illustrates how dairy products offered for sale must meet certain minimum standards relative to composition, wholesomeness and freedom from contamination. The advantages and disadvantages of grade labeling of dairy products also are discussed. The results of consumer preference surveys for a dairy product, such as butter or oleomargarine, indicate that such factors as family size and income, nationality and price differentials are as important as product quality in determining product demand. The dairy industry believes, according to Deane, that product quality is one of the most important factors in increasing demand for dairy
products. Finally Deane points to the vital roles of producer, processor and distributor in maintaining quality in food products.

Varnum D. Ludington sketches the history of the processed cereal industry, then outlines the organization of research and development in the industry. Ludington illustrates how research for new cereal products starts with ideas. Samples are developed and screened by a New Products Committee. Eventually the new products are reduced to a priority list and active development started. According to Ludington, a cereal product must be marketable, technically possible, reducible to mass production and economically feasible.

Development of a product and a process usually takes one to two years. Consumer tests are conducted and a pilot plant for production is built. Then if a market test of the products leads to a positive decision from management a plant for national production is built.

The process cereal business is consumer-oriented, not supplier-oriented, Ludington points out. The entire cereal industry consumes only a fraction of one percent of U. S. annual grain production. Ludington includes some details on economic criteria used to evaluate new products, consumer testing and consumer impressions relative to cereals.

Arval L. Erikson discusses research in the meat packing industry and relates the effects of this research on the demand for livestock and meat. Erikson refers to the variability in livestock marketing and the influence of excess capacity on earnings in the meat packing industry. Also, the general absence of packer identification and effective advertising are cited as restrictions on incentives for demand-inducing research. Thus, the lack of consumer loyalties on about three-fourths of total meats sold without any type of packer identification, together with relatively low capital requirements, means extreme ease of entry into the industry. Excess capacity and ease of entry result in intense price competition and, hence, in relatively low returns to support an expanded program of research and development.

The various areas of research undertaken by firms in the meat packing industry are reviewed. The results of this research are appraised by Erikson. The beneficiaries of this research are cited, namely, the company undertaking the research, the consumer and the producer. Because of the intense competition cited earlier, the private benefits of research are generally rather short lived. Erikson cites the consumer as the chief beneficiary. To the extent that the research is demand-inducing with reference to all meat, however, more resources will be needed to produce the meat or livestock.

Erikson concludes by citing areas in which more economic and technological research are needed. Some of the needed research, particularly in methodology and basic studies, is best performed by public research groups. Rapid progress, however, is being made by the meat packing
industry in cost-reducing techniques.

Willard F. Mueller discusses the impact of recent changes in grocery retailing on consumer choice and market performance. The consumer today has many more alternative brands and items to choose from than he did a decade ago and the modern grocery chain offers a wider choice than the independent food retailer. Grocery suppliers, however, are finding a decreasing number of stores as outlets for their products because of the growing importance of supermarkets. The growing concentration of food retailing in the hands of large chains has forced a decline in the number of food brands and consequently of food processors. In illustrating this battle for shelf space, Mueller refers to the concept of bilateral oligopolistic balance.

Mueller continues his presentation with an evaluation of impacts of changes of market concentration, product differentiation, and barriers to entry on market performance. Though independent retailers still account for a major part of the total sales, they have joined voluntary and cooperative chains in order to achieve some of the advantages of buying and merchandising enjoyed in corporate chains.

The emergence of larger chains also has reduced the traditional ability of many brands to command significant premiums through the development of their own buying and selling procedures. The relative ease with which grocery chains can develop their own brands places them in a unique position of being able to integrate into a wide assortment of grocery manufacturing industries. These chains are thus in a position to hurdle the traditional barriers to entry arising from the ability of manufacturers to differentiate their product.

Mueller concludes that the recent structural developments have improved market performance. These developments, however, have generated some socially undesirable performance characteristics in both retailing and processing. The increasing concentration of grocery sales in local markets has resulted in less price competition and more non-price competition among food retailers. Advertising and other selling costs have increased sharply during the past decade. Expenditures on research in the food industries, however, are only a tenth of the expenditures on advertising—a performance characteristic that in Mueller's judgment is obviously out of balance.

Lee R. Kolmer cites the changes in methods of retail food merchandising growing out of changes in consumer demands for food products and food service which have had an impact upon agricultural processing firms. For example, processors have shifted more to consumer packaged items that are extensively promoted. Also processors are becoming aware of the need for raw material quality control as well as quality control of the finished product.
According to Kolmer, processing operations are becoming increasingly capital intensive as the trend toward highly serviced foods continues. This has resulted as facilities have been relocated in producing areas. These new facilities are highly specialized and are in a better position to cope with widely varying shifts in supply than were the previous terminal-based plants.

Private brands have become increasingly important as the size of retail outlets increases. To counteract this growth, national brand firms have increased promotional efforts and have developed more precise quality control and more streamlined methods of procurement.

These changes have made product procurement more competitive than formerly and at the same time the level of raw material quality and raw material uniformity has become more important. This, Kolmer concludes, will provide additional incentive for larger-sized farm units and increased production efficiency at the farm level.

Two papers were presented on the subject of price and demand effects of recent developments in marketing and consumption. The first paper by Wilbur R. Maki reviews the effects of changes in the structure and organization of agricultural markets on pricing performance in related industries. Maki points to the structural characteristics of agricultural markets generally and livestock markets specifically -- size of establishments and firms, location, degree of product differentiation and the nature and extent of specialization or integration. These characteristics are noted further in a discussion of the size distribution of meat packing plants in Iowa and the United States. Finally, a series of functional relationships are presented which tie the profit accounts of meat packing companies to market prices, orders and deliveries.

The theoretical presentation on pricing behavior of meat packing firms is used in a critical examination of aggregate market performance in the livestock industries. Several proposals to improve the income position of farmers by reducing market costs, improving product quality, maintaining an active market and increasing the degree of control over the entire process of production and distribution are cited with reference to the market-oriented model of individual firm behavior.

George W. Ladd discusses three topics: (1) the relation between consumer income level and income elasticity, (2) the demand for marketing services and (3) the effect of commodity advertising. Under topic (1), Ladd presents alternative Engle curves appropriate for analyzing the relation of income elasticity to income level. A summary of some recent income elasticity estimates for the United States is presented. These results do not show any general tendency for elasticities to decline with rising income. The relationship between consumer income elasticity of demand and derived income elasticity at the farm level is presented. If consumer income elasticity
declines, derived income elasticity need not decline as fast.

Some qualitative considerations relevant to topic (2) are presented. These lead to the hypotheses that income elasticity and price elasticity of demand are greater for food products containing greater proportions of marketing services than for those containing a smaller proportion of services. It is shown that increasing the amount and kind of services, combined with a given amount of farm food product, may increase the derived income and price elasticities at the farm level.

Lastly, Ladd discusses some tentative ideas pertinent to quantifying the effects of farm commodity advertising on demand and farm income.
MEASUREMENT OF PRODUCT ATTRIBUTES RECOGNIZED BY CONSUMERS

Victor E. Smith

"Most commodities render several different kinds of service at the same time. A thing of this kind is to be regarded as a bundle of distinct utilities, tied together by being embodied in a common material object." (1, pp. 228-9.)

In 1899 John Bates Clark suggested that the Austrian principle of final utility was not being correctly applied. We should not regard entire commodities as marginal items of consumption, he asserted, for physical commodities are bundles of utilities or satisfactions of different sorts. Only the least important of the utilities in the bundle is really a part of one's marginal unit of expenditure or consumption.

"...What is the final increment of wealth consumed? It is not complete articles, as such: it is almost entirely composed of utilities of articles...." (1, p. 213.) "...It is final increments of wealth in commodities, and not... commodities in their entirety, that furnish those test measures of utility to which market values conform." (1, pp. 219-20. Italics in the original.)

Every individual utility has a market value, he argued, set by the purchase decisions made by the consumers for whom this utility is marginal. Suppose good I contains utilities A through F and good II contains only utilities A through E. If good I is the more expensive, it will be purchased only if utility F is worth enough to the purchasers for whom it is marginal to justify them in buying this good rather than the cheaper good II. In a similar fashion there is a class of men to whom utility E is marginal, and who will buy good II only if the utility of E is worth as much to them as the extra payment needed to get good II in place of one which contains only utilities A through D. (1, pp. 219-45.)

As for the market value of a commodity as a whole, it is equal to the sum of the market values of its several utilities. (1, p. 229.)

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1/ Journal Paper No. 2564 from the Michigan Agricultural Experiment station. This study was made partly under a fellowship granted by the Ford Foundation. The conclusions, opinions and statements set forth here are those of the author and not necessarily those of the Ford Foundation. I am indebted to Abba Lerner and Clifford Hildreth for helpful criticisms.
Clark would certainly have been skeptical if anyone had suggested that the subjective decomposition of a commodity into its component utilities might someday be approximated in empirical work. Yet the conception of a consumption good as a bundle of different utilities reappears today in the linear programming analysis of human diets. Each commodity is regarded as a bundle of separate goal-satisfying attributes, or utilities, each of which can be marginally valued at a sum equal to the smallest payment necessary in order to obtain an increment in that utility alone. The sum of these values of the component utilities is equal to the price of the commodity for those commodities which are in the optimal diet--those commodities for which price equals the marginal utility, in terms of money, for the hypothetical consumer who chooses a diet such as this. The specific utilities provided by each commodity are, of course, the several nutrients, plus whatever capacities to satisfy specific habit or taste preferences have been attributed to the commodity.

**Goal-Attainment Functions and Preference Theory**

In traditional theory the consumer is presumed to maximize his level of preference or utility subject to his budget restraint. He compares all the combinations of commodities he can afford and selects the combination that has the highest utility for him. Graphically, he moves along his budget line (AB, in Figure I) until he reaches the highest indifference curve attainable (curve II, at point P). This is the analog of the production problem of maximizing the output for a given level of expenditure on inputs. In production theory, however, we often find it convenient to pose the equivalent problem of minimizing the expenditure on inputs for a given level of output. That is, graphically, we move along a curve which shows the different combinations of inputs that can produce a given level of output (curve II in Figure I) until we find the point which corresponds with the lowest expenditure line attainable (AB). The cost minimization problem for a given level of output is equivalent to the output maximization problem for a given level of expenditure.
The economist has been rather unwilling to expound the theory of consumer choice in terms of minimizing expenditures for a given level of utility, even though many a housewife stoutly maintains that her objective is to spend as little as possible. Presumably the economist's reluctance to speak in these terms stems from a feeling that the utility function is best regarded as a vapor­ous, purely conceptual construction with little empirical relevance. Yet there are technical relationships between commodities and the satisfactions derived from their use that are analogous to the technical relationships embodied in the production function. The nutrients contained in an item of food, the speed of a car, the warmth of a sweater, the social acceptability of a picture window are attributes of commodities which help account for the utility which they render.

I suggest that progress might be made in consumption theory by a formulation that makes a place for such information.

Consumption is not a single activity; it is life. Consumption consists of carrying on a variety of activities, most of which involve the use of goods. The utility obtained from a consumption good depends upon the satisfactions received from the activities to which it contributes and the amount of the contribution which that good makes to each of the activities. Let us define the index of utility \( U \) as a single-valued function of the levels of attainment of a set of goals or objectives.
where the bi are variables representing the levels of attainment of each of the i goals which are important to this individual. Let there also be i goal-achievement functions,

\[ b_i = g_i (\lambda_1, \lambda_2, \ldots, \lambda_j, \ldots, \lambda_m), \]

where \( \lambda_j \) is the quantity of the jth commodity consumed. Each of these functions specifies the contribution of each good toward attaining the ith goal. Substituting (2) in (1) we have the utility function of traditional theory,

\[ U = w (\lambda_1, \lambda_2, \ldots, \lambda_n), \]

but any knowledge we possess about those technical attributes of commodities which give them their goal-satisfying powers may be used, while the difficult problem of specifying the nature of the subjective relationships that relate utility to levels of goal-achievement may be distinguished from the problem of comparing commodities with respect to their capacity to aid in achieving specified goals. Perhaps most important, we have a means of integrating the work of psychologists, motivation researchers and institutional students of consumer behavior into the framework of conventional economic theory.

With such a formulation the goal-achievement functions (2) provide the basis for empirical work concerning choices among alternative means of satisfying given goals. If we specify a given level of utility, \( U = U_k \), where \( U_k = f (b_{1k}, b_{2k}, \ldots, b_{mk}) \), the variables \( b_{ik} \) become constants. Each such set of \( b_{ik} \) corresponds to a particular level of utility. (Several such sets may correspond to the same utility level. If \( b_{ik} \), for instance, provides satiation of the ith goal, increases in its value will not alter the utility level as long as over-attainment involves no loss of satisfactions).

Having specified the set of attainment levels, \( b_{ik} \), we can use equations (2) to study the problem of economizing within the indifference region where \( U = U_k \).

The diet problem in linear programming is exactly this kind of analysis of the problem of minimizing the cost of attaining specified levels of various objectives, that is, if the list of goals is complete, a specified level of preference. Consider a case in which there are two commodities and three nutritional goals to be attained at specified levels. In Figure II, OA represents the quantity of commodity I needed if the specified Caloric level is to be attained by consumption of I alone; OB, is the quantity of commodity B required for this purpose if only II is to be consumed. If
less of I is taken, the deficiency in calories may be made up by adding II, at a constant rate determined by the ratio of the caloric contents of the two commodities. The slope of the line AB measures this substitution ratio. Any combination of foods I and II plotted along line AB will satisfy the caloric requirement. Similarly, the thiamine level desired (b2k) can be attained by any combination of foods along line CD, and the riboflavin level (b3k) by any combination of foods along line EF.

![Figure II](image)

If the utility obtained from one nutritional element is independent of the quantity of other elements present, any point along AB represents a given level of utility obtained from calories, any point along CD represents a given level of utility from thiamin, and any point along EF represents a given level of utility from riboflavin. The conventional programming requirement that each of these three levels be equalled or exceeded rules out any possibility of substituting one goal for another—that is, of replacing deficiencies in one nutrient by excesses of another. Thus the only acceptable points, taking all three goals into account, are those on or above AGHF, in the shaded region. Any
such point provides a level of utility at least equal to \( U_k = U(b_1^k) + U(b_2^k) + U(b_3^k) \). The combinations of foods along AG provide thiamin and riboflavin in excess of the \( b_{i}^k \) levels, but the conventional linear programming procedure regards any such excesses as irrelevant (possessing zero marginal utilities). Thus curve AGHF can be regarded as the lower boundary of an indifference region, within which any combination of commodities is an equally satisfactory means of attaining the specified \( b_{i}^k \) levels of these goals.

The programming problem is to choose the acceptable commodity set which requires the least expenditure. For positive prices of both commodities, the least-cost combination must lie on the curve AGHF, for all other acceptable points involve larger quantities of at least one commodity. Dotted lines \( \Delta, \beta \) and \( \gamma \) in Figure II show the combinations of commodities I and II which can be purchased for dollar expenditures of \( \Delta, \beta \) and \( \gamma \), respectively. It is obvious to the eye that in the figure \( O_{q_1} \) and \( O_{q_1} \) of commodity I and \( O_{q_1} \) of commodity II constitute the least-cost combination. Changes in the prices of the foods, by changing the slopes of \( \delta, \beta, \) and \( \gamma \), may alter the optimal combinations of foods.

Although the standard programming problem states the goals as constants, the simplex method of solution provides information about the effects upon expenditure of changing goals. In Figure III line \( ab \) represents a calorie requirement which has been increased slightly above the level of AB in Figure II. This change requires a small shift in the proportions of the foods to be consumed and a small increase in the minimum expenditure level. (The new expenditure line must lie slightly to the right of \( \gamma \)). The change in the minimum expenditure required is the marginal cost of increasing the level of attainment of the calorie goal. In this figure, raising the riboflavin goal slightly, to \( ef \), has no effect upon the cost of the diet; the marginal cost of expanding the level of attainment is zero with respect to riboflavin.

Although the programming procedure itself does not provide for comparisons among goals, an experiment can be devised that will accomplish this. Compute minimum cost diets for a comprehensive group of alternative sets of goal-attainment levels and ask a consumer to choose among these diets, telling him what the cost of each diet will be. When the marginal cost of raising an attainment level is positive, choice among diets involving different attainment levels may involve changes in his expenditure. The diet he chooses will embody that set of attainment levels which he finds just worth the extra expenditure required. If all the diets that correspond to small changes in any of these attainment levels have been considered and rejected we can conclude that the marginal utility of each level of goal achievement actually chosen is measured by the extra expenditure voluntarily assumed in order to have the preferred diet rather than an alternative that would have
provided a slightly lower attainment level for that goal. This extra expenditure is computed by the programming procedure in the course of discovering the least-cost combination of goods that will satisfy the attainment levels chosen.

Whenever the marginal cost of raising an attainment level is positive, choice among diets that require equal expenditures involves marginal substitutions among the attainment levels of different goals. When the marginal cost of raising attainment levels is zero for a certain goal, the consumer will choose that diet, from among the various diets available, that satiates his desire for this goal. If higher attainment levels cause no marginal disutility, there may be several such diets, differing only in the levels of attainment of this particular goal. The consumer may choose among these at random or take a mixture of them all, but the attainment level to be used in describing his choice is the lowest of the levels represented by these equally satisfactory and equally economical diets.
I have not actually conducted such an experiment, but I have empirical material which shows the kinds of marginal utility measurements that are possible from an experiment of this sort. Indeed, if we are willing to assume that there is a housewife for whom the solution of my programming model is the diet that would be voluntarily chosen, then the measures I shall present are measures, in money terms, of her marginal utilities for the various goal-attainment levels specified. Of course, no empirical model will be ideal as a representation of consumption goals, objectives and motivations (and this one was developed originally for a different purpose,) but this one will give us examples of what can be done, along with some economic measurements that can be of considerable practical use in the study of consumption.

Ideally, the model to be used for measurements of marginal utilities should both lead to the consumption plan that the subject would choose and be a faithful description of his objectives and motivations. Models embodying different hypotheses can lead to the same consumption plan, but only the one that gives the best representation of motivations and objectives will give relevant measures of marginal utilities. To construct appropriate models we may have to put ourselves in the hands of the psychologists.

But let us assume that there is a housewife whose objectives are nutrition, economy and a modest degree of pleasure in food consumption; that the model used here is an adequate description of the objectives and motivations of this consumer, and that the expenditure and diet which are optimal for this model are chosen by her over all alternatives available at the same or different levels of expenditure.

Obviously these assumptions eliminate many important problems. No person could be expected to choose without error. Prices vary from store to store and from day to day so that no individual is likely to confront a set of prices exactly like the average prices used in the analysis. Moreover, the whole question of how to construct a model that is an adequate description of the motivation and behavior of a person or a group is set to one side, in order to concentrate upon the central problem of the isolation of the specific contributions of each food to whatever objectives may be sought in the model.

**The Model**

Let \( n \) be the number of foods to be considered, \( p_j \) the unit price of commodity \( j \), \( \lambda_j \) the quantity of commodity \( j \) to be purchased, \( b_i \) the quantitative requirement or limit set by the \( i \)th restraint and \( a_{ij} \) the contribution of one unit of commodity \( j \) toward meeting the \( i \)th quantitative requirement, where \( i \) is partitioned into \( h, k \) and \( m \), according as the restriction is a "more-than", "less-than" or "equal to" restraint.
We minimize \( \sum \rho_j \lambda_j \) \((j = 1, 2, \ldots, n)\) subject to

\[
(5) \quad \lambda_j \geq 0
\]

and \((6a)\)

\[
\sum_j a_{hj} \lambda_j \geq b_h \quad (h = 1, 2, \ldots, 12)
\]

\[(6b)\]

\[
\sum_j a_{kj} \lambda_j \leq b_k \quad (k = 13, 14, 15, \ldots, 19)
\]

\[(6c)\]

\[
\sum_j a_{mj} \lambda_j = b_m \quad (m = 20, 21, 22, 23)
\]

\[(6d)\]

\[
\sum_j a_{kj} \lambda_j \leq b_k \quad (k = 30, 31, \ldots, 57)
\]

\[(6e)\]

\[
\sum_j a_{kj} \lambda_j \geq b_h \quad (h = 58, 59, \ldots, 98)
\]

The nutritional requirements provide minimum quantities of twelve nutritive elements and set a maximum upon caloric content. The complementarity restrictions take account of some of the more obvious preferences for joint consumption, such as butter for bread, dressings for salads, cooking and baking ingredients to accompany flour and meat sauces for meats. Restrictions \((6c)\) provide coffee and condiments in specified amounts. The maximum consumption limits on certain foods imply a desire to avoid surfeit or monotony; the minimum consumption requirements for specific foods or types of foods imply the existence of specific taste preferences for these items. 

These restraints, \((6a)\) through \((6e)\), are the goal-achievement functions. They specify the goals which matter to this housewife. The \(b_i\) give the achievement levels which are attained by her chosen diet.

Since the solution of this model is presumed to be the diet which the housewife voluntarily chooses in the light of the expenditures required for this and other diets, we can apply the reasoning of traditional utility theory and conclude that if she buys three pounds of picnic ham, this implies that she believes the marginal utility of a pound picnic ham to be no less than the utility of the money given for it.

\(1/\) I omit a statement of mathematical complications created by the fact that restrictions \((6b)\) do not apply to the minimum quantities of certain commodities which are required by restraints \(h = 73, 74, \ldots, 98\). For more detail concerning the model see \([4]\).
We may take the price per pound as a measure of the marginal utility, in equilibrium, of any commodity freely purchased. 2

Because we have a linear programming model of this diet we can go farther, and measure the avoidable outlay which has been incurred at the margin in order to achieve each specific goal-attainment level required in the model. The simplex method of solving the programming problem automatically computes the minimum cost of adding one unit to a given goal-attainment level while holding the others constant. The increase is obtained by adjusting the quantities of the various foods in the diet in such a way as to provide the additional unit of the ith attribute without altering the quantity of any other attribute. For instance, 1000 calories can be added to the levels achieved in this diet by increasing the expenditure by 5.6 cents. In a linear model like this the saving to be made by reducing the requirement by one unit will be the same, except possibly where the list of foods in the diet changes when the requirements are changed by such a small amount. Thus 5.6 cents may be taken as a measure of the expenditure which this housewife could have avoided by choosing a lower level of calorie attainment. Since she chose to make the expenditure, we may take it as a monetary measure of the marginal utility of calories to this housewife. There are similar measures of equilibrium marginal utilities for each of the goal-satisfying attributes specified in the model.

These evaluations measure the marginal utility of each component utility in pure form, even though no one of the component utilities may exist in pure form. We not only recognize that an ordinary commodity is a bundle of many different utilities, as John Bates Clark told us, but we can isolate the specific utilities and determine what market sacrifice is involved in obtaining a marginal unit of any specific utility. Indeed, the programming analysis also enables us to specify in what physical fashion the housewife can obtain an additional unit of the pure component utility, by making appropriate marginal adjustments in the quantities of the several commodities purchased, but I have not presented this information in this paper.

Mathematically, these evaluations of equilibrium marginal utilities are the solutions to the "dual" of the original programming problem. The dual of the present model is as follows. Choose values of \( \pi_h \), \( \pi_k \) and \( \pi_m \) so as to maximize (7) \( \sum_h \pi_h b_h - \sum_k \pi_k + \sum_m \pi_m b_m \), subject to the constraints

\[
\pi_h \geq 0, \quad \pi_k \geq 0, \quad \pi_m \text{ unrestricted}
\]

subject to the constraints

\[
\sum_j a_{hj} \pi_h - \sum_k a_{kj} \pi_k + \sum_m a_{mj} \pi_m \leq \rho_j
\]

2/ This measure is, of course, identical with the marginal rate of substitution of one pound of the commodity for money.
The mathematical peculiarity of a diet model which describes the objectives of a consumer interested in enjoyment as well as in nutrition and economy is that it is likely to have restraints which consist of both equalities and inequalities. This mixture of restraints requires us to distinguish three sets of \( \pi_i \) [2, 3]. The \( \pi_h \) corresponds to "more-than" inequalities; the \( \pi_k \), which are themselves constrained to be positive but appear in negative terms in the dual problem, correspond to "less-than" inequalities; the \( \pi_m \), which are unrestricted in sign, correspond to equalities.

Each \( \pi_ib_i \) term in the maximand (7) represents an assignment of value to the \( i \)th goal-attainment level by multiplying the level of achievement by the marginal valuation \( (\pi_j) \) assigned to the \( j \)th goal. The problem is to choose such valuations for the several goals as will maximize the sum of the valuations given to the goal-attainment levels, subject to (1) plausible restraints on the signs of these evaluations and (2) a set of restraints which require that the sum of the evaluations of the goal-satisfying powers of a particular commodity shall not exceed its market price. The restraints in set (9) hold as equalities for every commodity included in the optimal diet. For commodities which cannot be included in the optimal diet without adding to its cost, they hold as inequalities. (The goal-satisfying attributes of the commodity are worth less than its price). For commodities which are not in the diet but could be, without adding to its cost, the restraints hold as equalities.

The Empirical Example

A priori information does not tell which of the many utilities desired by a household with a specific pattern of goals will turn out to be scarce in the sense that they cannot be obtained without increasing the cost of the diet. The model assumes that all goals are equally important--taste preferences and consumption habits rank equally with nutritional requirements--but not all goals are equally difficult to satisfy through the market. \( J \) The solution distinguishes between utilities which are present in excess of the quantities required by the stated goal-attainment levels and those which are supplied by the diet in minimum amounts. Those which are present in excess are assigned zero marginal utilities; those which are scarce have positive marginal

---

\( J \) J. B. Clark held that nourishment would logically be bought with a man's first dollar \( [1, \text{p. 215}] \). I do not make that value judgment. Nor does this analysis lead to Clark's belief that only one of the utilities in a given commodity is part of a man's marginal unit of expenditure \( [1, \text{p. 229}] \). Here, several elements may be marginal in the sense that the housewife is evidently willing to make some extra expenditure in order to increase the achievement level for each of a number of different goals.
utility measures. Table I presents these measures for the twelve nutritional elements.

Table I. Marginal Utilities of Nutritional Elements, in Terms of Money

<table>
<thead>
<tr>
<th>Nutritional Element</th>
<th>Nutritional Element</th>
<th>Marginal Utility</th>
<th>Marginal Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>Iron</td>
<td>5.62¢ per 1000 calories</td>
<td>4.82¢ per gram</td>
</tr>
<tr>
<td>Protein</td>
<td>Vitamin A</td>
<td>--</td>
<td>.06¢ per 1000 International Units</td>
</tr>
<tr>
<td>Fat</td>
<td>Thiamin</td>
<td>--</td>
<td>1.04¢ per milligram</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>Riboflavin</td>
<td>--</td>
<td>1.19¢ per milligram</td>
</tr>
<tr>
<td>Calcium</td>
<td>Niacin</td>
<td>2.48¢ per gram</td>
<td>--</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Ascorbic Acid</td>
<td>--</td>
<td>1.50¢ per gram</td>
</tr>
</tbody>
</table>

Protein, fat, carbohydrates, phosphorus and niacin have zero marginal utilities; the household's requirements for these are more than fulfilled when minimum requirements for the scarce nutritional components are met.

Determining the marginal utility of each of the nutritional components of a specific food is simply a matter of multiplying the quantity of the nutrient by its marginal utility. The seven nutrient columns of Table II give the marginal utilities in money of the nutrient content of each food included in the diet. Only nutrients with non-zero marginal utilities are listed.

The marginal valuations of the utilities of the nutritional components of a pound of fresh, homogenized, plain milk, for instance, are 1.7 cents for calories, 1.3 cents for calcium, .9 cents for riboflavin, and .2 cents for thiamin. All nutritional components together have a marginal utility amounting to 4.2 cents per pound of milk.

If we look for commodities of which the calorie component in the whole bundle of utilities is large (in absolute terms) we find that lard and Swiftning lead the list, with calorie utilities valued at 23 cents per pound of commodity. Oleomargarine is next, with a marginal utility of 18 cents per pound attributable to its calorie content, and bacon is fourth, with a marginal utility from calories of 16 cents per pound of bacon.
<table>
<thead>
<tr>
<th>Commodity</th>
<th>Calories</th>
<th>Calcium</th>
<th>Iron</th>
<th>Vitamin A</th>
<th>Thiamin</th>
<th>Riboflavin</th>
<th>Ascorbic Acid</th>
<th>Total Nutrients**</th>
<th>Price of Commodity</th>
<th>Aggregate Utility of Nutrients as Percentage of Price</th>
<th>Quantity of Commodity in the Diet (Lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk-Fresh, Homogenized, Plain</td>
<td>1.7</td>
<td>1.3</td>
<td>.0</td>
<td>.0</td>
<td>.2</td>
<td>.9</td>
<td>.0</td>
<td>4.2</td>
<td>8.2</td>
<td>51.4</td>
<td>75.8</td>
</tr>
<tr>
<td>Ice Cream-Prepackaged</td>
<td>3.3</td>
<td>.9</td>
<td>.0</td>
<td>.1</td>
<td>.1</td>
<td>.6</td>
<td>.0</td>
<td>5.0</td>
<td>26.7</td>
<td>18.8</td>
<td>3.9</td>
</tr>
<tr>
<td>Cheese-Processed American (Velveeta, etc.)</td>
<td>9.4</td>
<td>7.6</td>
<td>.0</td>
<td>.3</td>
<td>1.1</td>
<td>2.2</td>
<td>--</td>
<td>19.6</td>
<td>51.8</td>
<td>37.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Cottage Cheese</td>
<td>2.4</td>
<td>1.1</td>
<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>1.7</td>
<td>--</td>
<td>5.3</td>
<td>27.9</td>
<td>18.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Fats-Oleomargine</td>
<td>18.4</td>
<td>.2</td>
<td>--</td>
<td>.9</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>19.5</td>
<td>24.0</td>
<td>81.1</td>
</tr>
<tr>
<td>Lard</td>
<td>23.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>23.0</td>
<td>18.8</td>
<td>122.4</td>
</tr>
<tr>
<td>Swiftning</td>
<td>23.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>23.0</td>
<td>25.6</td>
<td>89.7</td>
</tr>
<tr>
<td>Oils-Salad Dressing</td>
<td>9.8</td>
<td>.1</td>
<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>.2</td>
<td>--</td>
<td>10.2</td>
<td>28.4</td>
<td>35.9</td>
<td>.8</td>
</tr>
<tr>
<td>Citrus-Oranges, Fresh</td>
<td>.8</td>
<td>.3</td>
<td>.0</td>
<td>.0</td>
<td>.3</td>
<td>.1</td>
<td>.2</td>
<td>1.7</td>
<td>10.8</td>
<td>16.2</td>
<td>5.8</td>
</tr>
<tr>
<td>Orangeade and Orange Base, Canned</td>
<td>5.8</td>
<td>.7</td>
<td>.0</td>
<td>.1</td>
<td>1.7</td>
<td>.4</td>
<td>1.5</td>
<td>10.4</td>
<td>10.4</td>
<td>100.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Other Fruits-Apples, Fresh</td>
<td>1.3</td>
<td>.1</td>
<td>.0</td>
<td>.0</td>
<td>.2</td>
<td>.1</td>
<td>.0</td>
<td>1.7</td>
<td>13.2</td>
<td>13.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Bananas, Fresh</td>
<td>1.5</td>
<td>.1</td>
<td>.0</td>
<td>.1</td>
<td>1.2</td>
<td>.0</td>
<td>.0</td>
<td>2.0</td>
<td>16.2</td>
<td>12.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Green Leafy Vegetables-Cabbage, Fresh</td>
<td>.4</td>
<td>.4</td>
<td>.0</td>
<td>.0</td>
<td>.2</td>
<td>.2</td>
<td>.0</td>
<td>1.5</td>
<td>10.2</td>
<td>14.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Celery, Fresh</td>
<td>.3</td>
<td>.4</td>
<td>.0</td>
<td>--</td>
<td>.2</td>
<td>.1</td>
<td>.2</td>
<td>1.0</td>
<td>22.9</td>
<td>4.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Lettuce, Head, Fresh</td>
<td>.3</td>
<td>.2</td>
<td>.0</td>
<td>.1</td>
<td>.3</td>
<td>.0</td>
<td>.0</td>
<td>1.0</td>
<td>26.9</td>
<td>3.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Green and Yellow Vegetables-Carrots, Fresh</td>
<td>.8</td>
<td>.3</td>
<td>.0</td>
<td>2.4</td>
<td>.2</td>
<td>.2</td>
<td>.0</td>
<td>4.0</td>
<td>16.0</td>
<td>24.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Peas, Soup</td>
<td>2.9</td>
<td>.3</td>
<td>.0</td>
<td>.1</td>
<td>.7</td>
<td>.3</td>
<td>.0</td>
<td>4.3</td>
<td>18.0</td>
<td>24.1</td>
<td>2.7</td>
</tr>
<tr>
<td>All Other Vegetables-Onions, Mature, Dried</td>
<td>1.1</td>
<td>.3</td>
<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>.2</td>
<td>.1</td>
<td>1.8</td>
<td>10.2</td>
<td>17.9</td>
<td>6.0</td>
</tr>
<tr>
<td>Potatoes, Fresh</td>
<td>1.8</td>
<td>.1</td>
<td>.0</td>
<td>.0</td>
<td>.4</td>
<td>.2</td>
<td>.1</td>
<td>2.6</td>
<td>6.0</td>
<td>43.3</td>
<td>18.5</td>
</tr>
<tr>
<td>Tomatoes, Fresh</td>
<td>.5</td>
<td>.1</td>
<td>.0</td>
<td>.3</td>
<td>.2</td>
<td>.2</td>
<td>.1</td>
<td>1.4</td>
<td>34.7</td>
<td>40.3</td>
<td>5.4</td>
</tr>
<tr>
<td>Beef-Ground Beef, Hamburger</td>
<td>8.2</td>
<td>.1</td>
<td>.1</td>
<td>--</td>
<td>.3</td>
<td>.7</td>
<td>--</td>
<td>9.4</td>
<td>42.0</td>
<td>22.4</td>
<td>4.7</td>
</tr>
<tr>
<td>Beef Liver and Baby Beef Liver</td>
<td>3.5</td>
<td>.1</td>
<td>.1</td>
<td>11.5</td>
<td>1.2</td>
<td>17.9</td>
<td>.2</td>
<td>34.6</td>
<td>34.5</td>
<td>100.2</td>
<td>.2</td>
</tr>
<tr>
<td>Chuck Roast (Pot Roast)</td>
<td>5.0</td>
<td>.1</td>
<td>.1</td>
<td>--</td>
<td>.3</td>
<td>.8</td>
<td>--</td>
<td>6.2</td>
<td>48.1</td>
<td>13.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Pork-Bacon</td>
<td>16.1</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>1.8</td>
<td>.6</td>
<td>--</td>
<td>18.7</td>
<td>51.8</td>
<td>36.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Chops</td>
<td>6.1</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>3.0</td>
<td>.8</td>
<td>--</td>
<td>10.1</td>
<td>72.9</td>
<td>13.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Picnic Ham, Cured Butts</td>
<td>7.3</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>3.6</td>
<td>.8</td>
<td>--</td>
<td>11.8</td>
<td>34.1</td>
<td>34.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Pork Liver</td>
<td>3.4</td>
<td>.1</td>
<td>.4</td>
<td>3.7</td>
<td>1.9</td>
<td>16.1</td>
<td>.2</td>
<td>25.8</td>
<td>23.6</td>
<td>109.2</td>
<td>.7</td>
</tr>
<tr>
<td>Sausage</td>
<td>11.5</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>2.0</td>
<td>.9</td>
<td>--</td>
<td>14.5</td>
<td>43.4</td>
<td>33.5</td>
<td>.7</td>
</tr>
<tr>
<td>Other Meat and Meat Mixtures-Weiners and</td>
<td>6.6</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>.8</td>
<td>1.0</td>
<td>--</td>
<td>8.5</td>
<td>53.0</td>
<td>16.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Franks, etc.</td>
<td>5.6</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>.8</td>
<td>1.0</td>
<td>--</td>
<td>7.6</td>
<td>54.7</td>
<td>14.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* An entry of .0 means that the figure was positive, but less than .05. A blank means that no appreciable amount of this nutrient is present.

** May not equal sum of parts because of rounding error.
**TABLE II. (Continued)**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Calories</th>
<th>Calcium</th>
<th>Iron</th>
<th>Vitamin A</th>
<th>Thiamin</th>
<th>Ribo-flavin</th>
<th>Ascorbic Acid</th>
<th>Total Nutrients**</th>
<th>Price of Commodity</th>
<th>Aggregate Utility of Nutrients as Percentage of Price</th>
<th>Quantity of Commodity in the Diet (Lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry-Chicken, Broilers or Fryers, Ready to Cook, Fresh</td>
<td>2.9</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>.3</td>
<td>.7</td>
<td>--</td>
<td>4.0</td>
<td>51.6</td>
<td>7.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Eggs-Extra Large</td>
<td>6.2</td>
<td>.9</td>
<td>.0</td>
<td>.4</td>
<td>.7</td>
<td>2.4</td>
<td>--</td>
<td>10.7</td>
<td>29.4</td>
<td>36.4</td>
<td>8.2</td>
</tr>
<tr>
<td>Fish and Sea Food-Sardines in Sauce, Canned</td>
<td>5.5</td>
<td>4.3</td>
<td>.1</td>
<td>.0</td>
<td>.1</td>
<td>1.5</td>
<td>--</td>
<td>11.4</td>
<td>34.0</td>
<td>33.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Cereal-Oatmeal</td>
<td>9.9</td>
<td>.6</td>
<td>.1</td>
<td>--</td>
<td>2.8</td>
<td>.7</td>
<td>--</td>
<td>14.2</td>
<td>14.2</td>
<td>100.0</td>
<td>1.1</td>
</tr>
<tr>
<td>All Bran, 40% Bran, Krumbles</td>
<td>8.0</td>
<td>1.2</td>
<td>.3</td>
<td>--</td>
<td>1.8</td>
<td>2.5</td>
<td>--</td>
<td>13.7</td>
<td>28.9</td>
<td>47.5</td>
<td>.6</td>
</tr>
<tr>
<td>Shredded Wheat, Wheat Chex</td>
<td>9.2</td>
<td>.5</td>
<td>.1</td>
<td>--</td>
<td>1.0</td>
<td>.6</td>
<td>--</td>
<td>11.3</td>
<td>26.5</td>
<td>42.8</td>
<td>.6</td>
</tr>
<tr>
<td>Wheat Germ Flakes</td>
<td>9.2</td>
<td>.9</td>
<td>.2</td>
<td>--</td>
<td>9.7</td>
<td>4.3</td>
<td>--</td>
<td>24.3</td>
<td>39.5</td>
<td>61.6</td>
<td>.6</td>
</tr>
<tr>
<td>Bread-White, Enriched</td>
<td>7.0</td>
<td>.9</td>
<td>.0</td>
<td>--</td>
<td>.1</td>
<td>--</td>
<td>--</td>
<td>8.1</td>
<td>18.4</td>
<td>44.2</td>
<td>9.0</td>
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<tr>
<td>Crackers, Soda, Others Similar</td>
<td>10.7</td>
<td>.2</td>
<td>.0</td>
<td>--</td>
<td>.3</td>
<td>.2</td>
<td>--</td>
<td>11.5</td>
<td>28.3</td>
<td>40.7</td>
<td>.8</td>
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<tr>
<td>Cake-Loaf, No Frosting</td>
<td>8.3</td>
<td>1.7</td>
<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>.5</td>
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<td>10.7</td>
<td>37.7</td>
<td>28.4</td>
<td>.7</td>
</tr>
<tr>
<td>Cookies-Plain or Sugared</td>
<td>8.2</td>
<td>.3</td>
<td>.0</td>
<td>.0</td>
<td>.7</td>
<td>.7</td>
<td>--</td>
<td>10.0</td>
<td>43.9</td>
<td>22.7</td>
<td>.7</td>
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<tr>
<td>Mixes-Pancake or Waffle Mix, Buckwheat</td>
<td>8.1</td>
<td>5.3</td>
<td>.1</td>
<td>.0</td>
<td>1.7</td>
<td>.6</td>
<td>--</td>
<td>15.8</td>
<td>15.8</td>
<td>100.0</td>
<td>7.6</td>
</tr>
<tr>
<td>Flour-White, Enriched</td>
<td>9.3</td>
<td>.2</td>
<td>.1</td>
<td>.1</td>
<td>.2</td>
<td>--</td>
<td>--</td>
<td>9.9</td>
<td>9.6</td>
<td>103.0</td>
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<tr>
<td>Spaghetti and Macaroni-Bag or Sack, Plain</td>
<td>9.6</td>
<td>.2</td>
<td>.0</td>
<td>.0</td>
<td>.4</td>
<td>.3</td>
<td>--</td>
<td>10.7</td>
<td>20.5</td>
<td>52.0</td>
<td>.9</td>
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<tr>
<td>Hominy</td>
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<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>.6</td>
<td>.2</td>
<td>--</td>
<td>10.2</td>
<td>10.2</td>
<td>100.0</td>
<td>28.5</td>
</tr>
<tr>
<td>Sugar-White or Powdered</td>
<td>9.8</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>9.8</td>
<td>10.0</td>
<td>98.2</td>
<td>7.3</td>
</tr>
<tr>
<td>Brown</td>
<td>9.4</td>
<td>.9</td>
<td>.1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>10.3</td>
<td>13.8</td>
<td>74.9</td>
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<tr>
<td>Candy and Sweets-Other Candy and Sweets</td>
<td>9.7</td>
<td>.5</td>
<td>.0</td>
<td>.0</td>
<td>.1</td>
<td>.5</td>
<td>--</td>
<td>10.9</td>
<td>45.0</td>
<td>24.2</td>
<td>.7</td>
</tr>
<tr>
<td>Prepared Dessert Mixes-Gelatin, Flavored (Jello, Royal, Etc.)</td>
<td>9.7</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>9.7</td>
<td>41.4</td>
<td>23.4</td>
<td>.3</td>
</tr>
<tr>
<td>Nuts and Nut Products-Coconuts in Shell</td>
<td>4.9</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>.2</td>
<td>.0</td>
<td>.0</td>
<td>5.3</td>
<td>33.8</td>
<td>15.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Coffee, Regular</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>90.1</td>
<td>--</td>
<td>--</td>
<td>2.6</td>
</tr>
<tr>
<td>Cooking Aids, Meat Sauces</td>
<td>2.0</td>
<td>.4</td>
<td>.0</td>
<td>.2</td>
<td>.2</td>
<td>.1</td>
<td>.0</td>
<td>3.0</td>
<td>64.4</td>
<td>4.6</td>
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<tr>
<td>Salt</td>
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<td>--</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>6.9</td>
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<td>--</td>
<td>.7</td>
</tr>
<tr>
<td>Spices</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>184.1</td>
<td>--</td>
<td>--</td>
<td>.0</td>
</tr>
<tr>
<td>Pepper</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>169.7</td>
<td>--</td>
<td>--</td>
<td>.0</td>
</tr>
<tr>
<td>Vinegar</td>
<td>.3</td>
<td>.1</td>
<td>.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>.4</td>
<td>14.1</td>
<td>2.9</td>
<td>.5</td>
</tr>
<tr>
<td>Mustard, Prepared</td>
<td>2.0</td>
<td>1.1</td>
<td>.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>3.2</td>
<td>23.5</td>
<td>13.7</td>
<td>.2</td>
</tr>
</tbody>
</table>

** May not equal sum of parts because of rounding error
The commodities with the largest marginal utilities attributable to calcium are processed American cheese, buckwheat pancake and waffle mix and canned sardines in sauce, with marginal utilities valued at 7.6 cents, 5.3 cents and 4.3 cents per pound, respectively. Milk is a poor fifth at 1.3 cents per pound, being outranked by loaf cake (no frosting) at 1.7 cents.

The contribution of iron to the aggregate marginal utility of a pound of the commodity is greatest for pork liver (.39 cents), with bran cereals, wheat germ flakes and beef liver following with marginal utilities attributable to iron of .25 cents, .18 cents, and .14 cents, respectively. Beef liver leads with respect to the marginal utility of its vitamin A content (11.5 cents per pound of liver), with pork liver and fresh carrots following at 3.7 cents and 2.4 cents, respectively.

The utility contributed to wheat germ flakes by their thiamin content is valued at 9.7 cents per pound of commodity; the nearest competitors in utility from thiamin are picnic hams or cured butts (3.6 cents), pork chops (3.0 cents) and oatmeal (2.8 cents).

Only two commodities receive any large part of their marginal utility from their riboflavin content--beef liver and pork liver, which possess riboflavin valued respectively at 18 cents and 16 cents per pound of liver. Only one owes an appreciable portion of its marginal utility to its ascorbic acid content--canned orangeade and orange base, which has 1.5 cents worth of ascorbic acid per pound of the commodity.

It should be noted that the foods with the largest utilities from particular nutrients are not necessarily the principal sources of those nutrients. Clearly the greatest value of nutrient per pound need not correspond to the greatest value of nutrient per dollar where prices vary per pound of commodity. Even the commodities contributing the greatest value of a particular nutrient per dollar may not be the principal sources, partly because their contributions to satisfying other nutrient requirements must also be considered and partly because there are many taste and habit preferences built into the model that must be respected.

Powdered skimmilk, which is not included in the diet, is a cheaper source of calcium than fresh milk, but it will not satisfy the preference requirement for fresh milk. In the case of Vitamin A, the three principal sources are oleomargarine, eggs and milk, providing 66,000, 63,000 and 55,000 International Units respectively, compared with 49,000 units from carrots, 45,000 from pork liver, 38,000 from beef liver and 39,000 from hominy. Yet the vitamin A content of beef liver by itself has a value worth 33 percent of its price, and the vitamin A in pork liver and carrots is worth 15 percent of their prices, while in oleo and eggs the vitamin A is worth only 3.6 percent and 1.5 percent, and in milk and hominy less than 1 percent of their respective prices. Of course economy in providing a single nutrient is no indication of economy in providing the complex of nutrients required in the diet. Eggs are a prin-
cipal source of iron and riboflavin as well as vitamin A; oleo is the third most important source of calories in the diet; milk is a major source of calories, calcium, thiamin and riboflavin; and hominy a major source of calories, iron and thiamin.

The importance of taste and habit preferences is easily illustrated. Canned orangeade and orange base, which contain ascorbic acid worth 14 percent of the price of the commodity, is the principal source of ascorbic acid, but the two next most important sources are commodities present in the diet because the model requires them in deference to conventional habits of consumption: fresh potatoes and fresh oranges. The values of the ascorbic acid content of the last two are only 1.5 percent and 2.25 percent of their respective prices. Even more interesting is lard, the cheapest source of calories in the diet. The value of the calories provided by a pound of lard is 122 percent of its price, largely because a maximum limit on the amount permitted in the diet prevents making full use of it and keeps the marginal utility of calories at a higher level than would be the case if this taste preference were not being observed.

Further evidence of the significance of the habit and taste preferences built into the model is found in the last four columns of the table. The aggregate valuation placed on the utilities provided by the nutrients contained in each food is given in the total nutrient column; the next to the last column of the table expresses this marginally valued utility of the nutrients as a percentage of the total price paid for the commodity. Only eight of the commodities in this diet possess nutrients with sufficient utility at the margin to warrant their consumption in the absence of specific conventional or taste preferences for the commodity. These eight are canned orangeade and orange base, oatmeal, buckwheat pancake or waffle mix, hominy, beef and baby beef liver, pork liver, lard and flour. For the first four of these the marginal utility of the total nutrients is identical with that of the commodity, 100 percent of the price. Pork liver and lard have nutrients worth 109 percent and 122 percent of their prices; maximum limits on their consumption, representing limits on their acceptability as foods, prevent the marginal utilities of their nutrient contents from being driven to equality with their prices. Moreover, pork liver, like beef liver and many meats, is subjected to the requirement that meat sauces be provided in proportion to the quantity of this meat in the diet. This attribute of the consumption of these meats has a small marginal disutility, for the nutrient content of meat sauces amounts to only 5 percent of the price, on the average. In the case of beef liver this marginal disutility is compensated for by the fact that the nutrients in beef liver have a marginal value that exceeds the commodity price by .2 of 1 percent.

Flour, with nutrients worth 103 percent of its price, is subject to a requirement that complementary cooking ingredients be added if its quantity increases further. This prevents it from expanding enough to
drive the value of its nutrient marginal utilities down to equality with its price.

Commodities providing nutrients with very low marginal valuations in comparison with their prices are fresh broiling or frying chickens (with nutrient value equal to 8 percent of the price), meat sauces (5 percent), fresh celery and head lettuce (both 4 percent), and vinegar (3 percent). At the bottom are coffee, salt, pepper and spices, which provide no utility from nutrients. When the nutrients in celery and lettuce are worth only 4 percent of what we pay for the commodities it appears that the current stress on salad greens for good nutrition is not likely to lead to economical nutrition. Even with cabbage, only 15 percent of the price is recouped from the marginal utility of the nutrients.

Most of the commodities in this diet are here because they satisfy some requirement or requirements involving habitual consumption patterns or taste preferences. The marginal values attributed to this capacity are listed in Table III for all commodities which are involved in no more than one of the effective restrictions embodying these conventional consumption preferences. The commodities in this table for which specific preference utilities are zero are those that are not required by any of the preference or habit requirements, but that are present in the diet because utilities provided by their nutrients are exactly worth their prices. These, we have already seen, are canned orangeade and orange base, oatmeal, buckwheat pancake mix and hominy. Where the nutrient utility alone does not warrant purchasing the commodity, the specific preference utility or the capacity to satisfy some other restriction must make up the difference if the item is to be included in an optimal diet. In Table III the commodities with the highest specific preference utilities per pound are high priced items with no nutrients: spices, pepper and coffee. Next come broiling or frying chickens, candy and sweets, plain or sugared cookies and processed American cheese.

Where commodities are involved in more than one of the effective conventional or preference requirements the decomposition of their marginal utilities is carried even further. Lard, in Table IV, has the capacity to satisfy both a minimum requirement for cooking fats and oils and a maximum limit on its own quantity. It has a specific marginal preference utility of 2.6 cents per pound because it will satisfy the cooking fat requirement, but a marginal preference disutility of 6.9 cents per pound because its quantity has reached the maximum limit. That is, the marginal value of its nutrients plus its capacity to satisfy the cooking fat requirement amount to 6.9 cents per pound more than the price of lard, but greater lard consumption would be sufficiently distasteful to prevent the hypothetical household which we are discussing from taking advantage of this opportunity to save. Evidently the specific preference disutility of lard consumption has at least reached equality with the 6.9 cents saving that is possible, but foregone. Pork liver also has a specific marginal preference disutility (fully compensated for by the utility of its nutrients).
Table III. Marginal Utility (in Money) of Capacity to Satisfy Specified Consumption Habits or Taste Preference Requirements (Cents per Pound of Food)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Preference Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk-Fresh, Homogenized, Plain</td>
<td>4.0</td>
</tr>
<tr>
<td>Ice Cream-Prepackaged</td>
<td>21.7</td>
</tr>
<tr>
<td>Cheese-Processed American (Velveeta, etc.)</td>
<td>32.2</td>
</tr>
<tr>
<td>Cheese-Cottage Cheese</td>
<td>22.6</td>
</tr>
<tr>
<td>Fats-Oleomargarine</td>
<td>4.5</td>
</tr>
<tr>
<td>Swiftning</td>
<td>2.6</td>
</tr>
<tr>
<td>Oils-Salad Dressing</td>
<td>18.2</td>
</tr>
<tr>
<td>Citrus-Oranges, Fresh</td>
<td>9.1</td>
</tr>
<tr>
<td>Orangeade and Orange Base, Canned</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Fruits-Apples, Fresh</td>
<td>11.5</td>
</tr>
<tr>
<td>Bananas, Fresh</td>
<td>14.2</td>
</tr>
<tr>
<td>Green Leafy Vegetables-</td>
<td></td>
</tr>
<tr>
<td>Cabbage, Fresh</td>
<td>8.7</td>
</tr>
<tr>
<td>Celery, Fresh</td>
<td>21.9</td>
</tr>
<tr>
<td>Lettuce, Head, Fresh</td>
<td>25.9</td>
</tr>
<tr>
<td>Green and Yellow Vegetables-</td>
<td></td>
</tr>
<tr>
<td>Carrots, Fresh</td>
<td>12.0</td>
</tr>
<tr>
<td>Peas, Soup</td>
<td>13.7</td>
</tr>
<tr>
<td>All Other Vegetables-</td>
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</tr>
<tr>
<td>Onions, Mature, Dried</td>
<td>8.4</td>
</tr>
<tr>
<td>Potatoes, Fresh</td>
<td>3.4</td>
</tr>
<tr>
<td>Tomatoes, Fresh</td>
<td>33.3</td>
</tr>
<tr>
<td>Poultry-Chicken, Broilers or Fryers, Ready to Cook, Fresh</td>
<td>47.6</td>
</tr>
<tr>
<td>Eggs-Extra Large</td>
<td>18.7</td>
</tr>
<tr>
<td>Fish and Sea Food-Sardines in Sauce, Canned</td>
<td></td>
</tr>
<tr>
<td>Cereal-Oatmeal</td>
<td>22.6</td>
</tr>
<tr>
<td>All Bran, 40% Bran, Krumbles</td>
<td></td>
</tr>
<tr>
<td>Shredded Wheat, Wheat Chex</td>
<td>15.2</td>
</tr>
<tr>
<td>Wheat Germ Flakes</td>
<td>15.2</td>
</tr>
<tr>
<td>Bread-White, Enriched</td>
<td>10.3</td>
</tr>
<tr>
<td>Crackers-Soda Others Similar</td>
<td>16.8</td>
</tr>
<tr>
<td>Cake-Loaf, No Frosting</td>
<td>27.0</td>
</tr>
<tr>
<td>Cookies-Plain or Sugared</td>
<td>33.9</td>
</tr>
<tr>
<td>Mixes-Pancake or Waffle Mix, Buckwheat</td>
<td></td>
</tr>
<tr>
<td>Spaghetti and Macaroni-Bag or Sack, Plain</td>
<td>9.8</td>
</tr>
<tr>
<td>Hominy</td>
<td>0.0</td>
</tr>
<tr>
<td>Sugar-Brown</td>
<td>3.5</td>
</tr>
<tr>
<td>Candy and Sweets-Other Candy and Sweets</td>
<td>34.1</td>
</tr>
<tr>
<td>Prepared Dessert Mixes-Gelatin, Flavored (Jello, Royal, etc.)</td>
<td>31.7</td>
</tr>
<tr>
<td>Nuts and Nut Products-Coconuts, in Shell</td>
<td>28.5</td>
</tr>
<tr>
<td>Coffee, Regular</td>
<td>90.1</td>
</tr>
<tr>
<td>Cooking Aids-Salt</td>
<td>6.9</td>
</tr>
<tr>
<td>Spices</td>
<td>184.1</td>
</tr>
<tr>
<td>Pepper</td>
<td>169.7</td>
</tr>
<tr>
<td>Vinegar</td>
<td>13.7</td>
</tr>
<tr>
<td>Mustard, Prepared</td>
<td>20.3</td>
</tr>
</tbody>
</table>
Table IV. Marginal Utility Allocations for Commodities Subject to Maximum Limits or Meat Sauce Restrictions (Cents per Pound of Food)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Preference</th>
<th>Meat Sauce</th>
<th>Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disutility</td>
<td>Requirement</td>
<td>Utility</td>
</tr>
<tr>
<td>Lard</td>
<td>6.9</td>
<td></td>
<td>2.6</td>
</tr>
<tr>
<td>Beef - Ground Beef, Hamburger*</td>
<td></td>
<td>-.1</td>
<td>32.6*</td>
</tr>
<tr>
<td>Beef Liver and Baby Beef</td>
<td></td>
<td>-.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Chuck Roast (Pot Roast)</td>
<td></td>
<td>-.1</td>
<td>41.9</td>
</tr>
<tr>
<td>Pork - Bacon*</td>
<td></td>
<td></td>
<td>33.1*</td>
</tr>
<tr>
<td>Chops*</td>
<td></td>
<td></td>
<td>62.8*</td>
</tr>
<tr>
<td>Picnic Ham, Cured Butts</td>
<td></td>
<td>-.1</td>
<td>22.4</td>
</tr>
<tr>
<td>Pork Liver</td>
<td>2.1</td>
<td>-.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Sausage</td>
<td></td>
<td>-.1</td>
<td>28.9</td>
</tr>
<tr>
<td>Other Meat and Meat Mixtures -</td>
<td></td>
<td></td>
<td>44.5*</td>
</tr>
<tr>
<td>Weiners &amp; Franks, etc.*</td>
<td></td>
<td></td>
<td>47.1*</td>
</tr>
<tr>
<td>Meat Sauces</td>
<td>+61.4</td>
<td></td>
<td>0.0</td>
</tr>
</tbody>
</table>

* The meat sauce requirement does not apply at the level in this diet.
All the remaining commodities in Table IV are involved in the requirement that relates meat sauces to meats. Wherever the requirement applies, it imposes a slight marginal disutility (of .07 cents per pound, to be precise) on the consumption of meat, because every pound of meat purchased requires proportionate amount of the meat sauces in the diet. The starred items are commodities to which the requirement does not apply at the levels actually occurring in the diet. In each case, however, if an additional pound of meat were to be purchased the sauce requirement would apply.

If one were to choose an extra pound of one of these starred meats it would imply that his specific marginal preference for that meat was enough higher than the figures in the table to compensate for the .07 cents worth of additional disutility involved. Only in the case of bacon would this alter the rounded figure given in the table, and then only by one-tenth of a cent. Meat sauces themselves, it may be noted, have a specific marginal utility equivalent to 61.4 cents per pound because of their capacity to satisfy this preference requirement.

The two remaining commodities, enriched white flour and white sugar, are related by another complementarity restriction, only one of several to which flour is subject. None of these restrictions apply to the quantities of flour and sugar which are now in the diet, but all of them would apply if the quantity of either commodity were to expand and six of them have been effective in preventing the quantity of flour from increasing beyond the level at which these restraints come into effect. At the present levels, where complementarity restrictions do not apply, the marginal preference utility for white sugar amounts to .2 cents per pound, while that for white flour is a negative .3 cents per pound (Table V). The negative preference utility figure for flour indicates that the nutrient utilities in a pound of flour are worth .3 cents more than the price paid for it. As with lard and pork liver, the fact that nutrients of this value do not lead to an expansion in flour use reveals that some kind of disutility prevails at the margin. In the case of flour, the disutility implied by the model is not a distaste for large quantities of flour, but a distaste for larger quantities of flour without the six complementary ingredients which are needed in order to make effective use of flour in cooking. The disutility of flour without these complements is at least .3 cents per pound.

The last two columns of Table V show that the marginal utilities of the several non-nutrient want-satisfying or want-creating components of flour and sugar would be under circumstances in which the householder chose to add one pound of flour or sugar to the diet in the most economical way, with the complementarity restrictions holding for the additional pound. Each of the complementarity restrictions is responsible for a component of disutility in the aggregate of utilities which constitute the commodity, flour, for the nutrients included in the complementary commod-
Table V. Marginal Utility (in Money) of Capacity to Satisfy Complementarity Restrictions and Minimum Requirements Relating to Flour and Sugar (Cents per Pound of Food)

<table>
<thead>
<tr>
<th>Complementarity Restrictions</th>
<th>Complementarity Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do Not Apply</td>
</tr>
<tr>
<td></td>
<td>Flour-White, Sugar-White</td>
</tr>
<tr>
<td></td>
<td>Enriched or Powdered</td>
</tr>
<tr>
<td>White or Powdered Sugar</td>
<td>-.2</td>
</tr>
<tr>
<td>to Cake and White Flours</td>
<td></td>
</tr>
<tr>
<td>Baking Chocolate</td>
<td>-1.1</td>
</tr>
<tr>
<td>to Cake and White Flours</td>
<td></td>
</tr>
<tr>
<td>Yeast to Bread Flours</td>
<td>-.2</td>
</tr>
<tr>
<td>Baking Powder to Flour</td>
<td>-.3</td>
</tr>
<tr>
<td>Baking Soda to Flour</td>
<td>-.3</td>
</tr>
<tr>
<td>Extracts to Cake and White</td>
<td>-1.6</td>
</tr>
<tr>
<td>Flours</td>
<td></td>
</tr>
<tr>
<td>Minimum Quantity Requirement</td>
<td>-.3</td>
</tr>
<tr>
<td></td>
<td>+3.4</td>
</tr>
</tbody>
</table>
ities required with an extra pound of flour fall short of having utilities equal to their commodity prices. In the aggregate, the disutility attributable to these complementarities has a marginal value of 3.7 cents per pound of flour. The decision to buy flour under these conditions implies a specific preference utility for flour (or for the foods to be produced with the whole set of complements) amounting to 3.4 cents per pound. (The flour itself has nutrients possessing marginal utility worth .3 cents per pound more than the price of the flour.)

The decision to buy an extra pound of sugar implies no specific marginal preference for sugar if the flour-sugar restraint is effective and applied; the marginal utility of .2 cents per pound attributed to its capacity to satisfy this restraint, plus its marginal utility of 9.8 cents per pound as a source of nutrients, exactly equals the price of sugar.

We are often curious about commodities not in the diet. Table VI gives us the aggregate utility of nutrients as a percentage of price for a selected list of such commodities, together with the net marginal cost of adding one pound of the commodity to the diet in the most economical way--by making such substitutions for other commodities as will still meet the requirements of the model. There are some very economical foods outside the diet: powdered skim milk, vegetable shortening, dried navy beans, graham flour and corn meal all provide nutrients worth more than 85 percent of their prices. Yet introducing them would raise the cost of the diet, because the commodities they would replace are even more economical. Some apparently desirable substitutions are ruled out by the taste and habit preferences built into the model. For instance, fresh milk, though its nutrients are worth only 51 percent of its price, cannot be replaced by powdered skim milk because the taste preferences included in the model require that the diet contain 76 pounds of fresh milk. If powdered skim milk is introduced, it will have to be at the expense of other commodities.

The net marginal cost of adding one of the excluded foods to the diet can be interpreted as the measure of what the specific preference utility for that food would have to be before the housewife would decide to add some of this food instead of portions of foods already in the diet, but not at the minimum levels set for specific foods. Reducing her minimum requirements for specific foods that are close nutritional substitutes might have a great effect on these net marginal cost figures.

1/ Assuming that this addition is possible without forcing any commodity now in the diet entirely out of it.
Table VI. Selected List of Commodities Not in the Optimal Diet

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Price (Cents per Pound)</th>
<th>Aggregate Utility of Nutrients as Percentage of Price</th>
<th>Net Marginal Cost of Adding one Pound to the Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>14.6</td>
<td>58.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Evaporated, Unsweetened</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condensed, Sweetened</td>
<td>33.0</td>
<td>41.6</td>
<td>19.3</td>
</tr>
<tr>
<td>Powdered Skim Milk</td>
<td>41.2</td>
<td>87.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Cheese</td>
<td>59.4</td>
<td>35.5</td>
<td>6.2</td>
</tr>
<tr>
<td>Natural American (Cheddar, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butter</td>
<td>64.8</td>
<td>30.0</td>
<td>40.8</td>
</tr>
<tr>
<td>Vegetable Shortening</td>
<td>25.7</td>
<td>87.7</td>
<td>.5</td>
</tr>
<tr>
<td>Berries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strawberries, Fresh</td>
<td>31.7</td>
<td>6.6</td>
<td>29.6</td>
</tr>
<tr>
<td>Citrus</td>
<td>9.0</td>
<td>13.4</td>
<td>7.8</td>
</tr>
<tr>
<td>Grapefruit, Fresh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Fruits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cherries, Sour, Canned</td>
<td>24.6</td>
<td>7.4</td>
<td>22.8</td>
</tr>
<tr>
<td>Peaches, Canned</td>
<td>19.2</td>
<td>10.8</td>
<td>17.1</td>
</tr>
<tr>
<td>Green Leafy Vegetables</td>
<td>10.7</td>
<td>13.6</td>
<td>9.2</td>
</tr>
<tr>
<td>Sauerkraut, Canned</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green and Yellow Vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peas, Canned</td>
<td>17.8</td>
<td>17.5</td>
<td>14.7</td>
</tr>
<tr>
<td>All Other Vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans, Navy, White, Baked, Dried</td>
<td>16.9</td>
<td>89.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Tomatoes, Canned</td>
<td>16.3</td>
<td>8.9</td>
<td>14.9</td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corned Beef</td>
<td>60.6</td>
<td>11.8</td>
<td>53.5</td>
</tr>
<tr>
<td>Chipped Beef</td>
<td>157.9</td>
<td>4.8</td>
<td>150.4</td>
</tr>
<tr>
<td>Rib Roast of Beef - Not Boned</td>
<td>50.8</td>
<td>13.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Round and Swiss Steak</td>
<td>66.9</td>
<td>8.3</td>
<td>19.5</td>
</tr>
<tr>
<td>Porterhouse and T-Bone Steak</td>
<td>75.8</td>
<td>10.0</td>
<td>26.3</td>
</tr>
<tr>
<td>Lamb-Mutton: Roast (Leg, etc.)</td>
<td>66.2</td>
<td>10.8</td>
<td>59.1</td>
</tr>
<tr>
<td>Pork: Ham, Whole or Half-Boned</td>
<td>70.4</td>
<td>20.5</td>
<td>33.7</td>
</tr>
<tr>
<td>Veal: Cutlets, Chops, Steaks</td>
<td>72.8</td>
<td>8.2</td>
<td>66.9</td>
</tr>
<tr>
<td>Other Meat and Meat Mixtures: Spam, etc</td>
<td>49.0</td>
<td>20.8</td>
<td>38.9</td>
</tr>
<tr>
<td>Fish and Sea Food</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuna, Canned</td>
<td>75.0</td>
<td>11.1</td>
<td>44.1</td>
</tr>
<tr>
<td>Salmon, Canned</td>
<td>61.6</td>
<td>12.5</td>
<td>31.3</td>
</tr>
<tr>
<td>Lobster, Lobstertail, with Shell, Frozen</td>
<td>103.7</td>
<td>1.3</td>
<td>79.7</td>
</tr>
<tr>
<td>Cereal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheaties</td>
<td>31.9</td>
<td>41.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Corn Flakes</td>
<td>28.4</td>
<td>44.1</td>
<td>.7</td>
</tr>
<tr>
<td>Flour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graham</td>
<td>13.4</td>
<td>88.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Corn Meal</td>
<td>10.5</td>
<td>98.3</td>
<td>.2</td>
</tr>
<tr>
<td>Nuts and Nut Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanuts, in Shell</td>
<td>44.6</td>
<td>27.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Peanut Butter</td>
<td>51.6</td>
<td>32.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Beverages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beer</td>
<td>18.8</td>
<td>8.0</td>
<td>17.3</td>
</tr>
<tr>
<td>Soft Drinks, Bottled</td>
<td>11.9</td>
<td>10.0</td>
<td>10.7</td>
</tr>
</tbody>
</table>
Applications

Many who have no interest in the academic problem of the measurement of equilibrium values of marginal utilities will find these measurements useful in other ways. Whatever one may think of the probability of approximating an individual family's goals and motives at all closely, these are measurements of the marginal sacrifices required in order to meet each specified goal-attainment level. Anyone concerned with rational planning of expenditures needs such information.

The housewife who examines her food habits critically needs to know what she can save by replacing some of the more expensive items or what she would have to spend in order to add something to her menu of which her family is especially fond. Neither question can be answered by knowledge of price and nutrient content alone; only calculations such as these measures of preference utilities can tell her accurately what her net savings or additional expenditures will be. Or consider some of the figures which measure the aggregate utility of nutrients as a percentage of the price (Tables II and VI). We might call these the marginal efficiencies of foods as sources of nutrients. 1/ Few of us are aware how small a fraction of the price of many common foods is accounted for by the worth of the nutrients contained. Nor are we well-informed concerning the comparative merits of various foods. Is it not somewhat surprising that pork chops, with a marginal efficiency of 14 percent are as efficient a source of nutrients as wieners at the margin, and that both are much inferior to picnic hams or cured pork butts (35 percent)? That cottage cheese and prepackaged ice cream have equal efficiencies (19 percent), but are only half as efficient as ordinary processed cheese (38 percent)? Or that cheese has so little advantage over most of the meats in the diet? (The excluded meats generally have lower efficiencies, ranging as low as 5 percent for chipped beef.)

Perhaps the dietician is approximately aware of many of these relationships as a result of extensive experience and trial-and-error computation of low-cost diets. Without a formal model of this sort she can hardly be expected to determine the extent to which these relationships are altered by changes in the pattern of prices or in the nature of the basic diet for which changes are being considered.

1/ Chapter 16 of Clark's Distribution of Wealth is entitled, "How the Marginal Efficiency of Consumers' Wealth Is Measured."
These marginal efficiencies are particularly appropriate because they take account of only those nutrients that are scarce. Nutrients that are adequately supplied without extra cost are ignored. Moreover, the scarce nutrients are weighted according to the marginal costs of providing them, as they should be.

These marginal costs and the marginal efficiencies derived from them will vary in accordance with the diet under consideration. It follows that what is good advice for some consumers may not be good for all. Advice concerning economical nutrition should be based upon diet models that provide diets descriptive of the customary consumption of the people receiving the advice.

Economy may involve economy of time spent in food preparation as well as in dollar expenditures. Particularly for the housewife who works outside the home it may be desirable to base advice upon a diet model which limits or minimizes the amount of time spent in the kitchen.

Institutional feeding -- in prisons, college dormitories and hospitals -- might benefit considerably from the use of diet models that prescribe adequate nutritional standards and minimum levels of conformity to food preferences and habits. Dieticians in such institutions can make direct use of the measures of marginal nutritional efficiencies and of the net added costs or savings caused by adding or subtracting small quantities of certain foods from the diet.
Conclusion

By explicit formulation of goal-achievement functions which permit us to identify specific goals and make use of our knowledge of the attributes of commodities which contribute toward the achievement of these goals, we can extend our understanding of the relationships between goods and the satisfactions obtained from their use. The programming model used in this paper illustrates the kind of marginal evaluations that can be made of the contributions of the several attributes of a variety of goods to the attainment of a specified set of goal-achievement levels. These marginal evaluations are money measures of marginal utilities for the person who voluntarily chooses the solution of the programming model as his preferred consumption pattern; they are measures of the marginal costs of altering the specified set of goal-achievement levels for anyone whose consumption follows that pattern. In the latter interpretation such measures can be useful to those concerned with institutional feeding or with advice to consumers as well as to the student of consumption choices.
References


5. Tucker, A. W., "Dual Systems of Homogenous Linear Relations", in [3], pp. 3-18.
FACTORS AFFECTING CONSUMER PURCHASES OF GOODS AND SERVICES

Gordon E. Bivens

I perceive my purpose to consider some factors which affect purchases of goods and services in a fairly broad sense. This "broad brush" approach may appear to some to be non-sophisticated. However, it appears as we look at the seminar's list of program topics there will be much in the way of detailed and rigorous approach used, so perhaps it is well for us at least to take a broad look before applying the more high-powered lenses to our observations.

Many ideas I shall mention are just that -- ideas in rough form -- unrefined, not polished. I only hope we can open areas of discussion and in the process sort out those ideas which have merit and discard those which do not. A purpose will have been served if some ideas suggest areas of research to some of you, although I make no claim to having developed them to a researchable state, or if certain of these thoughts have implications for you as educators -- either in the extension field or resident teaching.

Some points I will try to outline will be brought forward primarily on logical grounds. Others will be illustrated by data. In cases where data are used, it is of a national nature since farm products move in broad circles, and are not provincial in their outlets in spite of provincial outlooks by some producer groups and others. Further, in clarification of my approach, I am taking primarily a cross section picture; in other words, one still shot from a series of pictures making up a movie strip.

Sources of Information about Consumption

Income and expenditure studies are not new. Starting in other countries, this type of study was undertaken by Gregory King, followed by Davies, Mandeville and Massie. The Le Play school studies and others during the 1800's are well known, as are Engle's works. Thus, although income and expenditure studies are not new, the paucity of expenditure data is striking... Striking in three aspects: (1) Lack of representative samples of the total population. Much of our information pertains only to city wage earner groups. (2) Validity -- questions about recall error and others can always be raised. (3) Consistency over time. Changes in definition of consumer units, expenditure categories, etc. make comparisons over time difficult.

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In the U. S., the earliest broad-scale consumption expenditure study dates back to 1888. This was the first year in which the Bureau of Labor Statistics made a survey of consumer expenditures among city wage earners. Since then, the BLS has continued to make periodic surveys of wage earner groups. The consumer purchases study by the BLS made in 1935-36 included all urbanizations. The more recent survey in 1950, however, included only urban wage earners.

In the case of food, the Survey of Household Food Consumption made by the U. S. Department of Agriculture in the spring of 1955 solicited information from about 6,000 households. This study was conducted by the USDA through National Analysts, Inc.

More recently, the Life magazine study of 1956, which was national in scope, included all urbanizations, and covered current expenditures for consumer goods. It was made by Alfred Politz Associates for Time, Inc., publishers of Life. This is the most recent nationwide study that has been published. In addition, of course, local studies are available.1/

Wants of Consumers

Wants can be classified in many ways. Dr. Hoyt has classified wants of consumers according to primary types of interests in which she includes sensory interests such as satisfaction of the human being insofar as food, drink, warmth and shelter, contacts of sex and exercise of body are concerned.2/ In addition, she includes social contacts as a primary interest -- pleasure stemming from contacts with other humans.

Secondary types of interests in Dr. Hoyt's classification include intellectual, technological, aesthetic and empathetic pursuits. In addition to these -- primary and secondary interests -- Dr. Hoyt indicates the desire for social approval as a strong and driving force in human behavior which affects consumption.


Gordon has classified wants as individual and social, or group wants. Individual wants include desire for:
1. Food and drink;
2. Shelter;
3. Clothing;
4. Health;
5. Opposite sex and love of children;
6. Contact with others;
7. Satisfaction of curiosity, manipulative and constructive tendencies;
8. Play, sport, and adventure.

Social wants are Gordon's second main category. These are more broadly defined than individual wants but may overlap individual wants. Certainly they would have their roots in terms of what individuals want, but have their expression in terms of group contacts. One of these social wants is an ability to communicate thoughts; in other words, a desire for language... an ability to communicate, not to live within oneself, but an ability to exchange and share ideas. Another social want is the desire to recognize some form of superhuman power, or religion. A third social want in Gordon's scheme is a desire for a governing body to assure equity and law; thus a want for government. Fourth, a recognition and appreciation of beauty. Whether this is a social want or an individual want could be debated, I believe, but he includes it here. Fifth, the want for stimulants and sedatives. Again, this often would have its roots in individuals' characteristics, but, to quite an extent, it is intensified by group interaction.

Cochrane and Bell have classified wants into two main classifications also.

I. Individual requirements. In this category, they include:
   A) Food;
   B) Protection against elements; for instance, shelter and body covering;
   C) Sex and family;
   D) Community and social activities.

Cochrane and Bell classify social or group-created wants according to the form of behavior which results:
   A) Custom-made wants: Those wants which are more-or-less accepted or forced upon the individual by social control -- in other words, the power of custom forcing acceptance of certain wants consciously or not. This results in a degree of conformity.

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B) Conspicuous consumption: First labeled by Veblen in "The Theory of the Leisure Class," this is consumption for the purpose of show. In other words, it is the consumption of goods which others probably cannot have or at least very few could have. It takes the form either of goods or services -- at any rate, it is for the effect that it has in setting apart from others the person who is indulging in it. At an earlier time, one expression of it was large and expensive houses. Currently, foreign travel may be an illustration; in other cases, entertainment on a lavish scale, although this may also be encouraged by quirks in our income tax laws and practices relative to business expense accounts. Sometimes hubbub surrounding weddings, anniversary celebrations and burial practices could be pointed to as conspicuous consumption.

C) Fashion-made wants: Those wants made by fashion. It is here that styles and changes of styles have their real effect. Clothing fashions, of course, run in short cycles. Changes in models of cars and major appliances also are examples of fashion-made wants. It is fashionable to have what is the latest, or near latest. I'd like to interpose here that fashions and changing fashions are not new phenomena -- Sacchetti in the 14th Century wrote:

"For whoever liveth but one day in this world changeth his fashion a thousand times; each one seeketh liberty and yet depriveth himself of it. The Lord created our feet free, yet many persons are unable to walk on account of the long points of their shoes. He created legs with joints, but many have so stiffened them with strings and laces that they can scarcely sit down; their bodies are drawn in tightly, their arms are burdened with a train of cloth, their necks are squeezed into their hoods and their heads into a sort of night cap whereby all day they feel as though their heads were being sawn off. Truly there would be no end to describing the women's attire considering the extravagance of their dress from their feet up to their heads, and how every day they are up on the roofs, some curling their hair, some soothing it, and some bleaching it so that often they die of the colds they catch..."
Therefore, fashions are not of a recent origin, but have been with us a long time and have been raising some questions in our minds as to the rationale surrounding them.

D) Imitative consumption: The tendency to imitate others we admire. This takes the form of copying ideas relative to food, clothing and other items. Who hasn't heard, "This is such a good dish, dear, may I have your recipe?" Such tendencies are not women's exclusively, of course. They have many, many ramifications in the desires of all people. And, of course, advertising relies a great deal on the tendency to imitate in consumption by bringing to mind testimonials of well known personages and suggesting you can be like this person.

E) Producer-made wants: Advertising and technological advance. Advertising may bring to the surface wants which heretofore have been only an undercurrent. To that extent, we might call them producer-made wants.

Arguments in favor of advertising and against it are legion. Favorable aspects of advertising commonly put forward are: 1) Information it provides concerning availability of goods, prices, etc., 2) More effective competition if this information is used, and 3) Large scale production is made feasible by increasing sales, and some of these economies may be passed on to consumers. On the other end of the scale, disadvantages of advertising are pointed out: 1) That most advertising is wasteful since much of it provides little information and probably does not result in greater competition among firms in the industry. Instead, it simply tries to build up brand loyalties and to expand shares of the market for certain groups within the industry, and 2) On ethical grounds, from a social point of view, it sometimes is argued advertising has an ill effect upon values and exploits and commercializes personal situations and relationships.

Technological advances also are considered by Cochrane and Bell to result in producer-made wants. For example, how badly would we want to get along without some of the things which have come to be an accepted part of our life at the present time— for instance radio, TV, hot running water, inside plumbing and others? These of course have their hand-maidens in advertising, emulative consumption and other aspects of group-made wants already mentioned.
But the point is that these may be a tremendously effective weapon influencing human wants and, in turn, affect consumers' choices among goods and services.

Regardless of how wants are classified, they have their moorings in basic and slow moving currents. For example, true changes in wants and differences in wants between cultures have their roots in psychology and cultural anthropology most certainly. The important point for agricultural adjustment is what can be done in light of human wants to improve returns to agricultural resources but at the same time not impair -- indeed, enhance, if possible - consumer welfare? And so, we come to the place, it seems to me, where we are in the position to evaluate how these wants affect choices of consumers and postulate some implications for agricultural adjustment.

**Consumer Decision-Making**

Consumers, in making choices among goods and services, have to evaluate what it is that they want. In other words, they have to look at their total complex of wants and apply weightings to them. They have to decide how far they are going to go in satisfying their wants for shelter and protection, how far they are going to go in satisfying their wants for food, their want for contact with social groups, their want to be fashionable and so on, within the limits of their resources. These choices are affected by the relative prices of goods and services. And so, decisions of consumers may have at least three aspects: First, they have to make decisions as to which wants are to be satisfied; secondly, they must decide the degree to which each want is to be satisfied. For example, in the case of food, are they going to ingest 4000 calories a day or 2500 (this is a little too specific, I know); for shelter, are they going to rent a two room apartment, or are they going to buy a seven room house? Third, which combination of goods and services is to be acquired from the whole array available? Here again, if the want for food is to be satisfied to the extent of 2500 calories a day, will it be done by consuming all cereal product, all meat products, (both extremes, of course), combinations of cereal, meat, vegetables, dairy products, and so on?

The competitiveness among various categories of consumer expenditures arises because consumers' resources are limited, particularly money, time and energy. Therefore, they have to make choices; they have to allocate, i.e., give relative priorities among the various categories of wants and then try to match these against what is available. That is, even if consumers recognize clearly their wants relative to consumption goods and services, could they actually recognize from what is available on the market those attributes that would best satisfy their wants for goods and services? The goal is to match consumer wants with the goods and services that are available on the market. Even if a person has decided,
in general, something relative to their wants for food -- for instance, that they want to consume 3000 calories a day and, in general, they are going to derive a certain proportion of them in the form of cereal products, dairy products, meat, vegetables, fruits and fat, they still have the further problem of deciding among all meat items, among all cereal products, among all dairy products, among all vegetables and fruits, the ones which have the attributes most important to them. Even within this overall want -- food -- there are sub-categories of desirabilities they are trying to satisfy with what is available on the market.

Our job today is to consider some factors which affect wants and, thus, purchase of goods and services. Factors such as education, income, occupation, size of family and so on affect either the extensiveness of the want horizon or they affect the intensiveness with which certain of these wants are felt. Therefore, perhaps we had better take a look at some of these classification factors to see as best we can whether or not they appear to be influential in affecting choices of consumers.

Very broadly I would like to use these classifications: economic, psycho-social and merchandising.

**Economic**

Under economic factors I will consider factors such as income, price, credit and market structure.

**Income.** Obviously the income of a family affects the expression it can give its wants. A family may have a very broad want structure and desire many of the things within it very intensely, but without some income it cannot obtain market goods and services. It can obtain some of those things that are either free in the sense of being social goods or those which they can make themselves. However, for purposes of our discussion I suppose our interest hinges around market goods and services, therefore income comes into focus as it makes possible the expression of wants for these.

In Table 1, families with incomes under $3,000 and those with $10,000 incomes and greater are contrasted. While some differences in the percentage of total expenditures going to each category are noticeable, the similarity is striking, particularly when it is remembered that extremes of income grouping are being considered. These data come from the 1956 Life survey. The income groupings were formed on the basis of 1955 income and include the earnings of all household members.
Table 1. Percent of Total Expenditure by Expenditure Categories and Income

<table>
<thead>
<tr>
<th>Expenditure Category</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under $3,000</td>
</tr>
<tr>
<td>Food and tobacco</td>
<td>35%</td>
</tr>
<tr>
<td>Clothing</td>
<td>11</td>
</tr>
<tr>
<td>Home Operation</td>
<td>18</td>
</tr>
<tr>
<td>Home Furniture and appliances</td>
<td>7</td>
</tr>
<tr>
<td>Medical and personal care</td>
<td>6</td>
</tr>
<tr>
<td>Automotive</td>
<td>12</td>
</tr>
<tr>
<td>Recreation and other</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: Life Survey of Consumer Expenditures. Time, Inc. 1957

The single most striking difference in Table 1 is expenditures for food and tobacco. Families under three thousand dollars were spending about 35 percent of their income on food and tobacco while those with $10,000 income or more were spending 24 percent on food. This, of course, is a reflection of a phenomenon well recognized: families with higher incomes spend a smaller proportion of their incomes on the "necessities" of life including food. Greater amounts and larger proportions were spent on clothing, home furnishings and appliances, automotive expense and recreation by families having incomes of $10,000 or more.

Credit. Insofar as the institution of credit affects various commodities in a different way, it might be well to consider the possible effect on food. Ready availability of credit for automobiles and other consumer durables may mean that families have tended to extend themselves on these items and have committed more of their future income to those purposes than would have been the case in the absence of credit. Certain areas of their spending where credit is not so readily available -- for instance, food -- may have been restricted compared with what would have prevailed either if credit had not been so easily available on other products, or if credit had been just as easily available on food items. This might be something that would be worth investigation. That is, estimates of the increase in demand for food if credit for food purchases were available easily and was widespread. It might be
that such a step -- implication of credit plans in more food stores -- might offset some of the tendency for families to commit income to other categories of consumer expenditure at the expense of food.

Occupation. Another factor which sometimes is used to help explain expenditures of consumers is occupation. How to classify families according to occupation is becoming increasingly difficult because of the incidence of multi-earner families as well as increased fragmentation of job classifications. However, the usual procedure is to classify the family either according to the male head's occupation or to that occupation which brings in the largest share of the pooled income regardless of who holds the job. The 1956 Life study classified families according to the occupation of the male head of the household.

Using broad occupation categories we can notice in Table 2 differences between non-farm labor and professional people, income constant. Again, though, the income groupings are the extremes so any contrasts that exist are more likely to show. For the group with incomes under $3,000 the more striking contrasts between non-farm labor and professional families seem to be in home operation expenditures. The home operation category included such things as home decoration materials, home fixtures (such as plumbing fixtures, electrical fixtures, etc.), home heating and utilities, housing (including rent or payment on mortgage), communications, basic materials for minor repair and upkeep, garden supplies, fences and gates, domestic and home care including a cleaning woman or laundress, maid, baby sitter, etc. and storage of household operation and improvement. This may help to explain the difference between the families of a professional nature interested in furthering their standing in the community where the housing and operations of the house have importance to them in gaining this foothold perhaps, as compared to the non-farm labor group. Professional families under $3,000, were spending less percentage-wise for food and tobacco, home furnishings and appliances, automotive expenses and recreation. (Differences for home furnishings and appliances and for recreation between the two groups were very minor, however.)

Contrasting families with incomes of $10,000, the professional group was spending less percentage-wise for the very same item -- house operation. On the other hand, families of the non-farm labor group that had achieved this level of income were spending 23 percent on house operation. Recreation and other expenses was the category in which professional people of the $10,000 category exceeded the non-farm labor group the most. This included such items as admissions, sports goods, games and toys, musical or electronic instruments and equipment, photographic equipment, pets and pet equipment and their upkeep, reading materials, recreation dues, rental of recreation equipment, etc. Differences which can be observed between occupational groups may become increasingly important as our occupational structure changes.
Table 2. Percentage Distribution of Consumption Expenditures by Category, by Income, and by Occupation.

<table>
<thead>
<tr>
<th>Expenditure Category</th>
<th>Income and Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under $3,000</td>
</tr>
<tr>
<td></td>
<td>Non-farm Profesional</td>
</tr>
<tr>
<td>Food and Tobacco</td>
<td>36%</td>
</tr>
<tr>
<td>Clothing</td>
<td>10%</td>
</tr>
<tr>
<td>Home Operation</td>
<td>17%</td>
</tr>
<tr>
<td>Home Furnishings and Appliances</td>
<td>7%</td>
</tr>
<tr>
<td>Medical and Personal Care</td>
<td>7%</td>
</tr>
<tr>
<td>Automotive</td>
<td>13%</td>
</tr>
<tr>
<td>Recreation and other</td>
<td>10%</td>
</tr>
</tbody>
</table>

100% 100% 100% 100%


Number of wage earners. Number of wage earners and the persons who are wage earners (that is, the composition of the family working group) probably makes a difference in the expenditure patterns of families. While little data are available, it seems reasonable to expect that where the homemaker works outside the home, additional expenditures may be made for such things as convenience foods, additional appliances to cut energy or time, or both, in homemaking activities. Increases in the amounts spent for clothing, for transportation to work and possibly for baby sitting might be experienced. Certain shifts if more and more married women continue to enter our labor force might be expected.

This increase in the number of married women who work outside the home for money, is not independent of the income classifications. In other words, this trend for more families to have more than one wage earner is one factor in explaining the increase in the number of families in the middle and higher income groups.
Expectations of the future. Family living expenditures will differ according to expectations for the future. For instance, families will differ according to what they expect as an income profile for the rest of their earning careers. If they are optimistic and expect a growth in their income then they may tend to be more willing to commit themselves to a relatively high level of consumption which will affect their spending patterns; that is, they will tend to be more liberal for the above subsistence commodities, less concerned about hedging against emergencies.

The Survey Research Center at the University of Michigan has used expectations in its work and tends to feel they are a useful explanatory variable. However, there are some reservations about expectation data and techniques; I share these concerns. But, on a logical basis it is reasonable to assume that expectations which families have affect ways in which they spend.

Whether large numbers of families tend to shift their feelings about the future enough that general expenditure patterns are affected is probably the important thing so far as total demand for any or all products is concerned.

Market structures. Another factor affecting expenditures for consumer goods and services is the market structures of industries providing these goods and services. For instance, it makes a difference whether an industry is relatively competitive or is relatively void of real competition. This affects the prices at which goods and services are offered and the number of new items which may be coming on the market. For instance, industries which tend to have rather sizeable firms competing within the industry will have a large number of new items, or at least modifications of items, being offered to consumers. This affects the availability of goods and services and affects the purchase decisions of consumers.

If one commodity is offered primarily through an industry that is relatively competitive -- such as agriculture and food products -- as compared to another category of goods which is sold primarily in an industry which is of a less competitive nature -- for instance, automobiles -- then changes in the product, at least in the minds of people (for example, the engineered obsolescence) are much different in the two categories and spending for goods and services in these categories will be affected. For example, if one industry offers goods which are primarily those that can be differentiated from one year to the next as contrasted to food, and if the engineered obsolescence attempted by the one industry is effective and consumers place a high enough priority on up-to-dateness, then their expenditure patterns will be affected favorably toward products of the industry which can engineer obsolescence. Food and others which do not have this "advantage" may suffer.
Also, the structure of the market may affect the quality of the product which is available to consumers. For instance, the industry in which the competition takes place between a relatively large number of strong firms may tend to have more quality improvements than those which are strictly competitive or in which there is very little competition. In other words, those in an intermediate stage of market control may tend to offer more quality improvements to consumers than is true at either of the extremes.

These are rather general, layman-like interpretations of market structures; but at this point, it seems to me we simply have to recognize them. Succeeding seminars are going to deal with certain aspects of these market-structure influences.

**Price.** Price has already been alluded to in discussing market structures. Relative prices of goods and services are an influence in consumer choice making, of course. Prices change over time and bring about shifts in consumption. A classic example is butter and margarine: the price of margarine and butter have been such that consumers were attracted to margarine with the result that margarine consumption has risen while the consumption of butter has dropped. Relative prices, then, of products that serve essentially the same want are extremely important.

In addition, the relative general price changes in any one category of expenditures relative to price changes in other categories are important. For instance, if food prices were to remain stable while prices of other categories rose, there would tend to be a favorable effect on food consumption and total expenditure on food. This, of course, works in the reverse, too.

**Other economic influences.** Many additional economic factors may influence consumer expenditures. Such factors as asset-liability situation, national income growth and shifts in distribution of national income merit consideration. However, time and space do not permit it here.

**Psycho-social Characteristics**

**Stage in family life cycle.** Stage in the family life cycle -- that is, whether the family is in the beginning years of its existence or in the years after children have left home and the couple has retired or at some intermediate stage between these makes a difference in the demands which are made on the financial resources of the family. The family which is just becoming established usually is acquiring an accumulation of the goods that go into operating a household, thus their spending pattern may be different than a family which has accumulated most of these goods. If the latter has enough fortitude to resist obsolescence propaganda, they may have less desire to be spending for items such as appliances, than the younger family.
Education. Rather noticeable differences in expenditure appear when consuming units are classified according to education. Table 3 indicates the

Table 3. Percentage Distribution of Consumption Expenditure by Category, by Income, and by Education.

<table>
<thead>
<tr>
<th>Expenditure Category</th>
<th>Income and Education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under $3,000</td>
</tr>
<tr>
<td></td>
<td>Not Through Grade School</td>
</tr>
<tr>
<td>Food and Tobacco</td>
<td>37% 31%</td>
</tr>
<tr>
<td>Clothing</td>
<td>12 9</td>
</tr>
<tr>
<td>Home Operation</td>
<td>16 24</td>
</tr>
<tr>
<td>Home Furnishings and Appliances</td>
<td>7 7</td>
</tr>
<tr>
<td>Medical - Personal Care</td>
<td>6 5</td>
</tr>
<tr>
<td>Automotive</td>
<td>11 13</td>
</tr>
<tr>
<td>Recreation and other</td>
<td>11 11</td>
</tr>
</tbody>
</table>

Source: Life Survey of Consumer Expenditures. Time, Inc. 1957

percentage of total expenditures by category, by education and income. It is noteworthy perhaps that in both income groupings, expenditure for food and tobacco is a smaller percentage of total consumption expenditures among college-trained people. For instance, for those under $3,000, with college training, 31 percent of the total expenditures were for food as compared to 37 percent for those who did not finish grade school. An increase in home operation is noticeable, too. Twenty-four percent of total expenditures for college-trained people went for this purpose, while 16 percent was for this purpose among the people who had not completed grade school. Consuming units in which the head had finished college spent less proportionately on clothing, medical and personal care, but more on automotive expenses.
Comparing families with $10,000 or more income by education levels, we notice again that the proportion going to food was less for families with college training. Also, they were spending a smaller proportion of their income on clothing, medical and personal care and a higher proportion on home operation, home furnishings and appliances, automotive expenses and recreation.

If this truly is significant, perhaps this is a bad omen for agriculture if the trend toward a higher percentage of our population obtaining college educations continues. This could mean that at higher educational levels, increased awareness of substitution possibilities in meeting basic needs such as food results in lesser expenditures for these categories, thus freeing money for other expenditures.

Reference group. Certainly the way in which a consuming unit sees its position in relation to its peers is important. In fact, the wants alluded to in texts such as Hoyt, Gordon, Cochrane and Bell as well as others, bring out the importance of social pressures. This is not particularly new, and they do not claim it to be. For instance, J. S. Mill writing 100 years ago was cognizant of the trend toward conformity at that time and was alarmed about it. More recently, writers such as Whyte and Reisman have written of conformity and its ramifications, and even more recently Packard has made a play of it in a sensational fashion. Reference group influences cannot be ignored; certainly the goods and services which families consider to be important are affected by the group in which they circulate and operate and have their contacts.

Resistance to sales pressure. Psychological make-up affects the ease with which consumers yield or resist pressures of sales people. This can be a factor affecting expenditure patterns of consuming units.

Persons with rather strong personalities who have assertive natures probably are more resistant to high pressure sales techniques and are able perhaps to keep their spending patterns more in line with their real wants than is true for those who are more malleable in the hands of pressure salesmen.

Numbers of family members. Certainly the number of members which draw upon the pooled resources of the family makes a difference in the way in which families spend. The very fact that there are more mouths to feed makes some difference in the relative importance of various categories of expenditure. This probably is a factor in some of the differences which we have noted previously.
Advertising. To try to explain differences in consumer expenditures without alluding to advertising would be incomplete. Certainly total advertising expenditures measured in dollar terms are important. Direct outlays for advertising run about 12 billion dollars a year, of which 17 to 20 percent is for food. Whether advertising actually can increase sales of products, either the sales of a particular category such as dairy products, or whether it can increase the market share of a particular brand within the category, for example "Dairy X's" share of total dairy sales, is an open question. Some people have severe doubts as to the effectiveness of advertising in expanding total demand for food. 1/

Advertising may have one of two objectives. One, to increase consumption of a given product at the same price. That is, try to drum up business without changing the price. Or, secondly, to increase the share of the market which any particular product has.

As has been indicated, the effects of advertising are not precisely measurable. However, ineffectiveness is not measurable either; it appears this explains why some firms are afraid to shut off their advertising budgets—fear of what might happen, although in continuing it, they are in doubt as to its outcome. So, in a loss minimizing fashion, they continue to advertise feeling that loss of the advertising expenditure is less than losses which might result if it were to be discontinued.

Often linked with advertising are promotional techniques, in-store promotions, and samples coming through the mail which introduce us to new products and therefore may affect our loyalty to those products in the future and possibly affect our expenditure patterns. Much of such efforts serve as confusion elements making it even more difficult to relate attributes which different products have and the satisfactions which consumers can expect from them. In other words, it would seem to me there is an obvious attempt to create confusion and that the identification of elements which will result in satisfaction to the consumer is befogged by most promotional techniques.

Recently, a report of the Royal Commission on price spreads of farm products quoted in the Ottawa Journal, Nov. 30, 1959, indicates: "It seems to us inevitable that, among the large firms in food merchandising, a substantial part of the promotional expenditures must be dissipated in competitive rivalry." If the findings of this Royal Commission study are valid,

and we have no reason to think they are not, and if conditions in the United States are similar to a degree, it would seem reasonable that promotional activity in the form of trading stamp competition, give-away contests and other store gimmicks might well be scrutinized further if efficiencies in agricultural production are to be passed along to the ultimate consumer. As it is now, it appears efficiencies in the production of food products may be offset by the large amount of promotional activity in merchandising channels of these food products.

The broad classifications of factors affecting purchases of consumer goods and durables seem to leave much to be desired in explaining anything like functional relationships between want structures of people and market purchases of goods and services. Factors we have considered may be helpful; however, it may be worthwhile to think of projecting an alternative approach to these. We might think of possible elements that make for desirability of consumer goods and services.

For example, there are the basic physical qualities of the good to be considered. Over and above this, though, consumers desire other elements such as convenience factors. Naturally, convenience factors will not be the same in all cases. One convenience factor in food may be shortening the length of preparation time. A convenience factor in an electric range may be the time controller which allows it to shut itself off. Safety elements may be desired by consumers in products and services they buy. In the case of food, this might be through the maintenance or enhancement of health. It might be the same for clothing; that is, protection from the elements. Safety in the case of an electric range might be in terms of whether it meets certain electrical specifications or the placement of the buttons on the back where children cannot reach them.

Another factor which may be an element in consumers' choice is beauty -- the design, balance, proportion, color combinations, etc. -- either of the package (as in the case of food, for example) or the overall design of the product itself (as in the case of an electric range). We don't know the relative importance of beauty in food products, in relation to beauty in other goods purchased by consumers; nor do we know the relative importance of beauty in food products relative to such elements as price factors, safety factors and convenience factors.

Social acceptance connotations -- in other words, what the social group accepts as the norm of consumption -- probably is another element in consumers' choices. But we don't know much about this, really. We make reference to conformity, emulation, and so on, but do we really know much about how important this factor is in relation to others -- e.g. price, beauty, convenience and safety? I think not. We don't know how important it is relative to other attributes of a given product -- e.g. an electric range -- nor do we know if it's relatively more important in food or in ranges.
Other elements in the total demand for products undoubtedly should be considered. However, the general approach is fairly obvious and it calls for a type of information which is difficult to obtain empirically but might indicate a direction in which we could move. The distance we can go down the road toward getting all the information necessary to quantify these relationships is an open question.

If such information were available, however, the relative importance of these various attributes in different consumer goods and services might be approximated. Cross elasticities of demand for the different attributes in a given product might be estimated, as well as cross elasticities of demand for an attribute which is common to different products. This would allow better predictions of outcomes if selected attributes of a given product were changed, and, presumably should prevent some social waste.

Implications For Agricultural and Economic Adjustment

I assume one of the interests of this group in considering factors affecting purchases of consumer goods and services is how can consumption of food and fiber either be maintained or increased in relation to other goods and services. With regard to food, it appears these possibilities might be thought of:

(1) Increased total consumption of food. This appears to be the professed justification of industry-wide advertising campaigns. That is, it is hoped that consumption of one category of products will be increased. Whether this can be done without decreasing food consumption in another area is an open question. In fact, I would say the answer might very well be in the negative since so many opportunities exist for substitution in food consumption. For example, more cheese, less meat; more broilers, less red meats.

(2) Substitution of food products that use more in the way of agricultural resources. For example, food products of animal origin use more in the way of agricultural resources. If, then, more of these were consumed in place of grains and tubers, returns to agriculture might be enhanced.

It would seem that educational programs aimed at improving consumers' information about goods and services and markets through which these pass might serve these purposes to some extent and might be beneficial to agriculture. For example, if consumers were better able to discriminate between sizes and grades of eggs for particular purposes, returns to agriculture might be improved. But it may be just as important to improve consumers' understandings about the market relative to non-agricultural products. For example, according to experts, aspirin is the same almost regardless of price; therefore, if consumers were alert to this, they would be able to make a saving in this spending category and channel these savings over into other
areas. This isn't a big item but is an example of what might happen in other areas that are more important in total dollars. Certainly consumers need to be alert to availability of identical goods at vastly differing prices so that in allocating scarce money resources, they may be able to satisfy more of their wants to a greater extent. If, by such programs, more spending for agricultural products resulted, then, of course, agriculture would benefit. It does not follow that agriculture would necessarily benefit from such programs. It seems to me, however, agriculture and consumers both stand a greater chance of benefiting if all consumer goods and services are incorporated in consumer information programs than if just food is included since the latter might serve to alert consumers only to ways in which to meet their food needs with products using less in the way of agricultural resources.

Justification

Reasons for our emphasis on increasing or maintaining returns to resources in agriculture and achieving a better balance between resources used in agriculture and other parts of our economy need to be examined occasionally. One justification might be that if consumption of food products relative to other goods and services were raised primarily among the lower end of our consumption range -- e.g. low income consumers -- it is entirely possible that the individuals whose consumption was raised, agriculture, and society all might benefit. Much would depend on how it was achieved, however.

If, however, food consumption were increased over the whole range of consumers, perhaps increasing average calorie intake, it would seem of questionable benefit to consumers even though agriculture might benefit. Of course, calorie intake might not be raised, since substitution among food items might simply achieve a better nutritional balance; in this happy situation, interests of both consumers and agriculture would be served.

In general, selection of courses of action which would have the effect of altering consumption patterns in a fashion favorable to agriculture need to include this criterion: If returns to resources in agriculture are improved and general welfare of society is improved, there is no doubt about the desirability of the action; on the other hand, if agricultural returns are increased while some segments of the general population benefit but others suffer (e.g. calorie intake increased when already in excess), some difficult welfare questions arise. We could argue the answer to this latter question on logical grounds, but getting empirical evidence or even concensus of thought to make societal decisions is difficult. At any rate, it cautions against reckless manipulation of consumers in the market.
RESEARCH IN THE MEAT PACKING INDUSTRY

Arval L. Erikson

In this paper, I would like to:

1. Sketch the types of research with which we will be concerned.
2. Give a brief indication of the nature of the meat packing industry which has a direct bearing on the types and magnitude of research performed.
3. Outline the chief areas where research effort has been directed and the reasons for this, and show the relative importance of research effort in the industry.
4. Consider the strong and weak aspects of the research conducted, i.e., is it properly oriented and balanced.
5. Consider the general effects of research efforts on the demand for livestock and the prices of meat.
6. And finally, give some thoughts on what types of research can be best done by private interests and by public effort.

Obviously, to cover this broad area, my comments on each point may prove quite sketchy. But perhaps points of interest can be more fully developed in our later discussion.

Research covers a wide range of activities and, as generally used, the term "research" is broad enough that we could say that research goes on in almost any part of a company where there are conscious people. The accountant simplifying a form, the industrial engineer modifying a process, the traffic manager laying out new routes, the engineer developing a new machine or a chemist doing basic research on protein, are all researchers. The difficulty of defining and limiting the term "research" complicates the problem of evaluating research even within one's own company. For purposes of this paper, attention will be devoted primarily to research in products, packages and processes in the meat industry and to industry's appraisal of consumers' wants.

To a large extent, scientific investigation in the meat packing industry, as is true of industry generally, tends to be applied on developmental research rather than basic inquiry. Our scientists are more likely to devote their efforts to application of known principles to a specific situation rather than to the development of new basic knowledge. This is not to say that important basic research has not been conducted in the meat packers' laboratories;

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grants have also been made to research institutions which engage in basic investigations. But it is quite apparent that with limits on both budgets and qualified personnel, results which are apt to show up quickly on the profit side of the ledger are more likely to come from the applied than from the basic research type of activity.

The research which we do may be classed for convenience into that designed to affect demand and that which has as its object the reduction of costs. Quite obviously the results of much research is a combination of these two. Research which might result in increasing demand is probably best represented by that designed to improve a product, or create a new product or package. This research is aimed at increasing total dollar margins on a product or developing a new product which will increase the total dollar margins from the processing of a given quantity of raw materials. This might come from the development of a product which will be consumed in greater quantity at the old margin from movement of the same volume of raw materials at a wider margin or some combination of both.

The other general kind of research aimed at reducing costs is illustrated by automation, improved layouts and that multitude of things done to result in a greater output from a given input of labor and capital. Here, as in the case of demand influencing research, the company may elect to sell the same quantity of the lower costing product at a wider margin, or it may decide to lower prices in order to move a greater volume. Usually some combination will result, even though it is recognized that a lowering of the price of a branded item invites competitors of similar products to reduce prices also, and the first company finds that its volume may not increase significantly.

Nature of the Industry

Before proceeding further, it seems in order to very briefly review some of the characteristics of the meat industry which have an important bearing on research. Today the meat industry is a collection of a very large number of firms intensely competitive with one another, both in the purchase of livestock and in the sale of meat. Two of the firms are large, together handling about 28 percent of the livestock; another group of eight firms represents about 18 percent of the livestock capacity. Smaller than these in size is a group of several thousand companies which compete very effectively in regional and local areas.

Most of each year, and at all times in many years, the industry's capacity exceeds the livestock available. This results, in large part, from the seasonal and cyclical fluctuations in livestock production. When livestock is abundant, margins in slaughtering tend to widen, and new capacity is created which becomes a millstone around the neck of the industry when supplies tighten up.
Despite the industry's notable progress in the direction of more processed and branded items, about 70 to 80 percent of total meats are still sold without any type of packer identification which effectively carries over to the consumer. The absence of identification and effective advertising means that over time not even the oldest or the most successful operators have been able to develop consumer loyalty for their fresh meats. This factor restricts the incentive for demand inducing research. The lack of consumer loyalties on such a large proportion of the production, together with relatively low capital requirements, means extreme ease of entry into the industry. The availability of government grading of fresh meats and the acceptance of it by retailers has facilitated selling on the part of new firms and this has been an added factor making for ease of entrance into the meat packing industry and for excess capacity. Many of the smaller firms are non-unionized and have more favorable labor costs than the larger firms. In addition, about one-quarter of the meat output comes from plants not subject to federal inspection.

These characteristics have led to a low income industry. And low income has resulted in limited research budgets. It has resulted, perhaps, in some tardiness in mechanized methods of operations. But low income should not be associated with backwardness. In the handling of fresh meats, the packers' position is much like that of the farmer's. In spite of increased efficiencies in agriculture, low income is still a problem. The individual farmer can do little to differentiate the demand for his own product -- to make the demand more elastic by means of branding or advertising. This is essentially the case with the packers in the sale of fresh meats. The narrow margin on which they operate is the result of intense competition and excess capacity more than lack of progress.

Areas of Research

The packing industry made some noticeable advances in the handling of fresh meat during its early history. The introduction of artificial refrigeration in the late 1800's and improved railroad transportation made it economical to concentrate processing in large packing centers. The concentration facilitated the introduction of mass production techniques.

Early research in fresh meats which resulted in the moving production line, and the gravity system associated with it, were developments with tremendous effects on U. S. industry generally, and they reduced costs sharply in the packing companies. While progress has continued, the more recent efforts in fresh meat research have not been very productive of major results. Most of the changes that have occurred have resulted from improvements in layouts and equipment which have brought economies but little change in the form of fresh meat passing through a packing plant. Recently, one company spent substantial effort in researching frozen
fresh meats, but high quality frozen meats have not caught on with consumers generally. Research in commercial tenderizers and irradiation have received considerable attention without noticeable results. Fresh meats continue to enter the consumer's homes primarily in unfrozen, non-tenderized and non-irradiated form, and any processing developments have generally made the product less desirable or too costly to the consumer. In this regard research in fresh meats is somewhat like research in fluid milk: it has not resulted in a more desired product than the old fresh form.

Another factor has served to hinder technological progress and automation in the handling of fresh meats. Packers purchase animals from several million producers without definite specification as to production. This results in a relatively high degree of non-uniformity of carcasses from which fresh meat is cut and impedes the use of high speed, automatic machinery. It appears that the relatively low degree of integration in livestock production and meat processing may have impeded more spectacular progress in the area of fresh meats.

In the area of processed meats, the packing industry shows a better record in research accomplishments. Here, at least on many of the processed items, the products can be differentiated and labeled with a brand which carries over to the ultimate consumer. Through advertising and a system of maintaining a consistent product, a degree of brand loyalty can be developed among consumers which gives the packer some bargaining power in his sales. The capital and management requirements are generally higher than in the fresh meat area, and consequently "ease of entry" is not as great as in fresh meat. The very nature of the operation offers more opportunities for effective research and for new techniques and operations which lead to increased efficiencies. Processed meats, particularly sausages, because they are mixed from meat cuts, have been more readily adapted to new methods of mass production all the way from the mixing of the meats to the final loading of the packaged products. It has been easier in this field than in the fresh meat area to cut labor costs by use of improved machinery and to obtain more consistent and higher quality processed meats. The ability to differentiate one company's products from another provides a strong incentive to conduct demand-inducing as well as cost-reducing types of research. And, because margins are higher on processed meats, companies who devote a significant part of their efforts to production of these products are better able to afford research.

**Appraising Research in the Meat Packing Industry**

In appraising the research of the industry it is useful to consider the resources devoted to this work. From figures collected by the Bureau of the Census for the National Science Foundation, the expenditures for research and development performance by all industries are placed at about $6 billion for 1956. Of this amount about $58 million or 1 percent was
expended by "food and kindred products." A separate set of data collected by the American Meat Institute Foundation for the same year (1956) and covering 87 meat companies places research expense in the meat packers' laboratories at $9.6 million. Although there are several hundred meat packers in the industry, the 87 in the survey, which presumably covers all the major size companies, probably expend a high proportion of all the funds which the industry puts into formal research. On the other hand, some of the large packers produce a large volume of products other than meat and it can be assumed that much of the research is devoted to these non-meat areas. But taking the figures as presented, it would seem that meat companies in 1956 spent about 16 percent of the research funds expended by "food and kindred products."

\begin{center}
\begin{tabular}{ l r r }
\hline
 & \textbf{1956} & \textbf{1957} \\
\hline
\textbf{All Industries} & $6018$ & $7155$ \\
\textbf{Food and kindred products} & 58 & 68 \\
\textbf{Meat Industry} & 9.6 & -- \\
\hline
\end{tabular}
\end{center}

1/ Research and development funds from census data prepared for National Science Foundation. In addition, in 1957, all industries spent $241$ million for basic research while "food and kindred products" spent $3$ million.

2/ From survey by the American Meat Institute Foundation covering all types of research conducted in the laboratories of 87 meat companies. In addition, these companies spent about $1$ million in support of fellowships, research institutions, etc.

It should be noted in passing that of the $7.2$ billion of total research and development funds spent by all industries in 1957, more than one-half ($3.7$ billion) was derived from the federal government. Very little, if any, of these federal funds went into the food industries.

Another method of looking at the magnitude of research in relative industries, particularly cost reducing research, is to review labor productivity figures, i.e., the physical output per man hour or per employee. This method has distinct limitations. A given industry might show a big increase in labor productivity because of the state of its automation in the selected base period. Also, the products put out by industries change over time. If they
become more complex, more labor might be required for a given physical output even though there has been a substantial amount of successful research. Realizing that these problems do exist, the comparisons still are of interest. Imogene Bright of the U. S. Department of Agriculture has brought together some figures on the output per man hour of product workers in a few agricultural industries.

<table>
<thead>
<tr>
<th>Index of Output Per Production Worker Man-Hour, 1/</th>
<th>Selected Processing Industries, 1947-57</th>
<th>(1947-49 = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Mfg. Industries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat Products</td>
<td></td>
<td></td>
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<tr>
<td>Bakery Products</td>
<td></td>
<td></td>
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<tr>
<td>Dairy Products</td>
<td></td>
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<tr>
<td>Canned &amp; Frozen Foods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar Mill Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1947 .96</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>1948 100</td>
<td>99</td>
<td>98</td>
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<tr>
<td>1949 104</td>
<td>100</td>
<td>103</td>
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<tr>
<td>1950 111</td>
<td>103</td>
<td>105</td>
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<td>1951 110</td>
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<td>106</td>
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<td>1952 113</td>
<td>104</td>
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<td>1953 116</td>
<td>106</td>
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<td>1954 119</td>
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<td>108</td>
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<td>1955 124</td>
<td>114</td>
<td>109</td>
</tr>
<tr>
<td>1956 126</td>
<td>115</td>
<td>111</td>
</tr>
<tr>
<td>1957 129</td>
<td>117</td>
<td>116</td>
</tr>
</tbody>
</table>

1/ Figures for "All Manufacturing" calculated from Federal Reserve Data; All other data from "Trends in Labor Input and Output in Selected Agricultural Processing Industries," Imogene Bright, Agricultural Economics Research, October, 1959.

Whether or not the product mix in the meat industry has shown a stronger trend toward more complex items than the other industries could be determined only by considerable study. As stated above, the meat industry has concentrated its research in the field of processed items, which products result in large amounts of additional labor compared with selling the same raw materials in fresh form.

Still another method of evaluating the extent of research in the meat industry is to look at the spreads in margins from farm to retail.
Marketing Margins - Farm to Retail

<table>
<thead>
<tr>
<th>Year</th>
<th>Beef</th>
<th>Pork</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949</td>
<td>$2.52</td>
<td>$4.80</td>
</tr>
<tr>
<td>1950</td>
<td>2.14</td>
<td>4.44</td>
</tr>
<tr>
<td>1951</td>
<td>2.35</td>
<td>4.66</td>
</tr>
<tr>
<td>1952</td>
<td>2.52</td>
<td>4.73</td>
</tr>
<tr>
<td>1953</td>
<td>2.93</td>
<td>4.69</td>
</tr>
<tr>
<td>1954</td>
<td>2.61</td>
<td>5.04</td>
</tr>
<tr>
<td>1955</td>
<td>2.51</td>
<td>5.67</td>
</tr>
<tr>
<td>1956</td>
<td>2.87</td>
<td>5.41</td>
</tr>
<tr>
<td>1957</td>
<td>2.73</td>
<td>5.58</td>
</tr>
<tr>
<td>1958</td>
<td>2.29</td>
<td>5.68</td>
</tr>
<tr>
<td>1959</td>
<td>2.50 Est.</td>
<td>5.75 Est.</td>
</tr>
</tbody>
</table>

1/ From Marketing and Transportation Situation, U.S. D. A.

It is significant that for beef there has been no significant change in the margins for processing and wholesale marketing during the eleven year period (1949 through 1959), in spite of large increases in labor, supplies and freight costs. Although fresh meat research has not been especially noteworthy in the postwar period, it appears that sufficient efficiencies --- better layouts, better buildings, better working conditions, more attractive incentives, etc. --- to largely offset the increased costs. It cannot be overlooked, however, that some of the apparent progress in beef may be the result of smaller returns in the beef portion of the business.

In the case of pork there have been increases in the margins, even though this is the general area where much of the packing companies' research is concentrated. This, of course, is partially explained by the fact that in the processed meats a great amount of extra services has been provided.

From the above considerations, it seems safe to conclude that research effort in the meat industry has been substantial. While many areas of the operations have not been automated, cost reductions have been sizeable. Work designed to increase the demand for meat has also been important.

**Appraisal of Research Efforts**

For the most part, research in our industry tends to be the cost-reducing rather than the demand-inducing type. This may be due to the fact that the meat industry has not moved into automation as fast as most big industries and there are many opportunities to reduce costs through new layouts and
improved machinery. The rapid rate at which wage costs have advanced in the postwar period has been a strong incentive to substitute capital for labor. At the same time, the industry has made good progress in recent years in setting up work standards which have been productive of more output per employee or per employee hour. In addition, there can usually be more surety that cost-reducing research will produce the results intended than is the case with the demand-influencing work. In most cases of changes of machinery or layouts, physical models can be developed and tested before there have been large outlays of capital. Even the total costs of the research project can be estimated with some degree of reliability and compared with the hoped for savings.

In the case of research of a new product or package to create new demand, it is difficult to ascertain the public reaction without first developing the new product or package and making consumer investigations. Even after initial market research, we cannot be sure that the consumers generally will react the same as those in a tested area. Nor can we be sure how the public generally will react after the newness of a product or package has worn off. In many cases, a new item must be before the public for some time and the demand for it developed through a coordinated sales promotion and advertising campaign before the product catches on. Thus the risk involved in the demand-inducing type of research is usually greater than that experienced in cost-reducing research. Also, as pointed out earlier, with about 80 percent of the pork being produced without brand identification which carries over to the consumer, the incentive for demand inducing research is limited.

Some of the risk involved in either type of research is reduced in the meat industry by the practice of moving in rather small steps. There is a tendency to modify a machine more often than to bring out an entirely new piece of equipment. The industry is not likely to radically change a plant's layout or to move too far from the customary way of constructing its facilities. Usually new products are likely to be very similar to the ones formerly sold. It is easy to add a new item to a line without much increase in product cost and frequently it can be sold along with the general line without too much market research.

While one can speculate that progress would have come faster with more imaginative moves, the increased risks cannot be questioned.

Without attempting to be inclusive, I would like to point out some of the progress which the industry has made in specific areas. In our efforts to affect demand, substantial progress has been made in finding ways to make what were formerly low valued raw materials into highly desired consumer items. While the new products (largely sausage items) compete with other meat products, they also compete effectively with non-meat foods and help increase the total consumption of meat.
Improved packaging has stimulated demand. Perhaps, unfortunately, progress in this research as far as our industry is concerned has been confined to processed meats. Canning, freezing or irradiating fresh meats has not resulted in a more desirable product than meat in fresh form, and the packaging of fresh meats has been largely left to the retailers. Packaging of beef as now done by the retailer in conjunction with self-service has probably been a factor in the strong demand which beef enjoys. In the modern food retailing world, where impersonal self-service dominates, meat must be attractively displayed to compete with progress in this same field in other food items.

The constant additions of new products in the processed meat lines, and improved flavorings which have resulted in part from market research, should also be a stimulus to improved demand. Similarly, the better keeping qualities of meat which result from better sanitation and superior packaging have increased the value of these meats. Our research, which has resulted in more consistent products, has probably been demand-inducing.

In the cost-reducing areas, in addition to the improved layouts, working conditions and machinery mentioned earlier, there have been notable results from the application of mathematical programming to many parts of our business. Some of the larger firms now determine formulation of sausage products by use of electronic data processing equipment. This insures the most efficient use of raw materials, and tends to equate the marginal value of each type available. Some firms also use electronic data processing equipment to evaluate their purchases of livestock. This enables them to compare cut-out values with costs over broad areas and to adjust the buying pattern rather quickly. To the extent that this is done, it insures a rapid correction of high or low priced pockets in the broad areas of livestock markets and makes these markets more competitive in light of the value of the livestock handled in them. Such analysis brings to light more efficient procurement methods. More recently, the use of mathematical programming in the meat industry is being applied to the location of plants and warehouses. It is used in connection with the routing of transportation equipment and in the control of inventories.

There are also areas where research has tended to be weak. As indicated above, the industry has devoted most of its research attention to the 20-30 percent of the total which is in the processed meats. Packers have done little to increase the palatability and acceptability of fresh meats. The low margins existing in this area may be an important factor in the lack of emphasis.

Market research in the industry tends to be done after new products are far along in development because of the difficulty in obtaining much assistance from consumers in what they want in a new product. This is not to say that we are not guided by the results of consumer research. The reverse is
the case. The move toward milder flavored products, greater keeping qualities, more visibility in packages, has been in part the result of consumer investigations. But to a large extent we have been fairly narrow in our research among consumers, investigating primarily reactions to processed items or packages in which the processed items are contained. The meat industry has done relatively little in the broad field of consumer research in fresh meats. Although we have been critical of much of the public research in consumer preferences, we have not attempted to go far in this field with our own research work.

Most of the new products developed have probably been competitive with old ones and have tended to have little effect on increasing the total consumption of meat. This is difficult to measure, but the fact that meat consumption per capita has been rising faster than most other foods for the last two decades can probably be attributed more to reasons such as the rise in real income per capita than to the development of really new meat products. Even the fact that the consumption of processed meats has risen faster than that of fresh meats can not necessarily be attributed entirely to new products or packages.

Beneficiaries of Research

As indicated earlier, industrial research is undertaken primarily to improve the relative position of a company. That is, each company tends to work principally on those projects which it believes will show improved financial results. If the results of research are improved layouts or company-developed machines, or patentable processes and equipment, the company can usually reap some benefits before others develop similar or closely substituteable products and processes. But even the patenting of processes or equipment has a drawback in that the mere act of filing for a patent requires sufficient detail of the operation to enable competitors frequently to devise an article similar enough to be competitive but different enough not to violate the patent. Thus, the rewards of research to the company doing the initial work may be short lived in many instances.

This is not to say that the results of a company's research efforts are always completely lost. A process might be closely duplicated by others without attaining all the cost advantages which accrue to the originator. In this case the latter might enjoy benefits from his research efforts over a long period of time. But in an industry as highly competitive as the meat industry, it seems safe to say that originating companies of new products, processes or machinery hold an advantage for a relatively short period.

To the extent that others are able to move in quickly to share the benefits of a given company's research, the more quickly the rewards of research are passed on to others outside the industry. The chief beneficiary is
usually the consumer. But for the livestock farmers as a group, packer research is vital. Consumers have many outlets for their disposable income. Historically, food expenditures account for about one-fourth of it. In the food line, there are thousands of products competing for this share. It is because of this kind of competition that packers, as processors and manufacturers of meat products, must constantly research new products and new means of packaging and labeling to attract a substantial part of consumers' expenditures.

Another important reason for keeping meat products competitive in the food market is the fact that more resources are required to feed the population at any caloric level with meat than with cereals or other foods. This means that if the consumption of meat is increased by packer research, more farm resources will be needed to produce the basic raw materials, livestock. To the extent that this is accomplished, the pain of adjustment in reducing the farm plant to meet the food and fiber needs of the country is lessened.

Areas for Public Research

Some people, starting from the premise that research in the meat industry has unduly lagged behind other industries and reasoning that stepped up activities in the packing of meat would be beneficial to livestock producers and consumers, have suggested that more public research efforts should be devoted to this industry. It is reasoned also that because the results of public research would be available to all processors, the benefits of the utilization of such research would be passed back to producers or on to consumers more rapidly than is the case where private research is involved.

Undoubtedly, with additional funds and personnel assigned to the task of reducing packinghouse costs and stimulating demand for meat, more progress would be made. But the areas of research work to be done are very broad and research funds and qualified personnel are not unlimited. Some choice has to be made of areas in which to work. There is no assurance that resources now available for public research would yield better returns if devoted in part to problems in the meat packing industry. But it has been quite effectively argued that agricultural producers would be benefited if some of the research resources now being utilized to increase the production of agricultural commodities were devoted to reducing the spread between farm and consumer prices, or to stimulating greater demand for farm products. Such a shift in research, it is pointed out, would result in less urgent adjustments in agriculture. That is, there would be less likelihood of making obsolete certain capital now in agriculture, and would tend to hold more farmers and capital in agriculture.
To the extent that public research in the cost-reducing area resulted in bigger gains than the cost involved, consumers would also be benefited. It is not so clear, however, the extent to which consumers might be benefited from research directed at increasing the demand for meat. With the human stomach quite inflexible, the research might merely shift purchasing power from one set of foods to another, and while one can assume that total satisfaction of consumers might have been increased, we cannot be sure that when all costs are considered, consumers as taxpayers would have gained in total satisfaction.

If there were to be a step-up in the expenditure of public funds in meat and livestock research, what are some logical areas for such work? It would seem that with the rapid progress which is currently being made by the meatpacking industry in cost-reducing techniques, there is probably little room for a public research program in this field. There are, however, some other fields which might prove profitable. Some of these are listed below:

**Economic Research:**
1. Further development of methodology:
   a. Techniques for effective consumer research.
   b. Procedures for measuring the effects of advertising.
   c. Improved techniques for mathematically programming location of facilities, control of inventories, evaluation of operations within the industry and formulation of processed products.
2. Improvement in supply price analysis.
3. Research into what happens in the hog and beef cycles --- who expands production; who cuts back; how can the cycles be smoothed; what are the economic losses from cycles, etc.
4. Overall appraisal of the position of pork. Can it successfully compete with beef and poultry over time?
5. What are the economic implications of the growth of private labeling on the part of retailers.
6. What would be the effects of sale of food on a credit basis.

**Other Research:**
1. Research into improving the nature of fat --- can pork and beef fat be changed so that it may have more of the better qualities associated with the unsaturated fats?
2. Research into color and watery condition of some lean pork.
3. Determination of the factors which make for quality in meat.
4. Production of lean meat which has the desirable qualities of tenderness, juiciness and flavor.
5. Narrowing the range of quality differences in animals.
6. Improvement in artificial insemination in swine.
The title for this discussion is Research and Development, which we at General Foods think of as technical research. However, the outline given to me indicates that the interest is in research in a broader sense -- including technical, engineering, market and economic. My personal experience and present responsibility is in technical research. I have, however, borrowed from my colleagues and am prepared to discuss R&D in the broad sense.

The other qualification that I must make is that I represent a company within an industry -- an industry that is highly competitive and in which there is little exchange of information. I have been assured by the president of the Cereal Institute that my presentation will be representative of the industry. I expect this is true with the possible exception of some details of organizational structure that are unimportant for this discussion.

In a presentation concerning the cereal industry, an historical background is important to the understanding of the industry as it exists; i.e., Battle Creek, Michigan, is the "Cereal Capital" of the world -- there is no economic justification for this situation.

The process cereal industry had its origin with the food faddists and certain religious groups. A series of inventions by individuals in this group provided the products that for the most part still exist today. These include:

- 1829 Sylvester Graham
- 1863 Dr. James C. Jackson
- 1893 Henry D. Perky
- 1895 Dr. John Harvey Kellogg
- 1902 Alexander Anderson

Varnum D. Ludington is research manager, Post Cereals Division, General Foods Corporation.
The Seventh Day Adventists, having food as a part of their religious teaching, established the Western Health Reform Institute in Battle Creek in 1866. Under the dynamic leadership of Dr. John Harvey Kellogg in 1876, this became a health center of the world. Dr. Kellogg exposed his cereal-based products to the sanitarium patients and established a mail-order business to supply them on their return home. The popularity for the sanitarium "treatment" was a result of the widespread dyspepsia caused by poor eating habits.

A former patient, C. W. Post, visualized the commercial possibility of these products and started the commercial production of them by the Postum Cereal Company in 1897. His immediate success (net of $1,000,000 in 1903) attracted others. W. K. Kellogg founded the Battle Creek Toasted Corn Flakes Company -- forerunner of the W. K. Kellogg Company -- in 1906. By 1913, there were 33 cereal companies in Battle Creek, by now a veritable boom-town. Thus, Battle Creek became the "Cereal Capital of the World."

Cereals were thought of as health foods -- not too good -- but good for you. They somehow became associated with breakfast. They were later thought of as energy foods. Then with vitamin fortification, they became one of the basic seven foods and a substantial contributor to the daily diet. They are also the first of the prepackaged convenience foods.

The success of C. W. Post was as much from his creative and imaginative advertising as from his products. He is often called the "father of modern advertising." From their origin, and today, breakfast cereals have been heavily advertised and promoted. This seems to be essential to the maintenance of a present day 7 to 8 lbs. per capita consumption.

Thus, not only was a cereal industry developed, but also an advertising industry and a packaging industry; and not from any economic justification but from the foresight, enthusiasms and energies of some rugged individualists.

Today R&D is in sharp contrast to those early days -- at least it doesn't seem as romantic.

Technical research is organized on a functional basis with groups devoted to product development, process development, package development, technical service and informational or basic research. It carries the development from an idea through a process and package. There is close co-operation with market research, particularly in the initial development stages, and with engineering research in the stages of pilot plant design and construction.
The personnel in technical research are all trained in the physical science disciplines, primarily chemists and chemical engineers, with an occasional refugee from the dairy industry, like myself. The people are also selected for their interest in foods and their ability to take basic information and translate it into products. To be successful, they must become enthusiastic generalists in applied science.

The personnel in market research are trained in social science disciplines. The engineering research people are either mechanical engineers or draftsmen.

In the Post organization, market research is a marketing function, and the engineering group is a function of the manufacturing department.

Technical research takes ideas from wherever they come, and this is primarily from idea generation projects, and produces prototypes -- bench-top samples. These samples are screened by a New Products Committee. Successful samples are then exposed, with or without description statements, to concept studies among consumers by market research. From this work, a product description or specification is evolved in preparation for product development. Last year Post cataloged several hundred "good" ideas, concept-tested 40 ideas, and defined 10 products for development. These were reduced to a priority list and four were selected for active development work. This is where R&D gets its definition sharpened up so as to minimize false starts, misunderstanding and failures.

A product must be marketable, technically possible, reducible to mass production and economically feasible to pass the test. The specifications should include grain type, physical attributes (form, shape, bulk density), nutritional value and any special properties (sugar coating, flavor, additives). The sharper this definition, the simpler the job for R&D, and the quicker the job can be done.

The development of a product and a process usually takes one to two years. It can be very interesting work, and it can be very, very discouraging. As much as a year can pass without making any demonstrable progress. The work can lead one from one field of chemistry to another, or to physics, or nutrition or enzymology. This is what makes the work fascinating to those who work at it, but bewildering to the true basic scientist.

When the product development is nearing completion, consumer tests of the product are run to establish consumer preference in relation to existing products. A product must compare favorably with existing products or return for further development.
Process conditions are partially established during the development stages. However, as soon as a product meets consumer requirements, process work proceeds in earnest. The process specifications are given to the engineering research for design and construction of a pilot plant. It may be a plant to test out the process, if the process is entirely new, or it may be a market test pilot plant for commercial production and market testing.

A completed pilot plant is turned over to R&D for them to operate and determine if it will produce the intended product. They work with engineering on modifications until it will produce, continuously and uniformly, the desired product. When this has been thoroughly demonstrated, it is handed over to manufacturing for operation. Research must also provide manufacturing with complete specifications for raw material, finished goods and packing; procedures for operation of the plant, and complete quality control information and test procedures.

During this period, marketing has been developing a plan for a market test. Markets have to be selected, advertising developed, sales coverage defined, package design and size developed and pricing volumes projected. The controller begins to formulate cost projections and gross profit figures. As a test market gets under way, R&D slowly withdraws from the scene. Market research, through field surveys, is following the progress of the product's movement. They follow advertising, distribution, consumer reaction and repeat purchase rates. Such an operation will run for at least six months and as long as two years before a decision is made concerning the fate of the product. If a positive decision is obtained from management, then engineering is called on to design and construct a national plant. R&D is generally called on to assist in this program and is always involved in the start-up of a national plant.

R&D's activities from this point on are in the areas of product improvement, cost reduction, shrinkage studies and general service to manufacturing. Such activities continue for three or four years on an active basis, with service work continuing forever.

From the activity described, it is planned to have at least one new product in national distribution each year that will attain a volume of 3 percent of the cereal market.

The span of time from idea to national expansion is at least 4 years and may be 6 or 7. To maintain such an activity, there are 65 people in technical research, 4 in market research (with most of the work being contracted with testing agencies) and 12 in engineering with support from the craft shops.
The process cereal business is a strongly consumer-oriented business. Through the years a consumer market has been created out of a changing need, from dyspepsia to prepackaged, convenient, economical breakfast food. This market is maintained with unusually heavy advertising and promotion programs -- by far the heaviest in the food industry.

There is no pressure from suppliers that has an influence on developments in the cereal industry. This is probably because the industry consumes such a small part of grain production. Although the cereal industry has sales in excess of 958,500,000 lbs. annually, it consumes only a fraction of 1 percent of the country's annual grain production. Among the major grain categories, the figures are as follows:

<table>
<thead>
<tr>
<th>Grain Category</th>
<th>1959 Total Production</th>
<th>% Total Production to Processed Cereal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>4,361,170,000 bu. (56 lbs.)</td>
<td>0.12%</td>
</tr>
<tr>
<td>Wheat</td>
<td>1,128,151,000 bu. (60 lbs.)</td>
<td>0.52%</td>
</tr>
<tr>
<td>Oats</td>
<td>1,073,980,000 bu. (32 lbs.)</td>
<td>0.44%</td>
</tr>
<tr>
<td>Rice</td>
<td>53,122,000 cwt.</td>
<td>1.79%</td>
</tr>
</tbody>
</table>

*Back calculated from Nielsen Food Summary Data

**Hominy grits are obtained from dry corn milling at a yield of approximately 20 lbs./bu. of grain. They are pieces representing approximately 1/3 of the endosperm of a kernel.

***U.S. D.A. Summary & Statistics - December 18, 1959

Wheat and rice are used largely as whole grain ("a whole kernel of wheat in every flake"), oats are used as flour and calculated back to whole grain assuming a 70 percent yield of flour.

With this data it is evident that the grain producers are unaware of the presence of the process cereal industry and would be unaffected by 100 percent variations in breakfast cereal consumption.

There is some pressure in the packaging area imposed by suppliers and their developments. However, this pressure is primarily in the opposite direction. The cereal industry applies considerable influence on paper
manufacturers and paper converters to produce better packing materials. This is for more product protection, more attractive, more economical, easy opener-reclosure features. This pressure is exerted to the tune of $35,000,000 of business concentrated in six customers.

There is a pressure not identified in the outline that is ever-present from governmental agencies. This can come from any level of government, but is felt in the cereal industry primarily from federal agencies—particularly the FDA and FTC. A current example of this is the 1958 Food Additives Amendment to the Food, Drug and Cosmetic Act of 1938. This law says in essence that no chemical substance can be added or used in such a manner, including packaging materials, as to become a part of the food, unless it is generally regarded to be safe.

A problem to the cereal industry may be the commonly used chipboard cartons. It is reasoned that since the board is made from waste no one knows what it contains, and there may be a deleterious substance. This could cost the industry somewhere between one and six million dollars and could have a serious economic effect on some board manufacturers. This governmental influence is very involved and could be the subject of an entire discussion.

The major pressure is from the consumer, so let us return to that one. The industry is influenced by strong competitive activity among a few large companies with immense resources, but the consumer is the object and, therefore, the primary source of the pressure. The consumer attitude toward cereal is a pallid one. The consumer psychologist says there is no "emotional involvement" on the part of consumers with their cereal purchases. They talk about their homes, cars, TV and steaks with enthusiasm, but it is difficult to get one to talk or brag about the cereal eaten for breakfast. People are concerned about the foods they feed their babies, children and dogs, but not about their own consumption.

In spite of this, the consumers do have some impressions. They rank cereals nutritionally: oats, wheat, corn, rice. They rank cereals in terms of preference: corn, wheat, oats, rice. The price rank is: rice, oats, wheat, corn.

Oats (some say for horses and Scotchmen) are considered good for growing boys. Corn is for adults; it is zesty, light, crispy and urbane. Whole wheat is for men and boys and is bland, fairly nutritious, sticks to the ribs and rural. Rice is for women, children and invalids; it is crispy, bland and light. The consumer does feel that breakfast cereals satisfy a need. This need is described as a compromise between a good breakfast and no breakfast. By feeding the family breakfast cereals, the housewife has somehow discharged her responsibility in feeding her family breakfast.
From this background, advertising as a communication must convey some message to the consumer that is exciting and impressionable. It must be impressionable enough to cause the customer to purchase the product. Then this impression must be repeated many times because of the consumer indifference. This indifference is measured by the fact that there is very little brand loyalty -- as measured by repeat purchase patterns. Only 35 percent of the people who buy in a given bimonthly period will buy again in the next bimonthly period.

The message that is used in advertising often seems indirect. It is as it is because it's the message the consumer understands. For example, a product having a completely balanced nutrition with 25 percent of the daily requirements across the board, is promoted as having "the nourishment of oat meal." That statement means more and is, therefore, much more impressive to consumers than "balanced nutrition." The problem is not what is the outstanding attribute of a product, but which attribute can be told to the consumer in the most impressionable manner.

Let's review this consumer situation briefly. This consumer pressure is one resulting from a desire created out of advertising. Advertising must overcome the indifference of the consumer about breakfast cereals, causing her to purchase a brand in the market place. This message, in order to be effective, must take into account the consumer attitude toward breakfast cereals, her feeling about various grains and her state of knowledge (in nutrition).

This situation accounts, in a large part, for the heavy advertising and promotion of the industry. The 7 lbs. per capita consumption must be earned every day in the market place, hence the consumer is the primary influence determining product and process innovations in the processed cereal industry.

It has been mentioned previously that the industry was concentrated among a few large suppliers. It is centered essentially in six companies with three of these representing 75 percent of the total volume. This makes for an intensive competitive situation. It also makes it possible to spend large sums of money on product and process innovations, and the overall consumer attitudes make innovations necessary for existence.

The final subject in the outline asked for an evaluation of procedures and criteria used in the selection of innovations. This part of the discussion is divided into three subjects: consumer, economic and manufacturing feasibility as the main areas involved.
The consumer testing involves the product acceptance as evaluated under various sets of conditions. Techniques have been devised for use at various stages in the product development, essentially based on reducing time and cost of the tests. Although consumer testing is an incompletely developed science, the various techniques do provide useful information when the technique used "fits" the information that is desired.

Concept testing -- is the testing among a small group of consumers (25 - 100) of a product description or positioning statement, with or without a product prototype. This work is done by consumer psychologists using depth interviewing techniques. It gives a measurement of the consumer's interest and involvement with a product idea. The results are purely qualitative but serve a useful purpose in the construction of a product specification in the early stages.

Triangular tests -- use independent evaluations by experts to determine if two samples are similar or different. They answer only the question of difference as determined by experts. This type of testing is used primarily by R&D in the laboratory.

Profile panels -- panels of experts selected for having an acute sense of taste, who can identify and describe product differences in meaningful terms. Profile panels are used primarily by R&D to determine direction in research. They do not contain any factor of consumer preference.

Consumer tests -- can be run as store tests or home use tests that are either mailed or placed. They can be local, regional or national panels. The test can be blind product, identified product, or product with positioning statement. They can be constructed as paired comparisons, multiple-paired comparisons or single evaluations. They can be single exposure or consumption studies. The consumption test may be preceded with diary information and can include "buying situations".

The size, scope and composition of these tests must be very carefully constructed, based on the information that is desired. These tests can be very helpful or extremely misleading.

The test that hasn't been conceived is one that will identify a product that is not generally accepted, but strongly liked by a minority group sufficient to represent a business opportunity. Also, the test that identifies the product that will gain acceptance only after extended use would be helpful.

The market test is the final acid test to determine the product's potential under the normal selling situation. This is expensive in terms of capital and expense monies, time and efforts. It involves the design and construction of pilot plant facilities, the development of complete market plans,
with built-in measurement techniques of product progress, and the selection of the sections of the country for the test that will be representative of the country.

The market test determines the consumer response to the product as purchased in the market place. It measures product acceptance, advertising effectiveness, trade and consumer promotion efficiency, the manufacturing plant and design and the packaging adequacy. It gives the entire management a look at product potential and the first real figures on costs and profit potential.

During a market test, measurements are made of the share of market -- at an advertising level and at a price -- the repeat purchase pattern and overall consumer attitude about a product. These tests are continued for 6 months to 2 years, culminating in a management decision that there is or is not a business opportunity.

Thus far there has been little reference to economic considerations. There is a continual economic evaluation going on throughout the development process. The figures are of the "ball park" or "box car" variety, however, until the market test is conducted. During this test, costs for raw materials processing and packaging are accumulated. The production yields are determined. The consumer price--involving package size, net weight and apparent value-- is determined. The advertising and promotional expense is measured in terms of the volume they generate. These figures produce the out-of-pocket cost of the product and thence the Variable Gross Profit which is the first economic index used.

The second economic criteria used is ROFE or return on funds employed. Here an accumulation of capital, inventory dollars, advertising funds, R&D costs and working capital is made. This accumulation for a 10-year period over the profit generated during a like period gives an average percent of return for the period. This is the second economic index.

A third calculation that is made involves the return of funds employed. In other words, how long does it take to get the investment back?

These criteria are used in all industries. The targets that are established, however, differ for different industries and are even different for different segments of the food industry. They do, however, come in for major consideration in the management decision regarding a new product-business opportunity.
Previous reference has been made to market test as an evaluation of plant and plant design. Since the value of a market test pilot plant as a means of measuring manufacturing feasibility is often overlooked, it bears repeating. The pilot plant answers the questions: Can the product be produced on the plant as designed, on any plant, of a given quality, uniformly and at what cost? The packaging feasibility and adequacy are also determined. These answers to manufacturing feasibility are often of sufficient significance to alone justify the cost of pilot planting.

These are the criteria used in the evaluation of a new product as a business opportunity in the cereal industry. They are not absolutely a guarantee of success. However, new product failures have generally been the result of short-cutting the described procedures in an attempt to gain time over the competition.

In summary, let me say that the processed cereal industry has a romantic past. It is a well established consumer business characterized by its heavy concentration and large advertising and promotional requirement. It has pointed the way for the consumer acceptance of prepackaged convenience foods that have grown so rapidly since World War II.
MARKETING ADJUSTMENT AND AGRICULTURAL ADJUSTMENT

Lee Kolmer

What effect will the changes in the organization and structure of the food processing industries have upon agricultural producers during the next several years? The increased decentralization and the rise in the number of small and medium-sized processors in the meat industry will increase the competition for supplies in the producing areas. This increased competition is in part the result of the increased number of buyers in the market and in part the result of increased requirements for high quality raw material. Along with the possible price benefits resulting from increased competition for raw materials will be the increased quality requirements which these new plants will demand. The increased control of the quality of finished products coupled with increasing concern with production costs in the plant means that processors will be more interested in raising their quality requirements and reducing the tolerances within different quality grades. It is very likely that producers will be forced to adopt new and improved breeding systems and production methods if they are to compete effectively in this higher quality, more competitive market. It will mean relatively higher producer prices than would have prevailed without this development. It will also mean increased quality standards with greater price spreads for lower quality products.

Another possible result of the increased decentralization of meat processing and milk processing plants in the Midwest region is increased competition from other areas. The shift out of cash crops, such as wheat and cotton in other areas of the country, has led farmers into feed grain and livestock production. Up to this time, however, this production has been geared in many areas to the market outlets that were available. Increased decentralization through the establishment of small flexible plants in such areas will provide added incentive for production in these areas. This increased output will increase the pressure on Midwestern producers. While it is difficult to see any mass shifting of the major production areas, it is very likely that midwestern producers will have to be able to produce a higher quality product for lower average price level in the coming years.

The change in the nature in organization of the processing industry will mean that the distance between the producer and the consumer will widen further. The consumer will be further removed in terms of product identification from the producer than in the past. Additional processing

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and fabrication of agricultural products in the marketing system will make it more difficult to separate the consumers' demand for food from the consumers' demand for food services at the retail level. Along with this will come an increase in communication problems within the production and marketing system between the producer and the consumer. Also, the producers' proportion of the consumers' food dollar will decline as more and more processes and services are added to products by the processing and marketing system.

All of the above are not new developments. They have been going on for some time, and as the nature of the processing industry changes, they will become more intense in the future. This increase in intensity will not occur at an even rate for all products. It will occur much more rapidly, for example, in meat products, perhaps, than for poultry products. To a large degree the poultry adjustment and changes have already taken place, whereas in the case of red meats, we are in the middle of this process of change. This intensification of competition for markets, competition for supplies, and increased quality requirements provide an additional incentive for larger-sized farm units and increased production efficiency at the farm level.

The fact that the retail outlets are very quickly becoming very capital intensive and are faced with the constant marginal cost for labor, as well as an attitude of nonprice competition along with a host of other things, has had repercussions in the processing industries. The trend toward larger units in terms of both the individual store and the retail firm has tended to increase the bargaining power of the retail sector of the food industry in relation to processors. This increased economic power has caused processors to alter their operations drastically during the past 15 years. Even casual observation reveals a very significant shift in product type and quality in almost every area of food processing.

The cereal industry, once characterized by the cracker barrel, 100 pound sack of flour, and bread and pastry baking, has shifted emphasis drastically in the past 15 years. The cereal industry was perhaps the first major processing area to recognize the possible gains from products that were more closely tailored to consumer needs and products that could be merchandised effectively through modern retail units. The development of cake and pastry mixes of all types represented a radical shift in operations for the cereal industry. Shifting to consumer-size units and branding and promoting them on a nation wide basis resulted in cereal processors becoming involved in the day-to-day decisions at the retail level. This meant nationwide promotion, constant expenditures for product development and product improvement, and to quite a large degree, a shift in emphasis from merchandising unfinished components to merchandising food as only one of the components in a product whose major attraction was the inclusion of labor and services in the final product.
The poultry industry has undergone a similar transition since World War II. It is even more apparent, however, in the case of the poultry industry because the shift in product type and the services connected with the product coincided with the development of the poultry industry as we know it today. Ice-packed poultry and New York dressed poultry are terms the modern housewife probably would not recognize if she were quizzed about poultry products. As the poultry industry moved from a farm chicken business to a modern, highly integrated commercial meat production business, the product shifted from a product with a minimum of processing to a highly processed and serviced product. Two to 3-pound broilers available 12 months of the year was unheard of prior to 1940. In the case of poultry meat, the shift in emphasis from a partially processed to a ready-to-cook product did not involve as much nationwide promotion or product differentiation between processors at the retail level. Much of the competition was in the form of price competition with competing red meats. Advances in production technology resulted in production efficiencies which were very quickly passed on to the retailer and consumer.

The red meat industry has undergone a similar shift in type of product during the past two decades. Meat processors have been constantly faced with the need to develop products that will compete with nonmeat foods in terms of convenience and price. More and more of the retail meat products are processed and serviced products as compared with 20 years ago. The introduction of defatted, skinless hams, heat-and-eat sausage products, corned beef, and many new types of luncheon and loaf products are first-hand evidence of these shifts.

One sector in the food business has not had as many basic changes in handling, processing and servicing as have the aforementioned areas. The fruit and vegetable industry, especially the vegetable industry, has not had nearly the basic change in type of product being merchandised today as compared with pre-World War II products. Even here, however, there have been some significant shifts in merchandising methods for particular items. For example, carrots, which were once sold in bulk with tops, are now prepackaged in film bags, topped and priced on a pound basis much as are cake-mix products, poultry products and meat products. In addition to the change in the merchandising of several of the fresh products the vegetable industry has been foremost in shifting from a fresh or canned product toward a frozen product. While this shift has had an impact upon merchandising methods and sales at the retail level, it has not involved a basic change in the product form but rather additional services and specialized storage for the vegetable product.

In addition to the shifts in the product type that have occurred within these major sectors, a completely new area of food processing has also developed. Since 1945 the frozen food industry has increased spectacularly in both
product line and size. While much of the increase came in the form of previously merchandised products now being offered to consumers in an additional form, such as frozen vegetables, frozen fruits, and frozen meat and poultry products, it has also involved development of completely new products and services that heretofore were unavailable. For example, the frozen concentrate juice industry provides a completely new product line available to consumers. Even more striking, however, is the development of the frozen dinner and frozen pie business. In these products the processor and merchandisers have been primarily concerned with developing a product that would provide the utmost in convenience and, at the same time, have price appeal.

**Small Changes in Branding**

The trend toward a greater degree of concentration of retail units into local and small chain operations both as single corporate entities and voluntary associations has resulted in a very rapid increase in the number of chain "private" brands available to consumers. This, I think, is a natural outgrowth of the developments we had been discussing. As store size and volume increased, small chains and associations were able to economically brand products sold through their outlets. As processors shifted their type of products and developed more products in final form for consumer use, it provided an added incentive to merchandise these products to retailers on a contractual, custom-labeled basis. In many cases processors were not especially enthusiastic about the shift from packer labels to private labels. They realized that the increased use of private labels would give them less control of consumer buying decisions. The store rather than the packer was associated with a certain quality and a certain flavor of a particular product. However, the size of retail outlets and the market power represented by these outlets made it imperative that they merchandise their product on a private label basis as well as on a packer label basis.

The retailers, of course, have been very interested in pushing private labels for several reasons: (1) In many cases the retailer brand is of equal or better quality than is the packer brand; (2) if they merchandise primarily their own brand, they are merchandising every other product in their store whenever a consumer purchases a private label item, and (3) their margins in many cases are better on their own labels than on packer labels.

This growth in the number of small chains and in the resulting growth in the number of private brands has forced the processors to do more national promotion and merchandising of packer label items. This is an effort on the part of the major processors to regain, to some degree, the consumer loyalty they once enjoyed. Increased brand loyalty results in greater
control of consumer purchase patterns. Private labels, which were once primarily confined to canned fruit and vegetable items, now include such diverse items as meat products, milk, frozen foods and bakery items. The processors' problem in this "battle of brands" is, of course, further complicated by the fact that there is not, so far as the consumer is concerned, very much actual difference between private labels and packer labels. This is to be expected since most private labels come through the same plants and use the same raw materials as do packer label items.

As the marketing power of the retail sector of the food industry has increased, it has forced some very fundamental changes in the wholesaling methods and procurement methods involved. Many retailers are now large enough to specify product quality they wish and to demand price offers before the sale is completed.

This increase in specification buying has prodded processors to devise methods of increasing control over the quality of raw material and the processing facilities required to perform the functions. This means two things: (1) The processors have been investing in new high capacity, high speed operations which will enable them to exercise more precise quality control and cost control of their operations and (2) it has resulted in more streamlined and more direct methods of procurement of raw materials.

The shifts in plant location and type of plant in the meat industry, the canning industry and the milk industry are examples of this type of change. A large investment in new plants has taken place in each of these areas. These plants are flexible plants in that they can operate at different levels of output efficiently, as well as being very capital intensive. This, in a sense, provides major processors with scale advantages (economies of size) that are not available to retailers through other channels. When this scale advantage is combined with increased and accelerated promotion and advertising programs to hold and to some extent retail consumer loyalty, it promises stiff competition for private labels so far as price and quality is concerned.

The need for increased control over quality of finished product means that processors must also increase control over quality of raw materials. In many instances this has meant that the processors have made efforts to develop a source of supply on contractual basis or on a direct basis that will permit them to exercise discretion in accepting or rejecting the product offered to them for processing and to exercise more price discrimination in purchasing raw materials. This has occurred in the case of egg handling and packing. During the past 15 years the traditional first assembler-wholesaler-packager-retailer chain of events has been to a large degree supplanted by a direct-purchase system by wholesaler-retailers wherein they serve as assemblers, handlers and packagers of eggs at the source of supply. In some cases this has been accomplished through direct extension of their procurement facilities into producing areas, while in other cases it
has been accomplished by contractual agreements with assemblers in producing areas to provide a certain volume at a certain quality level for every month of the year. This need for quality control of raw materials has also resulted in more direct buying on the part of meat processors. This has permitted meat processors to "educate" producers as to the quality they desire at a given plant and thereby reduce the variation in quality of finished products.

The new, relatively small, highly efficient, flexible plants are better able to operate profitably under present widely fluctuating supply conditions than are the large terminal-based plants built 30 to 50 years ago. The adoption and installation of modern, high speed processing has also made it possible to operate profitably at somewhat lower levels of capacity than was true with the large centralized plants years ago.

In addition to advantages gained from being able to operate profitably at lower levels of operation these modern, decentralized plants also are in a better position to offer improved service to processors' customers. Cost of transportation both in terms of distance and in terms of time is considerably reduced under such operations. In addition, these plants are more adaptable to specialized production of particular commodities to fit a given market than are large central processing operations.

With the investment in new facilities, new products and accelerated promotion, the processor hopes to regain some of the prestige and consumer control which has been gradually taken over by the retailing sector of the industry. Whether or not processors will be successful in this venture, only time will tell. However, in the intervening period it will undoubtedly provide for some lively competition between the different sectors of the marketing industry.

**Meat Processing -- An Example**

The meatpacking industry is a good example of an industry where the processors had, relatively speaking, a superior competitive position during the 1930's. In the thirties, packers were relatively few in number and were, in a sense, in the driver's seat. On the one hand, producers, from whom they procured the raw material, were large in number and relatively uninformed concerning prices and quality. On the other hand, the customers of the meatpackers, while larger than the producer units, were still relatively small compared with the packers and were large in number. Under these conditions, the packer was in a position to expend resources in research and collecting market information that would provide information concerning supplies, prices and demand that a national distributing system would permit him to exploit. Since 1945, however, this position has been altered drastically. Supermarkets, stores doing $400,000 per
year or more in volume, now account for a major portion of the total retail grocery volume. These operations are larger and are more informed than were their counterparts 30 years ago. Also, in this consolidation and growth process, supermarket operators, either corporate or voluntary associations, have acquired the resources necessary to develop and procure research and economic information concerning food distribution.

At the same time that this consolidation and growth occurred in the retail food industry, there was an extended period of enforced federal meat grading. This reduced some to the advantages of private brands for packers in that retail meat buyers had a basis for comparison of the quality of fresh beef and lamb procured from both large and small meat processors. Because of this grading requirement, small packers who heretofore were restricted to a regional or a local demand because of inability to sell their label to operators in other regions were in a position to sell beef and lamb on a quality basis in any market. This, of course, immediately increased the competition in the processing and distributing business.

In addition, there was increased use and dissemination of market news information to producers. This gave producers additional information concerning market conditions and prices at different points and provided them with alternative outlets which they, perhaps, were unaware of previously and reduced the price uncertainty involved as to price in shipping to more distant points.

These changes contributed to significant changes in the structure of the meatpacking industry. The additional information on the part of producers concerning prices and markets combined with the specification buying made possible through the use of federal grade standards provided added incentives to small shipper-type processors to locate and operate in areas of surplus meat supplies and sell a national market on the basis of grade specifications.

The end result of all these structural changes in the meat-processing industry has been an increased degree of competition in the industry and has tended to center the competition on price rather than brand quality as was the case prior to 1940. The industry today has more of the attributes of a competitive market than it had 30 years ago.

This trend toward decentralization and increased competition between processors has by no means been completed. Within the last year one of the large meatpackers has closed down a number of plants in widely scattered areas of the country. Another packer has recently built several small, highly capitalized packing plants in widely scattered areas. Other companies are also in the process of adding decentralized plants to their operation.
How important are the roles that family members take in decision making as far as the family expenditure pattern is concerned? How do we measure family roles? Are there entire categories of families which have a characteristic role pattern? These are the sorts of questions to which we will address ourselves in this paper in an effort to demonstrate what we know, or need to know, about family interaction that would have relevance to the way in which families consume goods. First, we will take a close look at the variable which is the chief focus of our discussion, family roles.

By role we will mean the total part a family member plays when two or more such members interact with respect to a household expenditure. Clearly there are expenditures made that are individually determined and executed. These fall outside the domain of our present discussion. There are many other expenditures which just as clearly have been determined or influenced by two or more family members. The part a person takes in group decision making can vary from trivial to important by almost any definition of either term, and he can either restrict his role to a certain aspect of the decision making process or play a part at various of the sequence of stages. Already the complexity of investigating family roles in decision making should be apparent.

In analyzing the roles of family members in expenditure decision making, it is useful to use as a model some orderly sequence of actions that occur in the decision making process. Fifty years ago John Dewey spelled out what he termed the "steps in problem solving" to explain the cognitive processes through which an individual goes in solving a problem. While the years have seen many adaptations of Dewey's phases of problem solving, each in essence describes the kind of action that takes place from the stage where it is recognized that a decision is necessary to the stage where a course of action is selected. One such scheme would be as follows:

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1. Recognizing and clarifying the decision that has to be made.
2. Exploring and evaluating alternative courses of action.
3. Choosing and carrying out a course of action.
4. Evaluating the course of action in the light of intended results.

We are assuming that something approximating this scheme of stages in decision making exists to a greater or lesser degree when two or more family members interact with regard to purchasing decisions. Even the so-called impulse buying has definite elements of it. By viewing decision making as a relatively orderly sequence of stages we are able to direct attention, not merely to quantitative differences in the contributions of various family members, but also to the nature or content of their contribution at various levels of the decision making process.

There have been a number of studies which deal in some manner with family roles in decision making. The simplest, and perhaps most widely used, methodology largely ignores the salient features of our foregoing discussion. That is, respondents are simply asked to state who made the decision or who had the most influence in such situations as the last time they purchased a car or when last they went out for an evening. While the method has a seductive simplicity, it contains several important difficulties which should be made explicit: First, it assumes that respondents are able to answer the question; that is, that they understand with sufficient clarity the part that they and other family members played in the given decision situation.

Second, it assumes that the total of a person's role in decision making can be calculated in an additive fashion that ignores, or considers irrelevant, qualitative aspects of his contributions. At best, it seems to assume that respondents, without further directions, are able to weigh and evaluate the qualitative aspects of the roles of family members and arrive at a reliable estimate of the total importance or total contribution.

Third, it ignores, by not directing attention to them, stages in the decision making process. This, in turn, may even lead to a confusion between the total decision making process and one of its aspects, the execution of the decision or the selection of a course of action.

A closer look at these difficulties will at the same time shed light on the complexity of determining family roles in group decision making. To return to the first difficulty with the common methodology, there is at least reason to question whether most people are sufficiently sensitive to the part that they and others play in group decision making to be able to give a reliable report of it. In our early studies of family decision making here at Iowa State University, a number of married couples were given a decision-making problem, the expenditure of a hypothetical gift of $300.

and the behavior of the spouses during the discussion was recorded by a field worker. Previous to the decision-making session itself, the husbands and wives were given simple questionnaires asking which of them would do the most talking, which would have the most influence, which would contribute the most ideas and suggestions, and which would do the most to keep the session running smoothly. After the session, the same questions were asked in the past tense. It was thus possible to relate what the individuals were observed doing, to what they thought they would do, and to what they had done. The results of such analyses were starting and intriguing. In general, the couples studied showed no great ability to judge the several aspects of the roles they would play, about two-thirds even failing to identify accurately the relatively simple matter of who would do more of the talking. More than this, even immediately after the interaction there was no great improvement in the number of accurate judgments. All in all, the couples appeared to be quite unpracticed at even the relatively superficial degree of analysis necessary to recognize the part they play in a simple and structured interaction. What, then, do we really learn when a respondent checks on a questionnaire that the husband usually decides about automobile purchases or the wife decides about household equipment? How valid are these responses?

In addition to the question of validity, there are problems with the completeness of the information received through this method of determining spousal roles in decision making. In other words, is a simple designation of the most influential family member all we would like to know, or need to know, about family roles in decision making? There are ways of describing more fully the part a person plays in a group discussion and we are suggesting that these merit greater consideration than they have heretofore received.

The system that we have used in our experimental decision-making studies is Bales' system of Interaction Process Analysis. Briefly, this consists of a set of twelve categories into which can be placed all behavior to which an observer can assign meaning. The basic division of the categories is

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along two lines, (1) task behavior and (2) social-emotional behavior. In the task area are six categories for behavior which relates in a direct manner to getting the job done, solving the problem, or reaching the decision that lies before the group. Three of the categories in the task area can be characterized as categories for questions, as asking for orientation or information, asking for opinion or analysis and asking for suggestions. The remainder can be thought of as categories for attempted answers, as giving a suggestion, giving an opinion or giving orientation. All behavior that falls within any of the three question or three answer areas can be considered task-oriented behavior. The remaining six categories have to do with behavior relating to the integration and emotional tone of the group. Three categories contain positive actions, as showing solidarity, tension release and agreement, while three are designated as negative actions, as showing antagonism, tension and disagreement.

Bales' system of Interaction Process Analysis allows an objective description of the part a person plays in a joint decision-making session. We have an empirical basis for determining, for example, which person talks most, which gives more suggestions, which disagrees the most and so on. If this system, or one similar to it, could be employed in conjunction with the concept of stages in the decision-making process, our description of family roles in decision making would more nearly approach completeness. We could describe with some accuracy how the various family members behaved when clarifying the decision issue, the parts they played when alternative choices of action were being evaluated, and what and how much each did when it came to choosing among the known alternatives.

Let us, at this point, review our major considerations. We have said that an adequate study of family roles in decision making is a complex undertaking, and we have attempted at least to trace the outline of what an adequate study would entail. In addition, and this is but the other side of the same logical coin, we have criticized simpler methods of assessing family roles and questioned their utility. The more complete role analysis we have suggested is time consuming. It is expensive, and it is difficult to conduct. These features may immediately remove it from considerations for some researches, and even when it does not, we should reasonably ask, "Is it worth it?" Thus in the area with which we are here concerned, we legitimately should determine whether our knowledge about family expenditures for agricultural products will be sufficiently enhanced through a fairly detailed analysis of family roles in the determination of such expenditures. Would that there were a simple answer to this question. Our approach to an answer to it will be twofold. We will, first, turn to the theoretical importance of family roles in decision making and attempt to set forth some of the kinds of differences in family expenditure patterns we should expect to find associated with various role arrangements. Following this we will turn to research to determine what has been discovered about the effects of family role arrangements and what kind of research needs to be done.
The area of products promotion immediately comes to mind as one which could be affected by decision making roles. Perhaps a homey example could best illustrate the point. Let us assume that in the class, age and income group that constitutes the potential source of purchasers of automatic washers it has been discovered that husband and wife share equally the task role in decision making, particularly at the state of evaluating alternatives. In other words, in decisions such as this, the man and woman would contribute ideas and suggestions about equally, would throw out points to be discussed about equally, and would "question and answer" one another to about the same degree concerning the features of various brands. From my observation, the makers of automatic washers do not believe that such a situation prevails, or at least they do not take it into account in their advertisements. Almost without exception, the advertisements that I have seen have failed to "feed" to the male observer the sort of information in which he could be presumed to have an interest unique from his wife. They do not dwell on the mechanical and electrical intricacies of their product nor on its unique features of an engineering sort. With respect to the product itself, they make it almost impossible to "lift up the hood" in dealer's showroom and peer knowingly at the silent innards. In short, it seems to me, the manufacturers of automatic washers seem to be assuming that women play the major task role when evaluating and choosing among brands. If the role arrangement we have suggested is correct, they are making it difficult for the male in our hypothetical group to play a task role in the decision making. This, in turn, may be reflected in his interest in the product generally and his willingness to discuss purchasing it. Let me remind you that I am not contending that husbands and wives in the group of potential purchasers of automatic washers do share equally the task functions relative to evaluating brands. This is but a hypothetical illustration. I do contend, however, that knowledge of how the task or idea function is typically performed in some universe of families would have a certain relevancy for the ways in which products for this group were promoted.

One other example in the area of product promotion will have to suffice. We are reasonably sure that at upper income levels the decision to purchase an automobile typically is individually made and executed. At middle income levels, by contrast, husband and wife share in this decision even though the husband may have a major role in the execution of the decision once it has been made. Yet manufacturers who hope to sell to middle income families consistently avoid the cheaper, day-time television hours when primarily women are viewing. My own haphazard sample of a stack of women's magazines, furthermore, failed to uncover a single automobile advertisement. It seems to me that both the television and magazine situations illustrate that automobile manufacturers are not fully taking into account the fact that middle-income women have been found to have an important and influential role in decisions on the purchase of an
automobile. Frankly, I have no idea whether day-time advertisements for automobiles would be economically sound. I am suggesting that advertisements directed specifically to them may create in women a greater interest in new automobiles generally and reverse the reported tendency for women to be interested in the less expensive models. 

We could hypothesize still other ways in which the roles played by family members could affect their expenditures. These hypotheses, furthermore, would flow logically from what we already know about the importance of role arrangements in small groups. Thus the way in which husbands and wives divide up the task and social-emotional functions in joint decision making would be hypothesized to be related to their relative influence. It is possible, too, that expenditures for whole categories of goods, for example, recreational equipment, home furnishings, or childrens' clothing, are affected by the parts that husbands and wives take when such matters are discussed.

The amount of existing research directly appropriate to our purposes is disappointingly meager. Some work has been done, however, that indicates a more general effect of role arrangements on the performance of the group. Lewin's study of autocratic and democratic groups is an example, for it demonstrates that the role behavior of members of small groups affects the productivity of the group as well as the human relationships. Torrance found that the way in which power is distributed in small groups has consequences for the group's decisions. Strodtbeck reports a relationship between spousal roles in decision making and "winning" a decision.

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One of our decision making studies at Iowa State seems pertinent to our present concern, for it attempted to relate spousal roles in an economic decision-making situation to the nature of the decision outcome. Fifty married couples were asked to assume that they had received a gift of $300. with the stipulations that it could not be saved nor spent for anything that previously they had decided to buy. They were then asked to discuss together how the money should be spent and to reach an agreement on items they would like to purchase. The ensuing decision making session was observed by a field worker and a tape record of it was made.

In analyzing the data, couples were classified as "about the same," "husband high," or "wife high" with regard to their total talking, performance of social-emotional actions, and performance of task actions. Their action pattern was then related to the kinds of items they determined to purchase with the gift money. Items were classified according to the user of the item rather than the nature of the item. The scheme was as follows:

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<thead>
<tr>
<th>Category</th>
<th>Typical Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wife-personal</td>
<td>Clothing of all sorts, jewelry, golf lessons</td>
</tr>
<tr>
<td>2. Wife-household</td>
<td>Washing machine, dryer, range, cooking utensils</td>
</tr>
<tr>
<td>3. Husband</td>
<td>Books, shotgun, clothing, fishing equipment, watch</td>
</tr>
<tr>
<td>4. Joint family</td>
<td>Furniture, vacation trip, television, car down payment</td>
</tr>
<tr>
<td>5. Children</td>
<td>Play equipment, clothing, toys, furniture</td>
</tr>
</tbody>
</table>

We next computed, for each couple, the percent of all items on their final list that fell into each of the categories and the percent of the gift money used for each category. Let us summarize our findings briefly.

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10/ The description and summary of this study that follows is adapted from William F. Kenkel, "Husband-Wife Interaction in Decision Making and Decision Choices," Journal of Social Psychology (in press).
Total talking. In 42 percent of the families the husband out-talked his wife. In such cases, the items chosen were more frequently for the use of the whole family than in the other two types of families. When the husband out-talked his wife, the couple chose more items for the children and for the husband, but fewer household items, than when the couple talked about equally.

The husband and wife did about the same amount of talking in 40 percent of the cases. The difference between such couples and others were apparent in four of the five category possibilities. Due to their small numbers, we cannot do too much with the cases in which the wife talked more than the husband. There was a strong tendency, however, for more of the items to be for the use of the children, more for the wife's personal use and, interestingly, more for the husband's personal use.

The "idea-man" role. The husband contributed more of the ideas and suggestions than did his wife in 60 percent of the cases. Among such couples, the proportion of items in the categories "wife household" and "joint family" was substantially higher than among couples where husbands and wives contributed ideas about equally. These latter couples, constituting 26 percent of the cases studied, were decidedly more likely than any others to choose items to be used by the entire family. When the wife contributed more of the ideas, fewer of the items were for the use to the entire family than in any other case and more were for the children.

Social-emotional actions. For every category of decision choice, there was a noticeable difference between the couples in which the wife was the social-emotional leader and other couples. When the wife played the expressive role, as she did in 72 percent of the cases, the items were less frequently for her personal use and more frequently for the children, for the family as a whole, and for the household, than when the husband was the social-emotional leader. When the wife led in this area, about twice as many items were for her husband's use as were for her own use.

In 20 percent of the households, the husband was the social-emotional leader. Among such couples the proportion of personal items for the wife went up and household items decreased. Perhaps this indicates that the personality type capable of playing this role, a minority among males in this sample, has greater sensitivity to the needs of his wife and thinks first of her personal wishes and then of household items. Not fitting this picture of the sensitive, empathic male, however, are the findings that he himself gets a liberal share of the gift money, even more than when the wife is social-emotional leader, and that the joint family and children's uses are reduced. While, in almost every instance, couples who shared
equally the expressive function differed from both types of other couples, there existed too few such couples to permit detailed analysis.

There were, in all, 45 possibilities for differences to occur in the proportion of consumer items selected by the couples with different interaction patterns. Of these possibilities, 32 showed a difference of three percent or more, 19 a difference of five percent or more, and 7 a difference of ten percent or more. This would seem to indicate that the role arrangement in decision making has some bearing on types of expenditures made. At the same time, the relationship does not seem to be strong. If one is accustomed to think of consumer choices being influenced chiefly by objective needs, wants produced by advertising, family goals and values, and the like, then it is indeed impressive that even some relationship was discovered between how couples decide to spend a sum of money and the roles they play in reaching the decision. We can readily assume that families differ with respect to how they allocate their resources according to the use-type categories here employed. Let me emphasize, however, that even if we were able to generalize from our small sample, the family role arrangement would seem capable of explaining only a small part of the variation among families.

**Major Variations in Family Roles**

We have said, to this point, that family decision-making role arrangements are of theoretical importance and that there is some empirical evidence of its relationship to family expenditure patterns. For many purposes, knowledge of this relationship would be useful only if it were possible readily to assess family role arrangements and if broad population aggregates shared a similar or typical family role arrangement. Once again we find, in our research, gaps of uncomfortable proportions. Our theory, supported by some research, suggests that family role patterns should indeed vary according to major characteristics of families. Social status is one such variable, while family life cycle, ethnic background, rural-urban residence, race, and employment status of wife are a few others. These characteristics, furthermore, have two distinct advantages. First, they define and differentiate broad categories of the population which, for some types of consumer goods, can be assumed to have different needs, wants and purchasing abilities. Second, these characteristics are relatively easy to measure.

The important question that remains, of course, is whether or not family expenditure patterns vary sufficiently according to family role patterns to make it worthwhile to investigate major societal variations in family roles. At the present juncture we would conclude that the manifest need is for basic research into the effects of family decision-making roles on family expenditures. Following this, we could turn our research efforts to a
more accurate delineation of families with specified role patterns. As we have indicated, already we are reasonably sure in which direction to search for the broad characteristics that differentiate families with varied role patterns. In other words, if or when the roles that family members take in joint decision making are shown to have a significant effect on expenditure habits, we should be able to move with fair rapidity in furnishing practical assistance to those concerned with the sale of particular products or types of products.
DIFFERENTIAL RESPONSE TO MARKET MOTIVATIONAL TECHNIQUES

John Harp

In order to understand or attempt to understand the behavior of the American consumer, one must view him in his societal context. A logical starting point would seem to be the salient structural characteristics of the society in which he lives.

Prevalent errors of both public and private action may occur from a failure to foresee the repercussions that often arise out of the total social system within which the particular acts take place. And often even a systematic analysis of various isolated parts of the social structure turns out to be highly unrealistic, if not simply fallacious, by reason of this same neglect of context. 1)

Perhaps the best single description of American society is found in the use of the term, popular culture or mass culture. Unlike any other type of culture, popular culture was facilitated and perhaps necessitated by mass production. One has to look to the process of industrialization for the genesis of our popular culture. Industrialization or mass production has:

1. shortened work time and toil
2. lengthened leisure
3. increased income
4. increased mobility
5. lessened the role of primary groups and expanded the role of secondary groups
6. facilitated the use of mass media
7. contributed to mass education

With regard to the kinds of things consumed, the consumption patterns which distinguished the rich is attenuated. John Stuart Mill, nearly a hundred years ago, perceived this process of homogenization.

"The circumstances which surround different classes and individuals, and shape their characters, are daily becoming more assimilated. Formerly, different ranks, different neighborhoods, different trades and professions lived in what might be called different worlds; at present to a greater degree in the same. Comparatively speaking

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they now read the same things, go to the same places, have their hopes and fears directed to the same objects, have the same rights and liberties, and the same means of asserting them."

Yet the homogenization which Mill cited 100 years ago is an unavoidable effect of the industrial system and its concomitant prosperity. Technological change and the altering patterns of demand also cause the products of each firm, as well as its methods of production and of marketing to change rapidly. 2/ Hence, the longevity of each skill we acquire, the demand for the work we do and the positions we have established are subject to change. Each of us will probably change more than once in his life time his residence and his occupation. In addition, the characteristics of the various groups and social classes, the attitudes they foster and the positions they occupy are themselves far from stable. All this is an integral part of our social system. A high degree of mobility is essential if one is to reap the rewards of the system.

In summary then:
1. "Industrialization has made more goods available to more people with less work and less individual craftsmanship.
2. The rise of scientific mentality, its spread through education and its technological applications, has rapidly uprooted group traditions and structures.
3. Groups have become more fluid and accessible, membership less permanent; feelings more equalitarian and undifferentiated; relationships discontinuous, temporary, and less intimate.
4. Personal, social and religious bonds have been extended, blurred and disassociated from each other and often weakened." 3/

It is within the societal context described above, that popular culture is sold or mass taste finds an environment so conducive to its propagation and growth.

2/ For an example of changes in agricultural markets, see Beal, George M. and Böhlen, Joe M. Unpublished research monographs. Department of Economics and Sociology, Iowa State University, 1960.

The relevance of the preceding discussion for consumer behavior research may be summarized as follows: Within an industrialized society, characterized by mass production, biological and non-biological needs are satisfied in accordance with group standards and norms operating within a framework of group values. Even goods that seem purely utilitarian include elements of nonutilitarian, of aesthetic and psychic appeal. The latter fact is often ignored by assuming primacy of our societal value on rationality. Indeed, the acceptance of the "economic man" is a necessary consequence of accepting our societal value on rationality. In addition to the assumption of rationality, the model infers that the consumer knows what his wants are and maintains an inventory of them in his mind to guide his purchasing; that he has knowledge of all available products and services which might meet his needs and that he can discern the want satisfying content of each product or service, at least in an ordinal sense, so that he can decide which items to buy in order to get the most satisfaction for his money.

Traditional economic assumptions have been challenged by results of research. A number of relevant findings of this kind have come from the University of Michigan's Survey Research Center, which is engaged in studying economic behavior in terms of social psychological variables. A study of purchase decisions for durable goods provided evidence that people are not always careful buyers, and that there are wide differences in buying behavior which cannot be explained in conventional economic terms.4/ Another study from the Center indicated that people with the lower incomes, and presumably the greatest economic need for information to guide them in their purchases, are the least likely to look for it. The results of a national consumer panel show a number of instances of lower income families buying the higher rather than the lower priced brands within categories where little product differentiation exist.

The inadequacies of the economic model or more specifically the rationality theory of consumer behavior led researchers at an early date to a study of buying motives. Copeland is alleged by many to have done the pioneering work in this field.5/ His dichotomous classification of emotional and rational motives was based on a content analysis of consumer responses.


Similarities are evident when comparing Copeland's original list of emotional and rational buying motives with recent consumer behavior research which treats of values as the independent or predictor variables. 6/

The differences in motives given by purchasers of industrial goods as compared with purchasers of consumer goods have been observed and reported by Duncan, Copeland and others. 7/ Rational motives tended to predominate among the former group of purchasers. While no explanation is given by the authors of these studies, the findings can be interpreted by an examination of the value systems operating within the respective systems. In a corporate bureaucracy one might expect, by the very nature of its structure, to find a more "rational" orientation than within any given household.

The inadequacy of the list-of-motives approach has been noted by a few writers over the years. Arthur W. Kornhauser advocated its abandonment more than 30 years ago. 8/ McGregor pointed out, as had Kornhauser, that motives are terms of classification of observed behavior rather than forces which constitute explanations of behavior. The argument advanced by McGregor is not palatable to a student of the "classifying" science. I would concur, however, that phenotypic motives in and of themselves may predict but not explain. The researcher must resort to a higher level of conceptualization, which is basic to his theoretical orientation. Granted we are plagued with a group Sorokin has so aptly described as the "New Columbuses," 9/ i.e., the penchant to coin new terms or concepts for processes and/or dimensions well established in the sociological literature. 10/ Kornhauser's and McGregor's abhorrence of naming and then attributing causal significance to names as a basis for theories of motivation is relevant when directed at the latter phenomenon.


Motives for behavior (in the marketplace and elsewhere) and similarly pre-dispositions to behave (attitudes) do constitute important variables useful in predictive schemes when: (1) they are related to general dimensions and (2) their genesis is found in social organization variables which form the logical basis for a study of roles: role performance, role clarity, role expectancies or behavior that is (a) shared by many individuals, (b) repeated in many successive situations and (c) definitely related to other patterns in the same social aggregate.  

An opportunity to utilize a categorization of motives and test hypothesized relationships to social organization variables was afforded the author during a study of urban attitudes toward consumer cooperatives. A few of the salient findings with regard to buying motives are now presented.

**Product Differentiation and Buying Habits**

Following the procedure of other market researchers, an attempt was made to ascertain consumers' patronage motives in buying groceries. Each consumer interviewed in the study was asked: "Why do you buy your groceries at this store?" The reasons given were ranked by respondents 1, 2, 3. A value of 3 was assigned to the first reason, 2 for the second and 1 for the third.

The results indicated that consumers patronize particular stores for specific reasons. In order to compare buying motives with buying habits (i.e., type of retail outlet chosen), categories of a more genotypic nature were sought. The dichotomy of emotional and rational, suggested by some marketing economists, was deemed unsatisfactory for the present data. An examination of the patronage motives given by respondents suggested that many were indicative of forms of product differentiation as defined by Chamberlain.


12/ Agricultural Experiment Station Project 1175. Joe M. Bohlen, project leader. Iowa State University, Ames, Iowa. 1958.


"A general class of product is differentiated if any significant basis exists for distinguishing the goods (or services) of one seller from those of another. Such a basis may be real or fancied, so long as it is of any importance whatever to buyers, and leads to a preference for one variety of product over another. Where such a differentiation exists, buyers will be paired with sellers, not by chance and at random (as under pure competition), but according to their preferences."

Recent research on the role of the retail fertilizer dealer in Iowa offers some additional support for Chamberlain's hypothesis. The data suggest a selectivity of dealers and customers, in terms of social, personal and economic characteristics. Research evidence also indicates a differential demand for dealers to play a technical consultant role with respect to the sale of commercial fertilizer. 15/

In addition, Chamberlain pointed out that differentiation may be based upon: (1) certain characteristics of the product itself or (2) the conditions surrounding its role. The illustration of the latter by Chamberlain is drawn from the retail trade and suggests some of the factors considered earlier as buying motives, namely: "...such factors as the convenience of the seller's location, the general tone or character of his establishment, his way of doing business, his reputation for fair dealing, courtesy, efficiency and all the personal links which attach customers either to himself or to those employed by him."

A further note on Chamberlain's typology is offered by Grether, who refers to the second type (the conditions surrounding its role) as enterprise differentiation.

"Variations in location, store fittings, the variety and assortment of goods, basic merchandising policies, and in ancillary services are the primary means of "enterprise differentiation" in the distributive trades. In the case of small dealers, personality influences and friendships may be important also." 16/

The other types defined by Grether are basic product differentiation and external product differentiation.

15/ Agricultural Experiment Station Project No. 1352. Unpublished data. Iowa State University. 1960.

In order to test a hypothesis which treats of patronage habits and motives, the former were analyzed as a dichotomy composed of consumers patronizing one retail establishment for all grocery needs, while the second group patronized more than one retail store. The suggestion gleaned from past research is that the significant level of competition at the retail level appears to be the whole store (factors indicating enterprise differentiation), the whole complex of factors that caused shoppers to patronize one store rather than another. Halton stated that, "...having made a decision at this level, shoppers seemed indifferent to even large differences in prices of individual commodities among stores." 

Research studies of the agricultural market conducted at Iowa State University have shown significant differences in farm size when compared on the basis of farmers patronizing one retail establishment and those patronizing more than one for their commercial fertilizers and agricultural chemicals. The difference is in the expected direction, with larger farm size associated with patronage of more than one retail dealer for the commodities under study.

The hypothesis is suggested, therefore, that consumers who patronize one retail store for grocery needs do so for reasons which may be classified as enterprise differentiation, while consumers patronizing more than one retail establishment display a less proportion of enterprise differentiation motives. The chi square test is significant beyond the .01 level. The hypothesis is supported.

Research in the agricultural market on commodities characterized by a low degree of product differentiation also illustrates the substitution of enterprise differentiation motives for product differentiation. When asked why they purchased a particular brand (of fertilizers or chemicals) a significant majority of farmers replied that it was the brand their dealer carried. When the hypothetical situation of changing dealers or changing brands was offered them, again a significant majority indicated they would change brands.

Following the previous suggestion that competition at the retail level appears to be the whole store, and since consumers have specific patronage motives which reflect basic needs, the hypothesis is suggested that the type of retail store chosen will be related to the patronage motives given by consumers. The chi square test is significant at the .01 level. The hypothesis is supported.

Patronage Habits and Reference Groups

Since patronage motives were found to be related to type of retail store patronized, but were not significantly related to income classes, one might

hypothesize that the holding of certain patronage motives, as reflected by the type of retail store patronized, was a function of common attitudes and need dispositions characteristic of certain reference groups. It has long been recognized that men act in a social frame of reference yielded by the groups of which they are a part. While the use of the reference group concept in the present paper is concerned with membership group orientations, the theory has been generalized to the point where it can account for both membership and nonmembership group orientations. To begin with the most general proposition, one may state that the behavior, attitudes, beliefs and values of the individual are all firmly grounded in the groups to which he belongs.  

The specific hypothesis involving patronage habits and reference groups is as follows:

Rural migrants to the city will patronize chains less frequently, and independents and neighborhood stores more frequently than urban born residents. The study of consumer cooperatives in Superior reported a more favorable attitude toward consumer cooperatives on the part of rural migrants, when compared with urban residents. In addition, similarity of environment has been shown by Axelrod to be a factor in the assimilation of the rural migrant in his urban setting. The suggestion is made that chain stores are a retail structure which is not as familiar to the rural migrant as it is to the urban resident. It is not, however, familiarity alone, but rather the differences between the role of the chain store, and that of the independent, within the context of the community social system, which warrant further investigation. The chi square test is significant at the .05 level. The original hypothesis is supported.

While no relationship was found between income classes and patronage motives, or income classes and type of store patronized, within income classes the rural-urban dichotomy displays some interesting differences in the selection of retail stores. One observes that as income increases the


rural group displays a greater affinity for chain stores. Unfortunately no data were available on length of urban residence, in order to test the relationship between purchase patterns and urbanization, within income classes. The limitations of sample size prevented the implementation of other controls.

Implications for Future Research

In the light of the above findings it would seem logical to suggest that future research explore the relationships between social organization variables and purchasing patterns and motives within income classes. Data would be required on ethnic group membership, social class membership in the sense of homogenous sub-cultural classes.

The preceding research results were presented as a crude example of how social organization variables may be utilized to explore the genesis of patronage motives. While the latter step should be of inestimable assistance to market researchers as an aid in delineating marketing publics, it does not represent a terminus for the sociologist studying consumer behavior. Lazarsfeld has referred to the initial area of inquiry as buying behavior determinants of the first degree. In this category he included conscious factors about which people were willing to talk, such as product attributes, influences on buying action such as advertising and the advice of friends, the circumstances under which the decision for purchase was made and the use for which the purchased item was intended. The reasons for and origins of the first degree emotional likes and dislikes, Lazarsfeld classed as biographical determinants.

Since Lazarsfeld made the above statement (1935) a great deal of market research has been initiated and completed. Consumer behavior has been related to opinions, attitudes, aspirations and these in turn have been correlated with relevant social organization variables such as social class, ethnic groups, age categories, sex, etc.

The basic need in consumer research which Lazarsfeld alluded to 25 years ago is for a coherent theory of values in relation to consumer action. The purchase of a consumer good is merely the last in a long chain of events in the consumer's life experience--hence, the low level of predictability in much of consumer behavior. We are in need of a systematic method of anticipating change in consumer action. This requires us to probe to the roots of motivation for large aggregates of people who as individuals may

be quite different in psychological background and other characteristics. What are the common links that affect their behavior as consumers? We need to know how these value systems relate to given products. It is within this value framework that the study of consumer behavior takes on additional meaning.

There seems to be some confusion in the researching of values. Many researchers imply that value is a preference. The latter is only one element of a value. A value is not just a preference, but a preference which is felt and/or considered to be justified—"morally"—or by reasoning or by aesthetic judgments, usually by two or by all three of these. Even if a value remains implicit, behavior with reference to this complex suggests an implication of the desirable—not just the desired. The desirable is what is felt proper to want and demands some social consensus. Values are ideas formulating action commitments. The research analyst observes certain kinds of patterned behavior. He cannot explain these regularities unless he subsumes certain aspects of the processes that determine concrete acts under the concept "value." While there are, of course, more general and more specific values, conception implies reference to a class of events which may encompass a variety of content and differ considerably in detail. Example: "Eating spinach is a value for Smith, because Smith likes spinach or prefers spinach to broccoli is to confuse the desired with the desirable. This practice negates one of the few constant differentia of values. It is much more convenient to separate value and preference, restricting preference to those selections which are neutral (i.e., do not require justification or reference to sanctions) from the point of view of the individual and/or the culture. Of course, if Smith justified his preference for spinach in rational or pseudo-rational terms of vitamins, minerals, etc., it then becomes by definition one of his values. If, however, he simply says, "I like spinach better than broccoli," it remains a mere preference.

With regard to the social implications of technological change, examples are numerous and more especially in the area of agricultural adjustment. The social impact of scientific discovery, and technological innovation made possible by a definite and unusual cultural context, has been discussed. The major trend has been one of extremely rapid advances in the application of scientific knowledge to the manipulation of physical and biological environment. The social resultants of these developments include the demographic

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revolution, the mechanization and specialization of work, the mobility and anonymity of urban life and possible indirect repercussions upon primary value orientations. It is in this societal context that the student of consumer behavior must work and the study of human behavior derives greater meaning and utility.
IMPACT OF RECENT CHANGES IN GROCERY RETAILING ON
CONSUMER CHOICE AND MARKET PERFORMANCE

Willard F. Mueller

Much of modern food distribution is a response to broad and complex technical and institutional forces - some causative, others permissive. But it is well to recall the economic environment which permits and encourages large-scale, self-service retailing, the very core of low-cost food distribution and a prime determinant of many past and prospective interfirm and interindustry adjustments.

Self-service food distribution is a native American institution. Certainly an important permissive, if not causative, factor responsible for this development is the high standard of living enjoyed by most American consumers. The phenomenon of widespread high living standards has made American labor a precious economic commodity. American consumers, whose income would permit them, if they lived abroad, to hire servants to perform many services for them, "do it themselves" in America. This includes their own shopping. On the other hand, usually the chief source of cutting distribution costs in America is to use labor saving technology. America's high income levels and the consequent high labor costs therefore create both demand and supply incentives for self-service retailing. Hence, self-service has become an imperative in modern food distribution, and anything which relates to its operation becomes a potential variable worthy of manipulation by food processors and distributors.

Range of Choices in Modern Retailing

Modern food retailers have responded to the peculiar demands of the American environment by supplying an ever growing variety and number of products for the consumer's titillation. This outflowing of products has taken several forms.

Consumers' choices. First, the number of items$^{1/}$ supplied consumers by modern grocery stores has grown from slightly under 900 per store in 1928 to nearly 5,600 in today's typical supermarket (Table 1). This expansion has

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$^{1/}$ Each can size of each brand of each product is customarily defined as a separate grocery item.
been accompanied by ever larger stores. In 1950, new supermarkets averaged about 10,000 square feet, whereas by 1958 they averaged 17,100.

Table 1. Growth in Number of Grocery Items Handled in Grocery Stores, 1928-58.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928</td>
<td>867</td>
</tr>
<tr>
<td>1946</td>
<td>3,000</td>
</tr>
<tr>
<td>1950</td>
<td>3,750</td>
</tr>
<tr>
<td>1955</td>
<td>4,723</td>
</tr>
<tr>
<td>1957</td>
<td>5,144</td>
</tr>
<tr>
<td>1958</td>
<td>5,600</td>
</tr>
</tbody>
</table>

Second, the kinds of products supplied consumers have expanded almost continuously during the last three decades. Not only have supermarkets expanded into all food items originally handled by specialty food stores, e.g., fresh fruits and vegetables, baked goods and meats, but into a host of nonfoods as well. By 1957 most supermarkets handled the following nonfoods: drugs and cosmetics (97.7 percent), magazines (74.6 percent), stationery (91.5 percent), toys (74.6 percent), beer (52.3 percent), hardware (72.3 percent), soft goods (64.6 percent), children's books (76.1 percent), greeting cards (53.1 percent), garden supplies (62.3 percent). Today, the typical supermarket derives 5.2 percent of its sales from nonfoods and devotes 15 percent of its floor space to displaying them.

Third, modern supermarkets provide buyers with more alternative brands of the same product from which to choose.

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3/ Progressive Grocer, April 1959.
4/ The following comparisons are between chain stores and independent stores rather than between supermarkets and small stores; however; they provide a minimum indication of the difference between the offerings of large and small stores because most Milwaukee chain stores are supermarkets and most, although by no means all, independent stores are quite small.
of brands of various food products handled by chain and independent food retailers in Milwaukee, Wisconsin, in 1959. In a modern supermarket, the 20 food products shown in Table 2 constitute about 23 percent of total sales and about 40 percent of total food sales excluding meats and produce.\textsuperscript{5/}

These data reveal that for all of these products consumers were offered more alternative top brands\textsuperscript{6/} from which to choose in chain stores than in independent stores. On the average, consumers could select from among 4.5 top brands in chain stores compared to only 2.5 in independent stores. Moreover, with only one exception (potato chips) a greater percentage of chains handled the top selling brand of each of these products; and with few exceptions they also handled more of the next top four brands as well.

The extent of this dimension of choice facing consumers in chain stores is indicated further by the fact that for all but two of these products -- frozen fruit pies and sugar -- one or more chains offered consumers one or more of their own private label brands.\textsuperscript{7/} This further broadened the range of consumer choice because private label merchandise usually sells at a definite price discount compared to well-known manufacturer brands.

Table 3 makes a similar comparison of the range of brands of nonfood items handled by chains and independents. The items listed here represent about 44 percent of the nonfood items sold in modern supermarkets. Chains average nine different brands in these items compared to 4.5 for independent retailers. However, in only four of these products did Milwaukee chains have private label brands which ranked about the top brands in these products.

\textsuperscript{5/} These estimates are based on the relative importance of these items as indicated by Progressive Grocer, "Super Value Study," 1959. Definitions of nonfood sales vary considerably. Most sources do not include beer, cigarettes, soaps, and detergents, and other standard nonfood grocery items among nonfoods.

\textsuperscript{6/} Top brands are defined as those purchased by more than one percent of Milwaukee consumers.

\textsuperscript{7/} Actually the number of private label brands is considerable greater than this for some products, since these figures include only those private label brands which were purchased by over one percent of Milwaukee consumers.
Table 2. Extent of Coverage Among Independent and Chain Grocers of Top Brands of Selected Food Products in the Greater Milwaukee Market in 1959 and Number of Brands Sold in 1935 and 1959.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milwaukee 5</td>
<td>Ind. : Chain</td>
<td>Ind. : Chain</td>
<td>No. 1 : No. 2 : No. 3 : No. 4 : No. 5</td>
<td></td>
</tr>
<tr>
<td>Instant coffee</td>
<td>32</td>
<td>5.8</td>
<td>9.6</td>
<td>0.4</td>
<td>74.0 100.0 80.5 100.0 67.5 100.0 71.0 100.0 60.0 100.0</td>
</tr>
<tr>
<td>Coffee</td>
<td>148</td>
<td>53</td>
<td>4.6</td>
<td>7.8</td>
<td>98.0 100.0 93.0 100.0 75.0 100.0 63.0 100.0 59.5 100.0</td>
</tr>
<tr>
<td>Canned pork &amp; beans</td>
<td>41</td>
<td>36</td>
<td>2.8</td>
<td>5.4</td>
<td>0.4</td>
</tr>
<tr>
<td>White bread</td>
<td>27</td>
<td>51</td>
<td>4.3</td>
<td>5.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Jams &amp; jellies</td>
<td>n.a.</td>
<td>53</td>
<td>3.1</td>
<td>5.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Tomato juice</td>
<td>80</td>
<td>54</td>
<td>1.4</td>
<td>5.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>n.a.</td>
<td>26</td>
<td>2.5</td>
<td>5.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Cake mix</td>
<td>n.a.</td>
<td>17</td>
<td>3.1</td>
<td>5.0</td>
<td>.4</td>
</tr>
<tr>
<td>Reg. flour</td>
<td>66</td>
<td>21</td>
<td>2.8</td>
<td>4.6</td>
<td>.4</td>
</tr>
<tr>
<td>Frozen fruit pies</td>
<td>n.a.</td>
<td>32</td>
<td>1.1</td>
<td>4.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Pkgd. cookies</td>
<td>26</td>
<td>54</td>
<td>3.7</td>
<td>4.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Soda crackers</td>
<td>(sq. or oblong)</td>
<td>38</td>
<td>22</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Canned tuna</td>
<td>n.a.</td>
<td>40</td>
<td>2.0</td>
<td>3.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Beef hash</td>
<td>n.a.</td>
<td>18</td>
<td>1.3</td>
<td>3.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Baby foods</td>
<td>n.a.</td>
<td>4</td>
<td>1.6</td>
<td>2.8</td>
<td>.2</td>
</tr>
<tr>
<td>Frozen vegetables</td>
<td>n.a.</td>
<td>33</td>
<td>0.9</td>
<td>2.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Potato chips</td>
<td>n.a.</td>
<td>26</td>
<td>2.5</td>
<td>2.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Sugar</td>
<td>61</td>
<td>30</td>
<td>1.6</td>
<td>2.4</td>
<td>.2</td>
</tr>
<tr>
<td>Ice cream</td>
<td>n.a.</td>
<td>49</td>
<td>0.9</td>
<td>1.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Fresh milk</td>
<td>n.a.</td>
<td>19</td>
<td>1.5</td>
<td>1.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Catsup</td>
<td>76</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry macaroni</td>
<td>&amp; spaghetti</td>
<td>108</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pkgd. bacon</td>
<td>31</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned peaches</td>
<td>102</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canned pineapple</td>
<td>99</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (N = 13)</td>
<td>64.0</td>
<td>41.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (N = 20)</td>
<td>2.5</td>
<td>4.3</td>
<td>0.4</td>
<td>64.0</td>
<td>92.0</td>
</tr>
</tbody>
</table>

<sup>a</sup> These are brands, including chain brands, purchased by more than 1 percent of Milwaukee consumers.

<sup>b</sup> These include only those chain brands purchased by more than 1 percent of Milwaukee consumers.

<sup>c</sup> Excludes chain brands and brands purchased by less than 1 percent of Milwaukee area consumers. Chains included:

- A & P, National Tea, Krambo (which is owned by Kroger), Red Owl and Kohls.

Table 3. Extent of Coverage Among Independent and Chain Grocers of Top Brands of Selected Nonfood Items Sold in Grocery Stores in the Greater Milwaukee Market, 1959.

<table>
<thead>
<tr>
<th>Products for</th>
<th>No. of brands</th>
<th>Average No. of chain handled</th>
<th>Percentage of Coverage of Top Five Brands Among Retailers, c/</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Average No. of top brands handled</td>
<td>No. 1</td>
</tr>
<tr>
<td>dishes</td>
<td>76</td>
<td>12.8</td>
<td>20.0</td>
</tr>
<tr>
<td>Household laundry</td>
<td>75</td>
<td>11.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Floor polishes</td>
<td>132</td>
<td>10.9</td>
<td>13.0</td>
</tr>
<tr>
<td>Canned dog food</td>
<td>27</td>
<td>4.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Toilet soap</td>
<td>44</td>
<td>9.0</td>
<td>10.8</td>
</tr>
<tr>
<td>Dry dog food</td>
<td>33</td>
<td>3.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Water softeners</td>
<td>43</td>
<td>4.6</td>
<td>6.8</td>
</tr>
<tr>
<td>Toilet tissue</td>
<td>38</td>
<td>3.1</td>
<td>6.6</td>
</tr>
<tr>
<td>Powdered cleansers</td>
<td>16</td>
<td>4.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Paper napkins</td>
<td>52</td>
<td>2.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Paper towels</td>
<td>20</td>
<td>1.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Aluminum foil</td>
<td>14</td>
<td>1.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Average</td>
<td>47.5</td>
<td>5.7</td>
<td>9.0</td>
</tr>
</tbody>
</table>

a/ These are brands, including chain brands, purchased by more than 1 percent of Milwaukee consumers.
b/ These include only those chain brands purchased by more than 1 percent of Milwaukee consumers.
c/ Excludes chain brands and brands purchased by less than 1 percent of Milwaukee area consumers. Chains included: A & P, National Tea, Krambo (which is owned by Kroger), Red Owl and Kohls.

Thus, looked at from the consumer's viewpoint, there is no question but that modern grocery chains offer him many more alternative top brands to choose from than do independent stores today, and did food stores generally several decades ago.  

Suppliers' choice  But how about the number of alternatives available to grocery suppliers? We hear much these days about the battle of manufacturers for grocer's shelf space. Some economists have implied that this battle stems from the fact that chains need and presumably do handle only a few top brands, thus making it more difficult for grocery manufacturers to get shelf space for their products. Actually, this explanation misses the real cause for the increased intensity of the historic battle for shelf space. As shown above, chains generally do stock more brands than do contemporary independent retailers, and they certainly stock more brands than did the independent retailers of 30 years ago. After all, in 1928, grocery stores typically handled only 867 different items (Table 1). Moreover, as shown in Table 2, the total number of brands of most products sold in the Milwaukee market has decreased significantly since 1935 (prominent exceptions among the items shown are white bread and packaged cookies). For example, whereas in 1935 there were 148 brands of coffee, by 1959 there were only 53. Therefore, today a typical store handles a greater percentage of all brands sold than did the typical store of 1935. Obviously the cause for the intensity of the current battle for shelf space cannot be attributed to the fact that modern retailers do not handle as many brands as did retailers of an earlier day.

But this is not to say that the terrain on which the shelf space battle is fought is becoming more favorable to grocery manufacturers; the big change of the last few decades is that although the shelf space of particular stores is larger than ever before, the number of retail food firms has decreased significantly with a consequent concentration in buying of grocery products (as shown below). It is simply impossible, therefore, for as many brands of particular products to find a place on someone’s shelf

8/ Although these data cover only brands purchased by over one percent of the consumers, I believe that chains also offer consumers more of the lesser known brands as well. Often small independent stores handle only national brands.

9/ It should be noted that today independent stores often operate supermarkets which may handle as many brands as chain stores. Thus, the above comparisons tend to understate the differences between modern chain stores and small independent stores.
today. An extreme case will illustrate this point. Food stores -- independ­
ents and chains alike -- usually find it most economical to handle only one
or two brands of milk. Today five corporate grocery chains do about 85 per­
cent of the grocery business in Milwaukee. If each of these chains handled
two brands (actually they average only 1.6 each) it inevitably follows that a­
bout 85 percent of the fluid milk sales of stores in Milwaukee will be con­
centrated among a maximum of 10 fluid milk dealers. And as these chains' share of sales increase, fluid milk sales concentration also will inevitably increase. Also, if the remaining independent retailers which are members of voluntary and cooperative chains buy their milk through their affiliated wholesalers, fluid milk sales will become even more concentrated. This is a neat example of the way structural changes in one industry may induce changes in another. I call this kind of interindustry relationship "bilateral oligopolistic balance." By this I mean that when two such oligopolistic industries face each other as seller and buyer in trading differentiated pro­
ducts, as the structure of food retailing becomes more concentrated, there is a tendency for the number of food brands, and consequently of food pro­
cessors, to decline until a proper "balance" is reached.

Of course, other factors also are important in determining the actual num­
ber of surviving brands. Especially important is the apparent consumer appeal of different brands.¹⁰ For example, Borden's is the only brand of milk to be sold by three of the five food chains in Milwaukee; even Sealtest is handled by only one chain. This brand preference is reflected in Borden's large share of total store sales -- 34.8 percent compared to only 16.6 per­
cent for Sealtest.

The requirements of bilateral oligopolistic balance are not yet a significant factor determining the market structure of many food processing industries selling in national or large regional markets because such industries usually are much more concentrates than is food retailing on a regional or national level. Hence they are not out of balance. But should food retailing become considerably more concentrated nationally, the inevitable forces of bilateral oligopolistic balance will make themselves felt in more and more industries.

The preceding discussion illustrates that modern food retailers offer con­
sumers a wider assortment of food and nonfood items from which to choose than do the small stores of today or did food retailers generally several decades ago. However, increasing concentration of food sales is tending to decrease the number of market alternatives available to suppliers of chains, especially suppliers operating in local or relatively small regional markets.

¹⁰/ Two additional factors determining the final number of brands are the economies of scale in food manufacturing plants and the volume of private label sales of chains.
Impacts of Changes in Market Structure on Consumer Choice and Market Performance of the Food System

These introductory comments on the increasing range of products offered consumers may sound like a deterministic explanation of the evolution of food retailing which implies that all changes in grocery retailing are responses to consumers' sovereignty; that is, that our food distribution system provides us with a wonderful mechanism which automatically translates perfectly the wishes of consumers into the appropriate marketing responses. Personally, I feel that to date there is some truth to such a deterministic explanation of its functioning. However, I think it is an overly sanguine observer who is not disturbed by certain developments which, on the one hand, make a mockery of the concept of consumer sovereignty in the market place and which, on the other, tend to offset the increasing efficiency with which our food system performs. The developments I am going to talk about stem largely from certain fundamental changes in the market structure of food processing and distribution. Therefore, I shall begin by reviewing very briefly certain fundamental changes which have occurred during the last few decades.

I shall direct my comments to three market structure variables, market concentration, product differentiation, and barriers to entry. These are variables which economic theory suggests as being important and industrial experience verifies as being crucial.\textsuperscript{11/}

Changing numbers and concentration in food retailing. The overall picture in food retailing is one of declining store numbers, increasing store size and increasing market concentration.

Between 1950 and 1958 alone, the number of food and grocery stores dropped from 401,000 to 285,000, or about 13,000 stores a year. Accompanying the drop in store numbers has been a dramatic growth in store size. Whereas in 1952, supermarkets (stores with sales over $375,000) accounted for 43 percent of retail food stores, today they account for nearly 70 percent.

But these changes are by no means the most crucial ones occurring in the structure of food retailing. A more significant change is the increasing market concentration of firms, rather than of stores.

\textsuperscript{11/} Much of the following discussion of market structure is based on, Willard F. Mueller and Leon Garoian, Changing Market Structure of Grocery Retailing, 1940-57, forthcoming, University of Wisconsin Press, and work continuing in this general area at Wisconsin in cooperation with the Marketing Economics Research Division, Agricultural Marketing Service, U.S. Department of Agriculture.
We long have had some large food chain firms. As early as 1930, A & P did 37.5 percent of the food chain business and 12.3 percent of all grocery store business. And in 1940, the four largest chains did 60 percent of all food chain business and 22 percent of all grocery store business.

Contrary to much popular opinion, the big change in market structure of food retailing in recent years is not that these traditional giants are growing in relative importance. On the contrary, the four largest chains do a smaller part of the total retail grocery business today than they did 30 years ago.

Are we to infer from this apparent decline in concentration that there have been no significant structural changes in food retailing other than the greater degree of specification buying, etc., that we hear so much of these days? Not at all! It is just that we must look elsewhere for the changes.

First, between 1947 and 1958 the share of grocery store business done by grocery chains has increased quite regularly -- from 34 to 41 percent for chains of over 10 stores, and from 37 to 43 percent for chains with over 3 stores -- and this trend will continue, I'm sure.

Second, although the top four chains do a smaller share of total chain business today than in 1940, concentration is increasing within the chain part of food retailing. Not only is the number of chains declining -- due largely to mergers -- but a fairly large number of significantly sized chains have evolved since 1940, thus joining the traditional giants. For example, back in 1940, Wrigley Stores in Detroit was an obscure chain with sales of just over $2 million; today its business has grown to over $350 million, or a 175 fold increase. In fact, today the country's top 20 food chains account for about 85 percent of all grocery chain business and about 32 percent of all grocery store business.

Also, although many chains are of insignificant size in the national market, they may be very important in the markets in which they operate. For example, whereas Red Owl, the country's 18th largest chain does only .3 percent of the country's grocery business, it does about 11 percent of the business in the regions in which it operates. And concentration in selling in local markets is even more pronounced. Typically, the largest chain in a city does about 25 percent of the business, the two largest chains about 40 percent, and the four largest nearly 60 percent.

But again, this is only part of the story. Independent food stores still do most of the grocery business -- nearly 60 percent. But big changes have occurred here too. More often than no independents have become affiliated with "voluntary" or "cooperative" chains.
Independent retailers have joined voluntary and cooperative chains in order to achieve some of the advantages of buying and merchandising enjoyed by corporate chains. Although such organizations date from before 1900, they have become increasingly important of late, until today around 70 percent of the sales of independents are funneled through members of cooperative and voluntary chains. In truth, some of these organizations rival in size even the largest chains. For example, members of Red and White Food Stores, the country's oldest voluntary chain, have combined sales of over $1.25 billion.  

Product differentiation and barriers to entry. I shall treat these two market structure variables under a single heading because they are inseparably related in the food industry.

Processing firms are seldom satisfied with taking a passive position relative to their markets. Through advertising, merchandising, product development and control, they try to develop unique demands for their products. Simply put, they try to convince the consumer that what he really wants is their product. They try to convince your children that they want Cheerios instead of Wheaties, or O.K.'s instead of Cheerios.

Through the years many processing firms have been successful in differentiating their products. In fact, I am convinced that this is the leading -- and often the only -- source of lasting market power food processors are able to achieve in selling. And some have been notably successful. Kraft cheeses, Campbell soups, Swift's premium hams, to name a few, have become household words.

But the picture seems to be changing. Many brands, including even some well-known ones, are losing their traditional ability to command significant premiums.

12/ It is easy to exaggerate the importance of the voluntary and cooperative chains. Few have duplicated entirely the advantages of large chains. Few provide a complete line of products for their members. In fact, independents affiliated with cooperative and voluntary chains buy only about 20 percent of their products through them. Thus, while independents affiliated with the 20 largest cooperative and voluntary chains do nearly 23 percent of the retail grocery store business they account for less than 5 percent of the wholesale purchases of grocery retailers. This indicates that affiliated independents aren't nearly as important in buying as we sometimes are led to believe. Of course, they are extremely important in certain products, and are becoming increasingly important in others.
This change has come about almost entirely because of the emergence of large chains which have developed their own buying and selling policies. Most importantly, they have developed their own "private labels" for many products. Today all large and medium-size chains, as well as many small ones (even with sales around $25 million or less), have developed their own labels or brands. Chains are in the unique position of being able to develop their own brands at very low per unit costs. Almost from the first day a chain introduces a product under its own label its label has as much or more consumer appeal as little-known processor brands. And because a chain can control the shelf space and location of its brands, it can improve rapidly consumer acceptance of its products. (This assumes, of course, that it is offering consumers products of roughly the same quality as competing brands.)

Not to be overlooked in the development of chain brands is the fact that the strength of each chain's brands depends largely on the image of itself which the chain is able to construct in the consumer's mind. As consumer confidence in a chain and its brands grows, it can develop additional brands which compete quite effectively at prices comparable to national brands. A & P seems to have gone furthest in this respect. In some products it has almost completely eliminated space for manufacturers' brands. In fact, its Holly Carter and Marvel brands leave no space in the ice cream cabinets for even Sealtest and Bordens. This represents the final triumph of chain brands.

The relative ease with which grocery chains can develop their own brands places them in the unique position of being able to integrate into a wide assortment of grocery manufacturing industries. They can do so either by manufacturing their own products and selling them under their own brands, or by buying on a specification basis for sale under their own labels.

Once a chain becomes large enough to sell under its own label the output of an efficient-size food manufacturing plant, it can enter a manufacturing industry which has excessive product differentiation barriers for other prospective entrants. Hence, as chains become larger and their brands stronger, increasing numbers of chains attain the ability to hurdle the product differentiation barriers protecting many industries from additional entrants.

An example will illustrate the magnitude of this structural change resulting from the recent growth of many chains. The smallest of the top 20 chains to have integrated into coffee roasting by 1957 had sales of $67 million at the time it entered this industry. If we assume that this represents the minimum retail sales which a chain must attain in order to enter coffee roasting, in 1940 there were only 10 chains large enough to have integrated into this industry, whereas by 1958 there were 32 chains large enough to have done so.13/

13/ All comparisons are made in comparable dollars.
Implications of Structural Changes

There is much vague talk these days about the increasing market power of food retailers. Some credit it to the increasing size of individual supermarkets and others seem to imply that specification buying somehow places suppliers of food retailers at a competitive disadvantage.

Much of this talk is nonsense. There is not much inherently new about the procurement policies of large chains. Rather, it is just that we have more large chains and voluntary chains and voluntary chains than ever before. The traditional giants have long done what is becoming so commonplace today.

The changing balance of power between food processors and retailers is to be explained by the structural considerations I mentioned earlier. Whereas in the 1930's food processors faced only a few very large chains and organized independents, today the bulk of their sales must be to large chains and organized independents. The greatest single force intensifying competition in food processing is that food retailers are in the unique position of being able to neutralize much of any market power many processors may have achieved. I want to emphasize the word neutralize because, as I read the available evidence, the so-called "buying power" of food chains does not give them much real monopoly power in the usual sense of the word. There are still so many food retailers (about 800 chains with over 4 stores, 800 cooperative and voluntary chains, and about 190,000 unaffiliated independents) that in buying, no one -- or even a few -- can push prices below competitive levels for long, except in quite localized markets. However, because so many retailers are now able to sell under their own brands or labels, and can easily enter many fields of processing, they have the effect of forcing many food processors into behaving like quite keen competitors. Large food retailers are able, in effect, to enter these industries and rob them of some of their market power; often the threat to do so is enough. The result? Processors' prices often are pushed down toward costs -- or in the short-run even below costs. Readily available empirical evidence indicated that profits in a number of food processing industries have declined relative to profits in grocery retailing.

The preceding observations suggest that recent structural changes in food retailing have, in certain respects, resulted in improved performance in some dimensions of both food processing and distribution. Food retailers are providing consumers with an increasing number and variety of food and nonfood items; and structural developments in food retailing (especially chain labeling and integration into manufacturing) seem to have intensified competitive behavior of many food processing industries; and insofar as this is reflected in lower marketing margins, consumers presumably have benefited. But I am not prepared to say that recent structural developments
have brought only improvements in the performance of the food industries. In truth, recent structural developments have generated at least some performance characteristic in both retailing and processing which seem inimical to the public interest.

As economic theory suggests, the increasing concentration of grocery store sales in local markets seems to be resulting in less price competition and more nonprice competition among food retailers. And whereas nonprice competition may be extremely vigorous, and under certain circumstances may lead to quite satisfactory performance in the long run, there is no guarantee that socially desirable performance will result. In fact, it appears that the major result of the increasing nonprice competition on the selling side of food retailing is increasing advertising and related types of costs.

There is evidence that this development is already well underway. According to internal revenue records, corporate food retailers' advertising expenses increased from $49 million in 1947 to $233 million in 1957, or from .48 percent of their sales to .92 percent of sales (Table 4). Between 1947 and 1952 advertising expenditures as a percent of sales remained relatively stable. But between 1952 and 1957 they increased from .54 percent to .96 percent, or by 75 percent in just four years.14/

Nor has this increase in advertising effort at the retail level been offset by decreases at the processor level. Food processors have not taken a passive attitude toward the growing importance of retailer labels. To date their primary retaliation has taken the form of increasing their own selling efforts. 15/ President Charles S. Bridges of Libby McNeill & Libby, in commenting on the expansion of chain labels, recently said, "This obviously has increased the pressure on the advertised brands, necessitating larger expenditures for advertising to hold their share of the consumer's business." 16/

14/ During 1947-56 all areas of retail trade increased their advertising expenditures as a percent of their sales by only 10 percent, and between 1952 and 1956 by only .1 percent.

15/ Another alternative being followed by some food manufacturers is to integrate forward in food retailing.

16/ Quoted in Food Field Reporter, March 2, 1959, p. 20.
Table 4. Advertising Expenditures of Food Retailers, 1947 to 1957.

<table>
<thead>
<tr>
<th>Year</th>
<th>Advertising expenses (Millions)</th>
<th>Advertising expenses as percent of total food sales (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>49.4a/</td>
<td>.48a/</td>
</tr>
<tr>
<td>1948</td>
<td>57.0</td>
<td>.48</td>
</tr>
<tr>
<td>1949</td>
<td>66.5</td>
<td>.54</td>
</tr>
<tr>
<td>1950</td>
<td>74.3</td>
<td>.55</td>
</tr>
<tr>
<td>1951</td>
<td>86.4</td>
<td>.55</td>
</tr>
<tr>
<td>1952</td>
<td>96.2</td>
<td>.54</td>
</tr>
<tr>
<td>1953</td>
<td>114.6</td>
<td>.61</td>
</tr>
<tr>
<td>1954</td>
<td>134.7</td>
<td>.68</td>
</tr>
<tr>
<td>1955</td>
<td>171.8</td>
<td>.76</td>
</tr>
<tr>
<td>1956</td>
<td>211.9</td>
<td>.85</td>
</tr>
<tr>
<td>1957</td>
<td>233.5</td>
<td>.92</td>
</tr>
</tbody>
</table>

\(\text{a/ Statistics of Income, U. S. Treasury Department, Internal Revenue Service, various editions. These data are for corporate food retailers filling corporate income tax returns. Roberta Lamb, Agricultural Economist in the Marketing Economics Research Division of the Agricultural Marketing Service, has estimated that if advertising expenditures on nonfood sales are excluded (by assuming that advertising expenditures of food retailers are divided between their food and nonfood products in proportion to the relative importance of each), retailers' advertising expenditures on food products amounted to $41.5 million in 1947 and $183.4 million in 1957. Her estimates do not affect the third column in this table.}\)
The result has been a great expansion of advertising expenses in an industry which already was the country's leader in this field. According to internal revenue records, food manufacturing corporations spent $337 million on advertising in 1947, which equaled 1.1 percent of their sales (Table 5). By 1957 food processors spent $808 million on advertising, or equal to 2.03 percent of their sales. Thus, their advertising expenditures as a percent of their sales almost doubled in 10 years. This compared with an increase of only 33 percent for all other manufacturing industries between 1947 and 1956.

Table 5. Advertising Expenditures of Manufacturers of Food and Kindred Products, 1947 to 1957.

<table>
<thead>
<tr>
<th>Year</th>
<th>Advertising expenditures (Millions)</th>
<th>Advertising as a percent of sales (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>$337.0</td>
<td>1.11</td>
</tr>
<tr>
<td>1948</td>
<td>366.9</td>
<td>1.17</td>
</tr>
<tr>
<td>1949</td>
<td>400.2</td>
<td>1.35</td>
</tr>
<tr>
<td>1950</td>
<td>462.2</td>
<td>1.45</td>
</tr>
<tr>
<td>1951</td>
<td>497.2</td>
<td>1.39</td>
</tr>
<tr>
<td>1952</td>
<td>560.5</td>
<td>1.56</td>
</tr>
<tr>
<td>1953</td>
<td>598.1</td>
<td>1.68</td>
</tr>
<tr>
<td>1954</td>
<td>656.8</td>
<td>1.80</td>
</tr>
<tr>
<td>1955</td>
<td>743.3</td>
<td>1.96</td>
</tr>
<tr>
<td>1956</td>
<td>774.3</td>
<td>2.00</td>
</tr>
<tr>
<td>1957</td>
<td>808.1</td>
<td>2.03</td>
</tr>
</tbody>
</table>

Source: Statistics of Income, U. S. Treasury Department, Internal Revenue Service, various years. These data are for corporate food manufacturers filing corporate income tax returns. Roberta Lamb, of the Agricultural Marketing Service, has estimated that in 1947 $17 million and in 1957 $46 million of the above advertising expenditures were for nonfood products (animal feeds).
If this trend continues, food processors and retailers will spend over $1,250,000,000 in 1960. And advertising represents only the most obvious selling cost in our modern food distribution system. Evidence on non-advertising promotional cost is scanty, and is usually buried in broad, vaguely defined categories of a firm's operating statement. Some food manufacturers spend considerable amounts on point-of-sale promotion which may not show up as advertising expenses. Similarly, entertainment and other miscellaneous expenses incurred by salesmen in charming their potential customers often are not recorded among advertising expenses. Also, much that is officially classified as product development costs may actually involve only superficial product and packaging changes aimed at increasing consumer acceptance of an otherwise unchanged product. It may not be unreasonable to expect that nonadvertising promotional efforts of many food processors are as great or greater than their advertising expenses.

Why all this concern over the size of selling expenditures? Clearly, all selling efforts do not involve social waste of resources. Many are informational in character; in a private enterprise economy this is the means of informing potential buyers of the availability, prices and quality of your wares. But it does not take a great deal of economic sophistication to appreciate that little of modern advertising effort is directed toward this end.

In fact, this objective often is conciously distorted by sellers who deliberately try to condition and control rather than discover and satisfy the wants of consumers. Most modern food advertising is persuasive advertising, and not only is much of it essentially socially barren, but it may become fruitless even to the firms involved because in the aggregate its effects tend to cancel out.

In judging advertising as a component of industrial performance, it is of more than passing interest to compare its magnitude with the size of ex-

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17/ For example, the Quaker Oats Company spent $49,166,990 on "selling, general and administrative expenses" in 1957. This equaled 16.3 percent of its total sales -- up from 14.3 percent in 1950. The bulk of these expenses very likely represent selling expenses of one kind or another, Moody's Industrial Manual.

18/ Even in food retailing, advertising effort is losing much of its informational value. Most full page newspaper ads of a typical chain lists price and other information on only about 50 items. This represents less than 1 percent of the items handled in modern supermarkets.
penditures for research. After all, these are alternative forms of com-
petition; a growing number of economists have come to believe that the main
and most fruitful competition in modern American capitalism is the drive to
develop better products and processes.

One measure of this performance characteristic is the amount of resources
firms devote to research aimed at product and process discovery and develop-
ment. In 1956 food and kindred products manufacturers spent an estimated
$76 million on research;\textsuperscript{19} this was equal to about .2 percent of their total
sales. This compared with 1956 advertising expenditures of $774 million.
Thus food manufacturers spent $10 on advertising for every $1 spent on
research. In 1960 food manufacturers will spend an estimated $96 million
on research\textsuperscript{20} compared to nearly $1 billion on advertising.

While I am not able to specify what constitutes the social optimum allocation
of resources between advertising, research and other firm expenditures, it
is my judgment that the present ratio is so obviously out of balance as to
cast grave doubts on whether this industry is performing in a socially
desirable manner. Moreover, when the advertising component of food pro-
cessing and retailing costs exceed the net profit component, it suggests to
me that something is awry; yet that is exactly what has happened in food
manufacturing and threatens to happen in food retailing.\textsuperscript{21} We rightly
justify reasonable profits in our system because they are a prime generator
of change and reward for success. But I personally find it impossible to
develop a similar rationale to justify the mounting size of the advertising
component of marketing costs.

Time does not permit further elaboration of the advertising dimension of
industrial performance. But farmers and consumers alike do have a stake
in it. A remote possibility is that the demand for food would be increased
sufficiently to compensate for more than the added marketing costs. But to


\textsuperscript{20} Ibid.

\textsuperscript{21} For the period 1947-50, food manufacturers' advertising expenditures
were 54 percent as great as their income after taxes. By 1956 their ad-
vertising expenses were 109 percent as great as their net income. During
1947-50 food retailers' advertising expenditures were 51 percent as great
as their net income. By 1956 they were 83 percent as great. \textit{Statistics on
Income}, op. cit. And according to the Harvard Business School's study of
the operating results of chains, in 1958 advertising expenses of the chains,
it studied exceeded their net profits. W. B. England, \textit{Operating Results of
my knowledge there is no reliable evidence to reject the hypothesis that the advertising elasticity of demand for food in the aggregate is zero. Hence, as marketing costs go up, the derived demand for farm products should decline.

Quite apart from aggregative considerations, being in an inferior bargaining position, farmers in particular have nothing to gain in the battle of advertising. If gains do accrue to some marketing and distribution firms, they are under no compulsion through either moral or market structure considerations to share these gains with producers.

Finally, the advertising battle may persuade the consumer that he is liking better and better that for which he is paying more and more as his choices are increasingly manipulated.

Is this really the best industrial performance we can hope for in the last half of the 20th century? I hardly think so! And happily, there are some economic forces at work which may eventually improve it, at least at the processor level. The increasing advertising expenditures of processors are intensifying the incentive for closer integration of processing and retailing in order to eliminate the mounting transfer costs of an unintegrated system. It is imperative, therefore, that any public policy aimed at alstrecting such closer integration be evaluated carefully to determine its probable effects on all aspects of industrial performance, not just on its most apparent and immediate effects.
QUALITY IDENTIFICATION AND CONTROL

John C. Ayres

Introduction

The word "quality" is derived from the Latin, qualis or qualitas, meaning "how constituted" and generally refers to peculiar excellence to distinctive character, trait, power, capacity or virtue. It can also refer to class, kind or type. Many different terms are used to identify or characterize product quality. When used in a broad sense, quality might involve all attributes that influence the consumer's demand for the product. More practically, the consumer takes into consideration a number of the product's characteristics and, after determining these several desirable and undesirable features, evaluates overall performance in comparison with a real or imaginary model or standard.

The criteria used in the identification of quality vary with the commodity, utility or service provided. For example, a set of attributes considered useful in measuring the value of a textile might be useless in determining the edibility of a foodstuff or the workmanship or preparation of a piece of machinery. In order to delimit this enormously complex subject to some extent, the following remarks will be confined to foods. Even within this restricted framework, the identification of quality is no easy undertaking.

Food quality has been identified as the product of the characteristics of a given item which influence its acceptability, preference and value to the consumer. One food technologist, Dr. Pauline Paul, identified food quality as a composite of (1) what the housewife sees in the store, (2) what she has to do with it when she gets it home, and (3) what happens when she serves it. Since these three considerations change in importance from day to day, from person to person, and from commodity to commodity, the identification of quality likewise varies.

Universally accepted standards exist for very few products and, consequently, judgment of quality varies with the evaluator's point of view. Recently, Dr. S. R. Hoover, in writing on the subject "Quality in Animal Products" concluded "There are three quality factors that the consumer looks for in fresh and processed foods. They are color, flavor, and texture." Dr. Hoover overlooked or failed to mention such considerations as convenience, uniformity, size and shape, absence of defects, body, performance, and utility, keeping quality or stability, wholesomeness, nutritive value, and economy. All of these attributes require consideration since any one of them may cause an otherwise satisfactory commodity to be considered unacceptable. For example, a product may be priced economically, have an

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attractive appearance, be wholesome and nutritious, but not have acceptable palatability. Such a product will be rejected. In addition, psychological considerations such as prestige, self-esteem, and approval of others and basic drives to overcome hunger and to provide necessary health, safety, comfort and beauty must also be considered.

Factors Used in Determining Quality

The relative weight that consumers assign to the various factors that comprise quality makes it difficult, if not impossible, to intelligently predict responses. A few words about each of the more readily recognized attributes will illustrate the complexity of the quality problem.

Convenience. Perhaps convenience is not in reality a quality factor but merely an attribute of the product that the consumer takes into consideration and substitutes for other desired characteristics. In whatever manner it is considered, convenience is becoming an increasingly important consideration and, depending upon the preferences and needs that apply to a particular situation, is an important determinant of acceptance.

The drastic change that has taken place within the past 15 years in the marketing of citrus juices is a graphic illustration of the influence that convenience exerts on demand. Notwithstanding this impact, the continued use of large numbers of whole oranges, lemons and grapefruit still bear witness to the fact that other quality factors require consideration.

The word convenience is becoming greatly overworked and misused. Several food preparations that are convenient to use for certain purposes do not have the same value for other applications. A few months ago "TV dinners" enjoyed a popularity that they do not now hold. While these meals were largely in prepared form and eliminated the need for purchasing a number of items separately, their palatability and cost characteristics were not completely satisfactory for many consumers; further, since the product required 35-45 minutes warm-up in the oven, it had no advantage over meals prepared in a more conventional manner when the consumer had no interest in spending the interim watching a television program.

Uniformity. The food processor will compromise or even sacrifice other quality attributes in order to attain a product with uniform characteristics. The food canner may not strive for the best possible product unless he has some assurance that he can maintain the same level of excellence throughout the season. Early during the growing period he may delay harvesting of peas or corn or may purposely add starch to the brine when these vegetables contain large quantities of sugar; later, when the peas or corn or more starchy and mature, the procedure is reversed so as to maintain duplicability of the product throughout the year. Uniformity characteristics
of prime importance vary considerably among commodities. Essential considerations of uniformity for tomatoes include size, firmness, acidity, maturity or ripeness, and color; for cucumbers, shape, length, absence of seeds, crispness, and color; for asparagus, compactness and straightness of stalks, and succulence; for eggs, size and shape, color of shell, and later of the broken-out egg, height and color of the yolk and albumen; for bakery products, airy texture with many regularly shaped, thin-walled gas cells, brownness and flakiness of crusts, and velvetiness of crumb.

Size and shape. Size and shape are important determinants of quality of commodities that are sold by number or by weight per container such as eggs, oysters, nuts, fruits and vegetables. For products such as citrus fruits and eggs, the larger the size, the higher the total food value. The size and shape of other commodities such as peaches, apples, potatoes, carrots, celery and the like determine the amount of wastage per unit when the products are peeled, sliced, diced or shredded. Large well-shaped prunes, olives, grapes, figs and dried fruits are preferred for aesthetic reasons and therefore sell at a premium. On the other hand, the smallest, most regularly shaped cucumbers are preferred for pickling.

Color. There is an old saying that "we eat with our eyes as well as with our mouths." Color is an important determinant of quality for a number of reasons. In fruits and vegetables it is an index of maturity; in meats it foretells freshness. In dairy products, color has been associated with butterfat content while in noodles and baked products, color provides a clue as to the presence of desired ingredients such as egg content. Artificial coloring is added to citrus crops to develop the characteristic color of the ripe fruit and in frozen green vegetables to provide an attractive appearance of the product.

Safeguards are taken to prevent loss of color in cured meats due to exposure to air or light or to bleaching of dried or canned fruits and vegetables as a result of the action of sulfur dioxide or chlorine. Similarly, the concentration of salts and the elimination or removal of trace amounts of metals are carefully regulated to prevent discoloration of food products (e.g. pickels).

Texture and body. Texture and body in food products refers to their structural make-up, variations of which have a great deal to do with acceptability of a number of foods. Consumer preferences for certain textural characteristics have led to descriptive adjectives such as "mealy" potatoes, "crisp" celery, "creamy" candy, "fluffy or fine-grained" cakes, "thick" cream, "flaky" pie crust. Determinations of characteristics such as spreading or pouring quality, viscosity, emulsifying ability, homogeneity, brittleness, toughness, etc. are of considerable importance for various food substances.
Flavor. Most foods have characteristic flavors that must be maintained. Accurate control of product ingredients contributing to flavor and aroma is essential if the food is to have desired palatability. Flavor and aroma are enhanced by roasting, fermentation, extraction, etc. Examples are coffee, sauerkraut and vanilla. Commodities such as fish, bakery products and fruit often give off odors that are objectionable. Products such as cocoa, coffee and spices lose their flavors on storage; others such as butter and bacon adsorb foreign odors. Unless handled properly, bacon and butter quickly become rancid.

Absence of defects. Defects generally refer to physiological or pathological imperfections in the foods or to faulty workmanship. Standards usually are established for the specific defect that is likely to be present in an objectionable proportion. These standards may be referred to as tolerances. In apple sauce, they refer to presence of bits of skin, core and seeds, mushiness, and wateriness; in canned peas, to presence of insect injuries or insects, to leaf- or stem-tissue and to broken, spotted or otherwise discolored seeds; in potatoes, to scabiness, irregular contour, discoloration, hollow hearts and sprouting; in eggs, to mottled shells or yolks, blood or meat spots, watery albumen, low yolk height, and green rot.

Performance and utility. Performance or utility of the product is a consideration of great importance for dried eggs; the injury sustained by the mucin due to shearing and to the action of heat prevents the product from reconstituting properly and, when used in cake formulations, results in flat, heavy products. Similarly, evaluation of the functional properties of popcorn, flour, dried milk, yeast, etc. is prerequisite to the acceptance of these commodities.

Keeping quality. In addition to satisfactory performance tests when used immediately, the product must retain desired quality until such time as the consumer would normally expect to use the product in the home. The expected shelf life for perishable commodities such as meat, milk, bread, bananas, lettuce, etc. contrasts sharply with that of dry staples such as sugar, flour, salt and corn meal. Keeping qualities of the latter foods are considered unsatisfactory if these products fail to function properly or become infested with insects shortly after purchase.

Wholesomeness. Wholesomeness includes such important considerations as freshness, cleanliness, purity and safety. Evaluation of freshness and cleanliness must be satisfying to the consumer at the time she selects many commodities such as fruits, vegetables, eggs, dairy products, meats and the like, or these products will be rejected without further attention. Purity and safety are not so readily determined but are essential determinants of quality. Various state and federal agencies maintain policing action to assure the consumer of receiving wholesome foods.
Nutritive value. Any consideration of a food product must include its ability to provide the necessary proteins, carbohydrates, lipids, minerals and vitamins that provide nourishment. While these constituents of the diet are essential, it must be recognized that most consumers give inadequate attention to the nutritional value and that, at best, the nutritive properties of foods can be appreciated only after the product has been utilized.

Economy. The cost of the product, to some extent, is determined in the light of its possession of the other characteristics named above and the values that the consumer places on these in the light of his wants or desires. Many attempts have been made to gain understanding of the relation of the price of the commodity in terms of its value to the consumer. In order to gain a better understanding of this relationship, two general types of survey are used: the market survey and the consumer survey. Market surveys do not present as complex a problem in the collection of data as do consumer surveys.

Limitations of Surveys in Determining Demand for Quality

Market survey. The market survey provides a quantitative measure of market preference, i.e. a picture of consumer choices in terms of price and the quantities and qualities purchased. Such choices may reflect preferences only roughly, i.e. establish an over-simplified relation between price and consumer preferences. Selections are not solely a function of price and quality of a particular product. Arrangement of foods in the store, proximity of the store to home, access to parking, store services, purchase incentives (e.g. trading stamps), credit privileges, volume of other goods purchased, types of display, and store personnel are a few other factors that require consideration. Also, the range of products and accuracy of labelling may limit the extent of choice. Morse\(^2\) states that, at best, the information secured pertains to past actions of consumers in the market and is applicable in the future only if allowances are made for changes in consumer preferences and changes in supply. A further limitation of the market survey is the inadequate information it reveals concerning the preferences of consumers. For example, the price-quality relationship may or may not indicate the ordinal relation of the consumer's preferences for various qualities. Some consumers may buy a lower-price quality even though they prefer the quality that is most expensive. Others may be indifferent with respect to qualities and will buy that which is lower in price while still other consumers may buy the lower-price qualities because they prefer them.

Consumer survey. The consumer survey circumvents the market and goes directly to the consumer. If well conducted, the information it supplies is restricted only to the extent of the consumer's ability or willingness to express

preferences. According to Morse\(^2\) two general types of preference surveys are recognized: (a) those intended to evaluate the status of consumer preferences and (b) those intended to search out and evaluate the influence of forces that have shaped their preferences and which might cause them to change. There are many difficulties encountered with consumer surveys. The cost of consumer surveys is often considerable. Wells\(^3\) estimated the cost of determining women's textile preferences at $35,000 to $50,000. One inherent weakness of the consumer survey is that it fails to measure the intensity of preference for one quality over another. Even if evaluations of the intensity of preference were sufficient to estimate market actions, such measurements would need to be weighted by the disposable income of the individual in order to secure an estimate of his willingness to pay more for one quality than another. Another criticism Morse\(^2\) made of this type of survey is that it attempts to secure information from the individual that she does not know or about which she has a nebulous concept she is unable to express.

**Assessments of Quality**

It has been shown that many factors contribute to the evaluation of food products. Therefore it is essential that satisfactory methods of control be employed. Probably no commodity that man uses is more stringently controlled, inspected, and regulated than is his food. Some years ago the federal government introduced grade standards for many fresh and processed foods to insure the buyer of uniform quality and to provide specifications that safeguard against the sale of unfit products.

**Grading.** The grading service provided by the United States Department of Agriculture is optional and, depending upon the agency requesting the service, may be charged to the seller, the processor or the buyer. Within certain limits, federal grades are intended to provide assurance to the seller and buyer that the commodity possesses a prescribed level of quality at the time of examination regardless of supply, demand, season, geographical location or shipping distance.

Meats, for example, may be graded in accordance with federal or with packer grades. When government grade standards are used, slaughter


livestock is evaluated on the basis of quality, conformation and finish of the carcass. Appearance is used as the index of quality. Form or shape, muscling and proportion of bone are used to evaluate conformation. Amount, quality, and color of fat within and around the muscle are considered in the judging of finish. For beef, seven U. S. Grades have been designated. These are: Prime, Choice, Good, Standard, Utility, Cutter and Canner. Government grading of meats has been censured as being archaic, arbitrary, and confusing and the specifications used in describing grade standards have been criticized as being subjective and insufficiently descriptive to permit the sorting of carcasses into homogenous groups.

Clifton and Shepherd\(^4\) suggested the use of an objective grade standard based upon weight, length and loin-eye fat thickness. They point out that other factors such as color, marbling, area of loin-eye muscle, etc. must also be considered before the final grading of the carcass can be made.

Several of the large packers argue that federal grading standards do not reflect consumer wants and that they will be better able to serve the consuming public if not limited by a federal grading system. Many packers prefer to use their own brand names to designate their better quality meats. Often names used in describing these products are chosen carefully so that they are properly flattering; for example, = Premium, Packer's Choice, Star and the like.

Standards used by packers are not uniform. In addition, some of the grade designations are needlessly complimentary. The terms "select" and "top select" are preferred by the industry to "standard" and "upper-" or "high-standard" for describing U. S. Standard carcasses. When one considers that "select" carcasses are inferior to the grades Good, Choice and Prime and that, in fact, a "select" carcass may be at the lower limit of the Standard grade, the layman's connotation of its desirability may differ considerably from that of the packer.

None of the methods of grading developed to date accurately foretell several of the factors that the housewife considers of greatest importance; namely, price, uniformity, color, tenderness, juiciness, and palatability. In other words they do not predict eating quality.

One of the greatest obstacles that must be surmounted in arriving at acceptable quality standards is the tendency of special interest groups to consider the desirability of the commodity in the light of their own wants and desires rather than from the point of view of the ultimate user. This sort of fallacious

reasoning often has been responsible for confusions and contradictions that arise later. An illustration in point is the recent decision of the United States Department of Agriculture to abandon grading of lamb and a few weeks later a retraction of this decision. The meeting leading to the mandate that lamb would not be graded beginning Jan. 1, 1960, resulted from deliberations of two factions---one opinion being represented by the wool producers, large meat packing firms and the American Meat Institute and the other by the small packers, chain stores, major farm organizations, and the Federal Grading Service. It should be pointed out that although the Federal Government had originally introduced grading "to provide consumers with a reliable guide to quality," no consumer groups were invited to participate in the discussion that led to the decision to abandon grading. A few weeks later when it became apparent to the Secretary of Agriculture that many important considerations had been handled in a rather cursory manner, the decision to abandon grading was reversed.

**Current Attitudes Regarding Quality**

At present, the viewpoint is taken that an imperfect measurement of quality, even though not entirely satisfactory, is better than none at all and that until more satisfactory methods of determining quality are devised, the elimination of grading serves little real purpose. The training and experience of men who are without a vested interest does provide a valuable service to the consumer. What is still needed, however, is a rating system that is simple, easily understood, practical and duplicable, and that will establish grade standards capable of separating carcasses into definite increments which will foretell the level of quality that the consumer wants.

Recently (Feb. 9, 1960) an editorial in the Des Moines Register indicated that "There has been a considerable shift in consumer preference for leaner pork in recent years = but so far (the packing) industry has made little progress in satisfying this preference despite valiant efforts by swine producing organizations and some packers to emphasize meat-type hogs." That American hog raisers and meat processors are paying insufficient attention to the importance of leaner, meatier hogs is witnessed by an annual importation of canned hams equivalent to the production of from 5 to 6 million hogs. Since these imported canned hams sell at a premium, it is evident that their excellent shape, size, leanness and slicing characteristics are in demand. As yet, agreement on methods of identifying these essential quality factors in carcass meats have not been developed nor have ways been found to establish the relationship of the original carcass characteristics to its final acceptability. Apparently some of the difficulty in satisfying consumer wants arises from the fact that the grower does not have proper incentive for producing types and kinds of hogs that consumers prefer. To some extent there is insufficient information regarding the kind of animal that is in demand and at the same time provides maximum return to the farmer.
Apparently the application of certain chemical agents such as the sulfonamides, diethyl stilbestrol, papain, ascorbic acid, and the antibiotics not only are reducing the incidence of disease in the livestock but are profoundly influencing methods of feeding animals, of making carcasses tender and attractive, and of enhancing color, palatability and storage life of meats. However, while providing these valuable services, specialists have not enjoyed equal success in making their knowledge understandable to the public and the use of "chemicals" is viewed with considerable suspicion. This common circumstance was ably outlined in a statement made by Richard S. Aszling before the Inter-Industry Conference on Chemicals in Foods sponsored by the Manufacturing Chemists' Association in New York, Jan. 15, 1952, which is quoted in part:

"Communicating successfully with large groups of people is not an easy thing to do... The job in communicating with the public is first and foremost one of semantics--that is, the translation of professional language into word-symbols that will get through to the public mind. The very word chemical itself is a handicap because it has adverse overtones. To many laymen, a chemical is something that smells bad, explodes, or poisons, and you can't blame them for not wanting one in their food. If you tell an average businessman that his wife added monosodium glutamate to his vegetable soup, he would probably suspect her of trying to collect his insurance. But you call the same substance "Accent," put it up in handsome packages, and advertise it with sophisticated copy in the New Yorker magazine, the same man will insist that his wife use it."
QUALITY IDENTIFICATION AND CONTROL OF DAIRY PRODUCTS

D. D. Deane

Dairy products offered for sale must meet certain standards relative to composition, healthfulness and freedom from adulteration. There are standards, for example, established by states as a control measure over the dairy products sold within their borders. For some dairy products, federal regulations concerning definition of product, identity and wholesomeness also have been established. In addition, certain dairy products which meet basic requirements as to composition and quality standards can be classified into various grades. Inspection and grade certification of farm products based upon established quality standards have been a part of our agricultural economy for many years. Fluid milk and milk products which are included in the Grade A program are under the jurisdiction of the U. S. Public Health Service and similar agencies. The dairy division of the Agricultural Marketing Service has the responsibility for developing grade standards for butter, cheese, nonfat dry milk and other manufactured or processed dairy products. This grading service is operated on a voluntary basis and performed upon the request of an applicant. Its purpose is to provide an impartial and uniform system of inspection and grading of dairy products for use by the dairy industry, city, state or federal government or others in setting up specifications for procurement needs.

A dairy products manufacturer operates within a framework of regulations and controls that establish certain standards his products must meet relative to composition and wholesomeness. In addition, some products can be given a grade designation as an additional criterion of quality.

Grade standards, to be of greatest value, should include the full range of marketable quality and should be based on factors that can be uniformly applied. They should reflect the essential commodity characteristics to be useful to industry and users of the product. Also, with respect to manufactured dairy products, in so far as possible, they should reflect the quality of the raw milk and sanitary conditions under which they were manufactured.

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The wholesaler can buy most dairy products by grade from the processor. What about the consumer? Can he do the same? The dairy product most familiar to the consumer that is sold bearing a grade label is Grade A milk. Grade A milk is produced and processed under regulations and standards based on those established by the U. S. Public Health Service. These requirements make it easier to produce high quality raw and processed fluid milk. The producer of Grade A milk receives a higher price for his product than if it were ungraded milk since it is utilized primarily as fluid milk, whereas the ungraded milk is used in producing manufactured dairy products which yield a lower return. Grade A producers tend to increase the size of their herds over a period of time. Since approximately 50 percent of all milk produced is used for fluid milk, would this mean that as Grade A milk production in an area increased above 50 percent of the total, some Grade A milk would be utilized as manufacturing milk at a lower price? This situation has not developed to any great extent since surplus Grade A milk from one area can be trucked for considerable distances to other areas in short supply.

What about manufactured dairy products? The original grading standards for cheese were developed in the early 1920's. They have been revised slightly since then with the most recent grade standard being issued in May 1956. There are four grades for cheese, namely: AA, A, B and C. Although there is no overlapping of quality between grades, a certain range or latitude in quality is allowed in each grade. As one goes down the scale, the range in quality within each grade widens progressively. Four quality factors are considered in establishing the grade, and these are: flavor, body and texture, color, and finish and appearance. Characteristics or defects of each quality factor are noted and classified, taking into consideration the age of the cheese. The final grade for any given cheese is established on the basis of the lowest rating of any one of the four quality characteristics. Detailed descriptions of the various grades are available for use by the graders.

It has been reported by Small that during the period of July 1956 through June 1957 the government purchased slightly in excess of 206 million pounds of U. S. Grade A paraffined cheddar cheese. An examination of the grading data on 55 million pounds of this, representing 16 states, showed that 91 percent met the standards for Grade A cheese, 8 percent was Grade B, and only .1 percent was below grade. Six states were represented in the

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summary of nearly 15 million pounds of rindless cheddar cheese offered to the government. Of this, 83 percent was Grade A, 16 percent Grade B, approximately 1 percent Grade C and less than 0.1 percent below grade. One might conclude from these figures that a relatively small amount of cheddar cheese made in the United States would not meet the quality standards for Grade A cheese. It is general knowledge in the industry, however, that a substantial amount of the cheese offered for sale to the government is screened before grading by official graders. Also, that approximately three-fourths of the cheddar cheese made in this country is not subjected to such grading, and that a significant portion of this would not meet Grade A standards. It is not too difficult to see then that work still remains to be carried out in improving cheese quality.

Butter is another dairy product for which grades have been established. The nomenclature for U. S. grades of butter, effective April, 1954, are as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. Grade AA</td>
<td>93</td>
</tr>
<tr>
<td>U. S. Grade A</td>
<td>92</td>
</tr>
<tr>
<td>U. S. Grade B</td>
<td>90</td>
</tr>
<tr>
<td>U. S. Grade C</td>
<td>89</td>
</tr>
</tbody>
</table>

The quality factors in grading are flavor, body and texture, color and salt. In general, if correctly processed, sweet cream produces Grade AA or A butter, while sour, farm separated cream produces Grade B or C butter. Butter labeled as to grade can be purchased in some areas. At the present time nine states have some type of a grade labeling program for butter. Seven of these, Minnesota, Wisconsin, California, Idaho, Michigan, South Dakota and Mississippi have a mandatory grading program. Two others, Iowa and Kansas have voluntary programs wherein the manufacturer may grade label his butter if he desires, but he is not required to do so. The grades used by most of these states are based on the U.S.D.A. standards although 89 score butter is labeled "Under Grade" rather than Grade C. The Michigan law, however, states that butter scoring less than 90 score be labeled "Under Grade." No label is required for butter scoring 90 or over. These nine states produced over 67.6 percent of the nation's butter in 1957.

Those who favor grade labeling believe such a program will bring about an improvement of butter quality which will, in turn, lead to greater consumption of this product. Well, although California has had a grade labeling program for butter since 1935, Wisconsin was the first of the major

butter producing states to enact such a law -- in October 1953. In 1953, 25 percent of Wisconsin's butter was of 89 score - or "undergrade" according to their grade label. In 1958 "undergrade" butter was virtually nonexistent in Wisconsin, amounting to less than 5 percent of the state's butter production. 5/ Butter manufacture in Wisconsin is increasing. In 1957 they produced 42.7 percent more butter than the average for 1951-1955. A short time ago Wisconsin was third in butter production, behind Minnesota and Iowa. Now Wisconsin rates second and Iowa third.

Those favoring grade labeling emphasize four factors necessary for a successful grade labeling program. 5/ These are:

1. There must be a definite need for such a program.
2. The proposed program must be completely and extensively explained to all members of industry and the consumer.
3. The program must be properly administered.
4. The program must receive full cooperation of industry.

A survey was conducted of every state department of agriculture to determine the degree of interest in grade labeling of butter. 6/ Not a single state department of agriculture went on record as opposing consumer grade labeling as such, although some stated they didn't believe such a law would be practical in their state at present. This latter group fell into one of two categories: (1) states in which butter was produced primarily from farm separated sour cream and this would fall into the lower grades and (2) states in which butter production is so minute that no need for such a law is recognized. There was an active interest in grade labeling of butter in Colorado, Tennessee, Nevada, North Carolina, Ohio and New York. 4/

Grade labeling is not endorsed by everyone in the butter industry. The American Butter Institute has taken a stand against grade labeling calling it "unrealistic" and "inaccurate." 5/ This organization believes consumer grade labels have a tendency to give consumers a false sense of security because the consumer is led to believe that the grade remains unchanged from the time it leaves the manufacturer until it is used by the consumer, regard-


less of treatment. They also point out that butter will not always be scored uniformly if graded by several inspectors. The American Butter Institute reported on a survey made of 26 samples of butter from 20 retail outlets in the Milwaukee area. \(^5\) These samples were regarded by U.S.D.A. graders and graders from two large butter distributors. According to the ABI the results showed wide discrepancies between the grade printed on the package and grade as determined by the U.S.D.A. and private graders. In answer to this, however, the Wisconsin Department of Agriculture stated that a study by "many authorities" of the results revealed loopholes disproving the conclusions reached by the American Butter Institute. The ABI denied this and stood by the results of its survey.

Some segments of the butter industry believe that brand labeling rather than grade labeling is the most effective way to improve quality. With brand labeling each organization would promote the use of its own brand and would control its quality factors.

The butter industry is very much aware that the per capita consumption has dropped from more than 18 pounds in the 30's to approximately 8.5 pounds at present. They also know that consumption of margarine has increased until people are now using more margarine than butter. Naturally, the butter industry would like to see butter consumption increased. When you look at other products that are highly successful in competing for the consumers' dollar, you find:

1. Product that is attractively packaged.
2. There is an effective merchandizing program to promote sales.
3. Product of uniformly good quality.

How about the butter industry? Well, they are:

1. Doing a fairly good job on packaging.
2. Doing more on promoting butter in the past few years through American Dairy Association than ever before.
3. But what has been done about quality? - Here is where those advocating grade labeling or brand labeling believe their respective programs can help.

Might it not also be helpful to determine the factors affecting consumers' choice of butter or margarine, for example, and determine if quality is one of the more important of these factors? Studies have been made to determine the importance of such factors as income, nationality, price differential,

size of family, education and age of homemaker on choice and consumption of fats and oils.

A study in Minnesota\textsuperscript{7} showed that in 1952 more than one-third of the families interviewed used margarine, although at that time butter was the predominant spread used. About 60 percent of the families used butter alone, 10 percent consumed only margarine and 30 percent used both. This study indicated that income, nationality and size of family influenced the relative consumption of butter and margarine the greatest, with family income the most important of all. As family income increased, the consumption of butter increased and that of margarine decreased. The total fat consumption remained nearly the same for all income levels. The price of butter was considered the most important factor in the increase of margarine consumption. Also, price differential between two products was important.

Surveys made of Michigan families in 1949 and 1954 showed different results.\textsuperscript{8} In 1949, 59 percent of families used only butter, 20 percent used only margarine and the remaining 21 percent used both. In 1954, only 38 percent used butter alone, 29 percent only margarine and 31 percent used both. In 1949, 83 percent of those not using butter said it was too expensive; in 1954, 59 percent of those not using butter gave the same reason. In 1949, 11 percent of the families had no preference for butter over margarine. In 1954, 33 percent had no preference. Taste was the main reason given for using butter rather than margarine.

A consumer panel study, comprising 40 families, was carried out in South Dakota in an attempt to determine whether the U.S.D.A. grading system for grading butter agreed with the preference of the consumer.\textsuperscript{9} The butter samples used were manufactured, graded and coded by the Dairy Department of South Dakota State College. Half the Grade A butter was made with starter culture to accentuate the desired aroma and flavor of the butter. Besides Grade A butter made with and without culture, the study also included Grades B: and C butter and margarine. Two adults, usually husband and wife, were asked to compare and rank two half-pound samples of butter or margarine.

\textsuperscript{7} Cox, Rex W. "Competition Between Butter and Margarine, Minneapolis, 1952." Minn. Agriculture Experiment Station Bulletin, 417. 1953.


rine received each week. The samples were identified only by code. Every family received the four samples of butter and one sample of margarine in all possible combinations over a 10-week period.

The findings of the survey indicated that these 40 families preferred a high quality butter with flavor and aroma found in cultured Grade A butter, followed by Grade A butter without culture, Grade B and Grade C butter with margarine last. It should be mentioned that the butter grader, and several panel members felt the quality of the margarine samples was below average.

A survey was conducted in Oklahoma with 216 households on consumer preference for butter or margarine. Both urban and farm families were studied. From the standpoint of flavor the urban consumers preferred Grade A butter, followed by AA, B and margarine, while the Grade C butter was last. These consumers felt that Grade A butter had more flavor than Grade AA. Those living on farms ranked AA butter first and Grade A butter second. However, when these products were ranked as to preference on the basis of spreadability due to body and texture, margarine was ranked first followed by Grade A, AA, B and C butter. Butter was preferred over margarine on the basis of such quality factors as taste, cooking qualities, appearance and what was expressed as a higher food value. Margarine was preferred on basis of uniformity and spreadability. Price also was a factor in determining which table spread was used. Where customers were asked if they would use more butter if butter was the same price as margarine, 72 percent said yes and 23 percent answered no. When asked if they would use less margarine if it sold at the same price as butter, 65 percent said yes, but 31 percent said they would still buy margarine. This, to the butter manufacturers, is a disturbingly large number that would pay such a high price for margarine. Evidently, to some, the spreadability and uniformity of product are important quality attributes. An attempt was made to determine what was considered a fair price for butter of the quality found in Oklahoma at that time. The survey showed that butter sold at 46 cents per pound would be considered a good buy by 50 percent of those interviewed.

There are those, however, who make a high quality product and sell it at premium prices. One example is a plant at Ladysmith, Wisconsin. Since the Grade AA butter found on the market usually has a rather flat flavor, they make Grade AA cultured butter. All their butter is sold to the retail trade in some 22 states. They found the average consumption of this butter in 100 families in the south was 52 pounds per person. A survey conducted among Wisconsin consumers of their butter showed an annual

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per capita consumption of more than 52 pounds. This would seem to strengthen the belief of those who believe that while inferior butter has a competitor, margarine, high quality butter with a flavor the consumer likes has no competitor.

A recent American Dairy Association survey, however, points to prestige as the housewives' most powerful motivation to serve butter. H. C. Christians, of Chicago, a large butter wholesaler, believes if this is what the housewife wants she should be able to get it. They believe, too, that the flavor of most high quality butter sold today is too bland. Also, that butter labors under a pricing structure tied to a fluctuating national market. This structure accents low profit margins that do not permit energetic promotion of butter. One million dollars was spent in 1958 promoting butter; 18 million were spent on margarine. H. C. Christian, therefore, has based their new program to sell more butter on what they call the 4 P's.

1. **New Product.** Made from sweet cream, cultured to provide "deep-bodied, farm churned flavor." Has improved spreadability. To be called "Pride" butter.

2. **New Package.** Use double foil packaging with a design of an old fashioned churn on carton, wrapper and embossed on quarters of butter themselves - a carry-through of prestige identity.

3. **Promotion.** National distribution and handled exclusively by home delivery dairies - backed by money back guarantee. There is an introductory offer of one free pound of butter provided the customer agrees to buy four pounds at regular price within next thirty days. Also a customer booklet introducing and describing the product.

4. **Price.** Product is priced at 71 cents to dairy and suggested retail price is 84 cents except on west coast--(86 cents).

This program is just getting started. I am sure it will be watched with interest by the butter industry.

These two examples illustrate one approach to the problem of increasing the demand for dairy products. That is to produce and manufacture dairy products of high quality. Of the quality factors used in grading dairy products, the one assigned the greatest value by those responsible for grade standards is that of flavor. I think all would agree that flavor plays a very important role in milk consumption. Those who drink milk do so because they like it. Parents admonish their children to drink milk for reasons of health, in other words because "It's good for you". Actually the average young person doesn't concern himself too much with the problem of health. He drinks milk because he likes it as a beverage; it tastes good.

Today the entire food industry is taste and flavor conscious and makes use of taste panels in its attempts to achieve and maintain superiority of flavor.
The dairy industry, too, is forced to place more emphasis upon the flavor of its products in order to meet competition of other foods. It also is important with respect to competition within the dairy industry itself. Consumers are often enticed to a certain brand of dairy products because of the superiority, to them, of some organoleptic quality. The dairy industry certainly cannot afford to ignore or minimize the importance of flavor in dairy products.

Improved facilities for production, handling and transportation of milk and better processing methods make possible the marketing of milk products of excellent quality. We have mentioned the importance of flavor; there are other quality factors perhaps not as easily observed by the consumer. The milk must be clean, free of adulteration and pathogenic organisms. It should have a low bacteria count. If consumers can buy a wholesome, nutritious, reasonably priced product with a consistently good flavor, they are likely to be satisfied consumers.

These quality characteristics, of course, do not just happen. They are a result of supervision of the product from the time it leaves the cow until it reaches the consumers' table. In other words, a result of quality control. There are at least three, and sometimes four, groups involved in the control of quality of dairy products. Let us briefly consider the responsibilities of each group.

First, the producer. Milk has been called nature's most perfect food. As it come from a healthy cow, this is no doubt true. It is wholesome, clean, fresh and good. This is the point where its true quality must be measured. We can protect and prolong the life span of this intrinsic quality. We can even eliminate certain undesirable flavors, but we can't really improve the quality itself. It is obvious then that if we are to market a high quality finished product, we must have a high quality raw product. This is the role and the responsibility of the milk producer - to make available a high quality raw product. To do this he should have:

1. Disease free animals.
2. Good water supply free from contamination.
3. Milk house and milking barns or parlors of proper design and properly equipped for taking care of milk, including cooling.
4. Employees free of communicable disease.

There is another factor. He must be genuinely interested in producing high quality milk. One fact that helps achieve a motivation toward the goal of high quality milk is that there is a direct correlation between the quality of the milk and its monetary value to the processor.
The milk producer, of course, does not have all responsibility for the quality of dairy products. The processor also plays an important role.

A well-organized, efficient and aggressive processing plant will have an effective quality control program and a well equipped laboratory. The equipment need not be elaborate, but it must be adequate to do the job efficiently. The laboratory must be staffed, too, by someone trained in this field. One aspect of a quality control program is to carry out a program of quality control on the producers' farms through a farm inspection and education program. To do this effectively a well-educated and well-trained fieldman is necessary. The fieldman serves as a liaison agent between processor and producer. He helps producers solve problems that arise in their efforts to produce quality milk. The fieldman can explain results of laboratory tests carried out by the quality control laboratory. The fieldman must be competent, fair and a good diplomat if he is to gain respect of the producer. He must gain the respect of the producer to be effective.

Once the milk is brought to the processing plant, quality control becomes the responsibility of the processor. In brief, laboratory tests must be made on both the raw and finished product every day. Routine checks should be run daily on the operation and performance of all plant equipment. Cleanliness and sanitization of the equipment is checked periodically to prevent a build up of milkstone and other contamination. It has been estimated that one-third of the labor involved in processing and packaging milk and other dairy products is devoted to cleaning and sanitizing the equipment and premises. The processing plant, through its quality control program, attempts to insure that it is selling dairy products that meet the high standards required if they are to find a market. From this point on, the retail stores, if involved, and the consumer can, by their actions, help maintain this high quality or bring about deterioration. Milk, if it is to be held, must be held at a temperature below 40°F. if bacterial growth is to be restricted. If in a clear glass bottle it should be kept out of as much direct light as possible. In the store the milk and other dairy products should be kept in a separate dairy case. At home, care should be taken to keep the containers closed. The average home refrigerator contains a strange and wonderful collection of foods each with its particular odor, and milk and other dairy products have the ability to pick up alien odors - odors not necessarily bad until they get into the milk. All too often the producer or processor is believed responsible for deterioration of milk quality that occurred in the retail store or in the home itself. The proper care of milk in the retail store or home is not a demanding task. On the contrary, it is merely the application of common sense procedures in a routine fashion. But, like the products it involves, the dividends are far in excess of the cost.

To briefly summarize then, quality control is the responsibility of not only the producer and processor, but also the retailer and the consumer. The realization of this by those concerned is important since many in the dairy
industry believe that with the aid of more effective quality control, dairy products of higher quality and greater consumer appeal can be produced. Any resulting increase in consumption should be beneficial to both producer and processor and a uniform high quality would be a consumer benefit as well.

I have mentioned some of the factors affecting consumer acceptance or preference in dairy products. They vary to some extent with the product concerned.

Such things as nationality, diet habits, product familiarity, family size and age distribution are affecting consumer preference. Price or price differentials affect consumer choice of product, such as choosing between butter and margarine. The quality characteristics of the products themselves are very important. These include body and texture characteristics, color and appearance. Uniformity of product is essential. The quality characteristic I believe most important in all dairy products is flavor. The dairy industry of today cannot minimize the importance of flavor in their attempts to increase consumer demand for dairy product. Someone has said, "flavor is the voice of food." Flavor should be such that the voice is pleasing and uniformly so from day to day. People may be told a great many times of the high nutritive value of dairy products but unless they have what might be termed an excellent eating quality consumer demand will not reach its full potential.
PRICE AND DEMAND EFFECTS OF RECENT DEVELOPMENTS IN MARKETING AND CONSUMPTION:

I. MARKET STRUCTURES AND PRICING IN SELECTED AGRICULTURAL INDUSTRIES

Wilbur R. Maki

Recent studies of firms engaged in agricultural marketing activities show these firms using various means to control the factors affecting their profit accounts. These controls are effected in the manipulation of product, price and merchandising. Marketing, thus, has come to mean "a systematic integration of product planning, procurement, manufacturing and merchandising." 1/

The broad changes in marketing have been achieved partly by shifts in market structure. In the retail food market, for example, one-stop automobile shopping, private brand development, management changes in sales and marketing, and price-specification buying have evolved through the profit policies of firms. In several food industries, the number of plants has decreased, and the output per plant has increased. According to a recent report on the food marketing industries, "Shortage of capital, overcapacity in the industry, an inadequate or uncertain supply of raw materials, and other unfavorable prospects for profitable operation have caused some plants to be closed rather than modernized." 2/ Changes have occurred also in ownership and diversification among companies in a number of food and fiber industries. 3/

Other studies of changing food consumption patterns have pointed to the subtle influence of technology on the whole pattern of consumer interest. 4/

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A growing concern with nutrition parallels a preoccupation with "the gadgetry of food preparation and service." Concern with nutrition has helped to improve our diets. This interest is associated with shifts in consumption patterns, including a declining per capita consumption of pork and lard.

Concern with modern kitchen gadgetry may represent a shift in status values from food itself to the equipment used in its preparation. Moreover, new convenience foods, or foods which economize on the time of the housewife in food shopping, meal preparation and meal planning, have increased as much as five-fold in total sales since 1950. These developments have accompanied an increase in the proportion of our labor force which is comprised of "working" housewives.

Most striking of all is the rapidly growing importance of advertising and promotion in the consumer markets. An increasing proportion of our resources is committed to "want creation." Advertising is described by one writer "as distinctively the institution of abundance."

What, then, are the effects of the recent developments in marketing and consumption on farm prices and the demands for farm products, particularly meat products? In this section of our presentation, an attempt will be made to review the effects of changes in the structure and organization of livestock markets on price (and profit) performance in the livestock industries. Of particular interest are the buying and selling activities in the primary livestock markets insofar as these activities influence farm prices of livestock.

**Market Structures in the Livestock Industries**

Individual plants, firms and associations of firms -- the essential elements of market structure -- vary in size, location, degree of product differentiation, and the nature and extent of specialization or integration. If the technological, market and organization decisions of the firms display a similar structural pattern, the firms belong to the same industry. Because livestock production, marketing and slaughtering differ with reference at least to the nature of the production processes (and specialization), firms

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5/ Fortune Magazine, "The 'Ordinary' $125-Billion Market", September, 1959


in these activities belong to several different industry groups. These firms also belong to different markets insofar as they are in different industries and different areas of competitive behavior. The pricing system, however, serves to coordinate the activities of different businesses operating in the various livestock and meat markets.

Whether or not the livestock and meat markets perform satisfactorily depends upon the particular criteria used to evaluate performance. For example, livestock markets are unable to reimburse each livestock producer for the exact derived market value of the livestock sold. Livestock producers cannot always depend upon adequate price differentials to compensate for possibly higher production or related costs associated with the more desirable meat-type of livestock. The pricing system thus fails to function with the desired degree of precision or persuasion. In this connection, some underlying conditions of pricing performance in the Iowa livestock industries are examined in the following discussion.

In Iowa, the livestock industries comprise 180,000 livestock producers and over 1,200 livestock markets. In a recent year -- 1956 -- Iowa livestock producers sold 4,398,000 head of cattle and calves and 20,110,000 head of hogs and pigs, of which 82 percent and 91 percent, respectively, were slaughter livestock. In addition, purchases of feeder and breeding livestock included 2,783,000 head of cattle and calves and 3,107,000 head of hogs and pigs.

Iowa slaughtering plants handle an annual kill equivalent of 75 percent of the Iowa farm marketings of cattle and calves and 70 percent of the Iowa farm marketings of hogs and pigs. Most of the packer purchases of livestock are directly from farmers or through salaried packer buyers and dealers operating on a commission basis. Of the 25 federally inspected slaughtering plants in Iowa, 10 employ more than a 1,000 workers per plant and slaughter the equivalent of a million hogs or more (table 1). Hence, no more than 10 slaughterers (several operate more than one plant in Iowa) account for practically all of the meat production in Iowa. Since slaughter livestock are bought from many different sellers and market sources, the livestock market structure in Iowa is characterized by a complex size distribution of firms representing the major groups of buyers and sellers -- the packers, the primary market operators and the livestock producers.

Meatpacking establishments differ in the degree of specialization or integration. Most large plants are diversified, integrated operations involving processing as well as slaughter of two or more species of livestock. Many plants of smallish or medium size (i.e., 20 to 249 employees) are highly

specialized and some also represent large-scale operations. Because of the lack of integration of slaughtering and processing, personnel and capital requirements are much smaller for these plants. Hence, entry into the industry via this route is relatively simple. The specialized slaughterers, however, must sell their outputs in a highly competitive dressed meat market (unless the individual specialized plants are part of an integrated meatpacking business). Thus, the less efficient or flexible of these slaughterers find a profitable level of operations quite difficult to maintain.

Table 1. Percentage of Meat Packing Establishments Reporting Specified Average Number of Employees Per Establishment in 1954. a/

<table>
<thead>
<tr>
<th>Employees per Establishment</th>
<th>West</th>
<th>North-central States</th>
<th>East</th>
<th>Other</th>
<th>Total</th>
<th>Other</th>
<th>United</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iowa</td>
<td>Other</td>
<td>States</td>
<td>States</td>
<td>States</td>
<td>States</td>
<td>States</td>
</tr>
<tr>
<td></td>
<td>(percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 19</td>
<td>34.9</td>
<td>55.9</td>
<td>52.6</td>
<td>64.4</td>
<td>60.4</td>
<td>60.6</td>
<td></td>
</tr>
<tr>
<td>20 to 49</td>
<td>14.0</td>
<td>13.8</td>
<td>14.8</td>
<td>19.4</td>
<td>17.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 to 99</td>
<td>11.6</td>
<td>11.6</td>
<td>11.6</td>
<td>8.2</td>
<td>9.0</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>100 to 249</td>
<td>11.6</td>
<td>7.6</td>
<td>8.2</td>
<td>6.2</td>
<td>6.1</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>250 to 499</td>
<td>2.3</td>
<td>2.7</td>
<td>2.6</td>
<td>3.6</td>
<td>2.7</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>500 to 999</td>
<td>2.3</td>
<td>1.3</td>
<td>1.5</td>
<td>1.4</td>
<td>1.9</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>1,000 and over</td>
<td>23.3</td>
<td>7.1</td>
<td>9.7</td>
<td>2.1</td>
<td>0.5</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

| Number of establishments   | 43    | 225                  | 268   | 585   | 1,514 | 2,367 |

a/ Based on U.S. Census of Manufacturers.

The 1954 data on the size distribution of meatpacking plants show a somewhat smaller than expected percentage of establishments of intermediate size -- 250 to 999 employees. In fact, four logical size classes of meat

10/ A cumulative log normal distribution of establishments according to the number of employees per establishment was used to identify the four size classes of plants. For further discussion of technique in the analysis of size distribution of firms, see Herbert A. Simon and Charles P. Bonini, "The Size Distribution of Business Firms," American Economic Review, 58: 607-617, 1958.
packing plants are suggested by these data: 1 to 19 employees, 20 to 249 employees, 250 to 999 employees, and 1,000 employees and over. The first group of plants services a small local market and mostly would tend towards relatively low levels of efficiency. The second group includes many efficient but specialized slaughtering operations, which vary in scale of operation all the way from small to large. The fourth group of plants includes largely the integrated operations of the largest packers. Perhaps the intermediate size class of plants, though quite large as specialized operations, are rather small as single plant firms to effectively complement a national distribution organization. Thus, the size distribution of meatpacking plants is affected by the extent of diversification and vertical integration among these plants. Specialization among plants under the same ownership, however, complicates the picture of size distribution as related to the functional differentiation of plants.  

In summary, differences in the size, location, nature and extent of specialization of meat packing plants, degree of product differentiation, and the condition of entry to the market describe the market structures in the livestock industries. Moreover, these elements of market structure affect pricing performance and establish the conditions of competitive behavior among firms. 

Firm Behavior and Pricing

A systematic review of firm behavior and pricing appropriately might start with a formulation of the relevant economic relationships involved in the firm's decision making. For example, the pricing of livestock at primary markets can be described in terms of a single meat packing enterprise engaged in the pursuit of business profits. The profit account of this

11/ Technology tends to promote a smaller scale of operations but not necessarily a smaller scale of organization. For a discussion of the effects of technology on scale of operations in widely different industries, see John M. Blair, "Does Large-Scale Enterprise Result in Lower Costs? - Technology and Size," *American Economic Review*, 38:121-152, 1948.


13/ Oxenfeldt suggests that "while systematic differences in performance in industries can be attributed in moderate measure to their structure, important aspects of industrial performance lie outside their structure characteristics." For a thoughtful discussion of market characteristics that influence price behavior, see: Alfred R. Oxenfeldt, *Industrial Pricing and Market Practices*, Prentice-Hall, Inc., New York, 1951.
enterprise can be represented by the net profit identity

\[ \Pi = \sum_{i=1}^{f} p_i x_i - \sum_{j=1}^{g} q_j y_j - \sum_{k=1}^{h} r_k z_k \]  

where the letters \( p, q \) and \( r \) represent, respectively, the prices of the meat outputs, \( x \); the livestock purchases, \( y \); and the labor and other complementary inputs, \( z \). The subscripts, \( i, j \) and \( k \), denote the different classes of outputs and inputs in this enterprise. Thus, the net profit of the firm is expressed as an accounting relationship—the difference between total revenue and total expenditure. 14/4

Some additional relationships are relevant in describing the market behavior of this firm. The engineering or technical conditions of the firm are represented by the product yield and production equations. The predicted quantity of product output, \( x_i \), and the predicted quantity of complementary input, \( z_k \), are obtained with two equations,

\[ \hat{x}_i = \sum_{j=1}^{g} \alpha_{ij} y_j, \quad \text{and} \]
\[ \hat{z}_k = \sum_{j=1}^{g} B_{kj} y_j, \]

where the symbol \( \alpha \) denotes the relationship between a given number of cattle, calves, or hogs, and the output of beef, veal or pork, and where the symbol \( B \) denotes the amount of labor or other inputs required to slaughter and process each unit of livestock. Again, the subscripts pertain to the individual classes of inputs and outputs. Product outputs and complementary factor inputs are not related exactly to the quantity of livestock purchased because of variability in the quality of livestock inputs or because of other factors affecting the dependent variables, \( x \) and \( z \). These additional factors are not included explicitly in equation 2. Hence, the two dependent variables are estimated subject to some degree of estimation error. 15/

14/ Considerable practical difficulty can be expected in identifying revenue-generating outputs with the precise inputs used in producing these outputs. Therefore, an exact measure of profits for a given time period would not be a reasonable expectation. Nevertheless, the accounting relationship offers a point of departure when conceptualizing about ideal data requirements for decision making.

15/ Numerous attempts to derive input-output relationships from survey or time-series data have been reported, of which the Douglas studies perhaps are the most notable. A rigorous methodological discussion on this subject is presented in a monograph by Ronald W. Shepherd, Cost and Production Functions, Princeton University Press, Princeton, New Jersey, 1953.
The market demands for the aggregate product outputs and factor inputs of the meat packing industry also are relevant in describing the behavior of this firm. Symbolically, the output and input market demands are represented by the functional forms

\[
\hat{P}_i = \sum_{i=1}^{F} A_{ii} X_i i + \sum_{i=1}^{F+1} A_{i*i} X_i i
\]

\[
\hat{Q}_j = \sum_{j=1}^{G} B_{jj} Y_j j + \sum_{j=1}^{G+1} B_{j*j} Y_j j
\]

\[
\hat{R} = \sum_{k=1}^{H} C_z z k + \sum_{k=1}^{H+1} C_z z k
\]

where \( \hat{P} \), \( \hat{Q} \) and \( \hat{R} \) are the predicted average market prices of the aggregate meat output, \( X \); the aggregate livestock purchases, \( Y \); and the aggregate complementary inputs, \( Z \). The variables, \( X_{F+1} \), \( X_{F'*} \), \( Y_{G+1} \), \( Y_{G'*} \), and \( Z_{H+1} \), \( Z_{H'*} \), are other specified factors, such as personal income and assets, affecting market prices of livestock or meat products. Additional factors may affect market prices, but these are not included among the explanatory variables in the regression model. Again, the dependent variables are subject to some degree of estimation error. 

A supply relationship for livestock is involved also. This relationship shows the level of farm marketings of livestock at different levels of prices and other supply determinants. The prediction equation is of the form

\[
\hat{Y} = \sum_{j=1}^{G} D_{jj} Q_j j + \sum_{j=1}^{G+1} D_{j*j} Q_j j
\]


17/ Though the methodology of supply estimation is somewhat less advanced than the estimation of demand, several studies are available in this area, of which the most recent is by Gerald W. Dean and Earl O. Heady, Changes in Supply Functions and Supply Elasticities in Hog Production, Iowa Agr. and Home Econ. Exp. Sta. Res. Bul. 471, 1959.
where \( Q \) represents the major factors affecting farm marketings, including market prices, \( Q_1, \ldots, Q_G \), and other specified market conditions, \( Q_{G+1}, \ldots, Q_G \).

Finally, the internal activities of the firm are related to the output and input markets through the firm's own product demands, its pricing practices and its market share. The product demand function is simply

\[
\hat{x}_i = \sum_{i=1}^{g} V_{ii} P_i + \sum_{i=t+1}^{g} V_{i*1*} P_{i*1/2},
\]

where \( \hat{x}_i \) is the predicted quantity of the \( i \)th product sold, \( P_i \) is the price of the firm's product \( x_i \), and \( P_{i*} \) is the specified nonprice or market price variable accounting for changes in the sales or output quantity, \( x_i \).

Though the techniques of estimating market demand for an entire product, such as beef or pork, are quite sophisticated and reliable, the techniques employed to estimate the demand for a single firm's output are rather limited. Generally, packers are able to determine the most profitable price they could charge without estimating demand because they face a "kinky" demand curve or because they simply adjust to the market. Price reductions by one firm, for example, are quickly followed by comparable price reductions among competing firms while price increases by the one firm generally are not followed by corresponding price increases among competing firms. Or, inventory accumulations may trigger a series of price reductions among a group of packers which serves to encourage retail orders and a gradual depletion of excess inventories. Thus, the pricing system may operate quite effectively without extensive market knowledge on the part of individual sellers and buyers.

Another internal phenomenon for each meatpacking firm is its unique market price relationship. If the firm "follows the market" quite closely, its product prices would be described by the equations

18/ Some large firms make use of "consumer panels" and "test markets" in connection with their new product development activities. Most meat, however, is sold in fresh form under a system of federal grades. Hence, small differences in price among sellers of a given federal grade would result in large differences in their sales, unless compensating factors exist to differentiate sellers in terms of the services offered. In either situation, sales forecast might be prepared on an annual, quarter-year or weekly basis for the outputs of an individual company. These forecasts would be improved, however, by additional information about the effects of specified decision variables on sales, as indicated in the report on Forecasting in Industry, Studies in Business Policy, No.77, National Industrial Conference Board, Inc., New York, 1956.
\[ \hat{P}_i = a_i + a_{ii} P, \quad (6) \]
\[ \hat{q}_j = b_j + b_{ji} q, \quad (6') \]
\[ \hat{r}_k = c_k + c_{kl} R_k \]

where \( a, b \) and \( c \) denote the change in the firm's predicted prices, \( \hat{P}, \hat{q} \) and \( \hat{r} \), associated with a one-cent change in the appropriate market prices.

Lastly, the total purchases of the firm may be prescribed by the form
\[ \hat{y}_j = d_j + \lambda_j Y_j \quad (7) \]

where \( \lambda \) is the firm's market share of the \( j^{th} \) input, \( Y_j \). If the firm purchases only a small percentage of the total slaughter livestock, its procurement activities would not involve speculation about adverse competitive effects associated with rising (or falling) market shares. A large firm, however, is restrained by a market strategy aimed towards a certain predetermined share of the total industry purchases.\(^{19}\)

The firm theoretically seeks its profit objective by varying the inputs, outputs and prices until any further change in any variable reduces total profits. The most profitable level of operation, however, depends upon the relevant prices, quantities and price-quantity relationships specified earlier.\(^{20}\)

Inasmuch as the level of livestock purchases establishes the level of meat output, the former represents a critical decision variable of the firm.

Several planning periods are involved in the livestock pricing process. To illustrate, meat buyers place their orders with packers sometime before the delivery date. These orders ordinarily are fulfilled even at a loss to the packer. Furthermore, if the planning period is extremely short, most costs


\(^{20}\) Cutting tests made daily in larger plants provide management with current cost and selling price data, but no adjustments are made in these tests for deviations of current output from the output levels on which the cost data are based. In practice, daily prices are established on the basis of a number of relevant factors, as suggested by A. D. H. Kaplan, Joel B. Dirlam and Robert F. Lanzillotti, Pricing in Big Business, The Brookings Institution, Washington, D. C., 1958, p. 40.
are fixed. Therefore, the supplies of livestock and the market demand for
meat are basic determinants of livestock prices in the extremely short-
run production period. During longer planning periods, however, the firm
may contemplate alternative levels of sales, prices and overall plant
management.

Prices among specified market classes of livestock in the long-run are
established at levels prescribed by the livestock supply function (equation
4), the market demand function (equation 3), and the market price relation-
ship (equation 6). Theoretically, livestock purchases can be varied until
a set of optimum livestock prices are obtained for the specific meat packing
plant. 21/ The optimum set of prices are shown by a set of g (i.e., \( q_1, \ldots, q_g \)) price relationships,

\[
\begin{align*}
q_1 &= \left( \sum_{i=1}^{f} \left( \frac{p_i + x_i \frac{\partial P_i}{\partial x_i} \frac{\partial P_i}{\partial x_i} \frac{\partial X_i}{\partial x_i}}{\frac{\partial P_i}{\partial x_i} \frac{\partial Y_i}{\partial x_i}} \right) \frac{\partial X_i}{\partial Y_i} - y_1 \frac{\partial q_1}{\partial Y_1} \right) \\
q_g &= \left( \sum_{j=1}^{g} \left( \frac{\partial Y_j + y_j \frac{\partial Q_j}{\partial Y_j} \frac{\partial Q_j}{\partial Y_j}}{\frac{\partial Y_j}{\partial Y_j}} \right) - \sum_{k=1}^{h} \left( r_k + z_k \frac{\partial r_k}{\partial z_k} \frac{\partial r_k}{\partial z_k} \frac{\partial z_k}{\partial z_k} \right) \frac{\partial z_k}{\partial Y_1} \right) \\
q_{g-1} &= \left( \sum_{j=1}^{g-1} \left( \frac{\partial Y_j + y_j \frac{\partial Q_j}{\partial Y_j} \frac{\partial Q_j}{\partial Y_j}}{\frac{\partial Y_j}{\partial Y_j}} \right) - \sum_{k=1}^{h} \left( r_k + z_k \frac{\partial r_k}{\partial z_k} \frac{\partial r_k}{\partial z_k} \frac{\partial z_k}{\partial z_k} \right) \frac{\partial z_k}{\partial Y_1} \right)
\end{align*}
\]

The pricing model represents an intermediate stage in the derivation of the
optimal set of purchase prices. Each of the variables applicable specifically
to the firm, i.e., \( p_i, x_i, y_j, r_k \), can be related further to the
relevant market prices and quantities using the equations cited earlier.

21/ Firms typically react to changes in livestock prices by changing pro-
cessing margins or kill schedules, but in either case an optimal set of
prices would exist which equates marginal revenues with marginal costs
and which, in the long run, covers total unit costs. For a discussion of
sources of price variation in the meatpacking industry, see Elliott S.
Clifton "Effect on the Meat Packing Firm of Short-Run Price Variations in
When purchase quantities rather than prices are used as the dependent variables, a more useful representation of optimal firm behavior is obtained. In equation 8, however, each of the variables can be related to the input variable, $Y_j$, and thus the effect of changes in aggregate supplies on livestock prices, $p_2, \ldots, p_g$, can be ascertained. The intermediate form is presented, therefore, to illustrate and evaluate market structure as one of several pricing determinants that may affect significantly the optimal behavior of an individual meat packing firm engaged in the pursuit of business profits.

The intermediate pricing model includes (1) the internal firm relationships in equation 2, (2) the firm's quantity-price relationships in equation 5, (3) the firm-market price relationships in equation 6, (4) the firm's market share prescribed in equation 7, (5) the market price relationships in equation 3, and (6) the conjectural market share relationships (showing the effect of a one-unit change in the firm's sales or purchases on total market sales or purchases). Thus, the optimal set of livestock prices is dependent upon six groups of price and quantity relationships in addition to the market variables upon which the values of the firm's prices and quantities, $p_i, r_k, x_i, y_j$ and $z_k$, are based.

In summary, the sales orders $(x_1, \ldots, x_f)$, the prospective deliveries $(y_1, \ldots, y_g)$ and the complementary inputs $(z_1, \ldots, z_h)$ must be estimated for the relevant pricing period. Also, the values of the coefficients, $\gamma, \delta, \psi, a, b, c, \lambda, A, B, C$, must be known. Finally, the conjectural relationships must be reduced to known values. This latter procedure can be accomplished by assuming that under certain prescribed conditions, changes in $x, y$ and $z$ in the given firm do not induce changes in equivalent variables among other firms operating in the livestock and meat markets. Hence, each of the conjectural relationships is assigned a value of unity. If the prescribed conditions of market structure are not satisfied, the individual firm must consider the effects of its activities on the performance of other firms. 

### Aggregate Market Performance

Several sets of firm-market relationships are dependent upon the components of market structure, particularly the size of firms and even more specifically, the scale of operations. A meatpacking plant that slaughters one percent of the total Iowa farm marketings of livestock can maintain a fairly stable pattern of slaughter and sales from week to week. In the operations of a much larger plant, however, the effects of the larger volume of livestock purchases on the conduct of other firms must be taken into

---

account. Thus, the operation of an individual meat packing firm involves a large number of rather complex technical and economic considerations in the adjustment of sales and purchases to prospective market price relationships.

Even a cursory examination of aggregate market performance would show that an optimal set of purchase prices for one firm may not represent an optimal set of purchase prices for another firm. Hence, different firms will shift in their buying and selling activities from one market to another as they attempt to meet their commitments with respect to specific future deliveries, labor contracts and other obligations. Moreover, the market quantities of different classes of livestock and meat affect the magnitude of the price premiums paid for the most desirable qualities of livestock.

The manner in which these diverse activities of many firms in many geographically separated markets results in the coordination of aggregate farm production with aggregate consumer demands is not obvious from the theoretical pricing model. One obstacle to effective market coordination via the pricing mechanism is the uncertainty of the estimates involved in actual pricing. Nevertheless, numerous proposals dealing with market performance in the livestock industries require some lessening of their pricing uncertainties.

Proposals to improve the income position of farmers by reducing marketing costs, for example, involve some consideration of pricing practices in the agricultural marketing sector of the economy. Reductions in the costs of marketing would mean a smaller set of values for the complementary input relationships in equation 2. Hence, higher prices could be offered for livestock, which would tend to increase the supplies of these inputs. Reductions in marketing costs are quite uncertain, however, when the quantity of complementary inputs is fixed and when the quantity of agricultural raw materials is subject to substantial variation. Moreover, increases in the quantity of purchases would mean increased sales output and, hence, would require price reductions or additional merchandising effort on the part of the processor. The incidence of benefits from cost reductions in specific processing activities depends, therefore, on a number of variables and relationships, each of which is quite difficult to ascertain with any high degree of precision for the individual firm.23/

23/ A subcommittee of the U.S. Congress, nevertheless, concludes a report as follows: "Research and educational programs should be undertaken jointly by representatives of employers and employees to discover ways and means of accelerating technical progress and cost reductions in meat processing and distribution... Great changes are in progress in meat distribution.... These great changes in technological and economic forces in meat distribution make it highly desirable that a broad research and experimental program aimed at producing fundamental economies in meat processing and distribution be undertaken promptly." See "Trends in Efficiency in Meat Processing and Distribution," A Report of the Consumers Study Subcommittee of the Committee on Agriculture, House of Representatives, Eighty-Fifth Congress, Second Session, March 10, 1958, p. 6.
Another set of proposals to increase farm prices pertains to quality improvements in farm products, particularly in pork production. These improvements are profitable to the producer as long as the increase in unit costs of production is less than the increase in unit price. But the higher retail value of a particular quality of product such as pork must be translated into appropriate price signals at the primary market level if the producer is to engage in quality improvement. The use of standard grades is one means to remedy this shortcoming in the pricing process. In effect, grading would facilitate prediction of retail product value at the primary and wholesale market levels. However, attempts to use only primary market grades, estimates of product yields and sales, or even product output prices to determine primary market prices for the agricultural raw materials are likely to fail as long as the relevant quantities and functional relationships described earlier are ignored. 24/

Under certain market conditions, an agricultural processor may find the customary price relationships inconsistent with the profit-maximizing objective of the business. When these situations occur, the firm may temporarily discontinue its buying activities or it may consider some costs as temporarily fixed and negligible in the short-run. If the latter situation occurred, the firm would continue its buying activities at a somewhat higher price level. 25/ If a large number of firms engaged in buying activities in each factor market, presumably the temporary withdrawals of a few firms would not penalize the individual sellers in these markets. 26/ Again, pricing performance would be related to market structure. 27/

24/ Recently, a study was initiated at Iowa State University by an interdisciplinary group (comprising a food technologist, a sociologist, a statistician and an economist) to measure the effects of changes in selected socio-economic, product and merchandising variables on consumer preferences for meat products and, thence, on livestock demand and prices. In this study, the demand variables which are subject to some degree of human control are identified and related finally to alternative programs of product and market development, including industry-wide programs of commodity promotion and grading.

25/ Elliott S. Clifton, op. cit.

26/ Even producer-controlled packing plants may procure livestock from distant, rather than nearby, markets to minimize short-term price instability.

27/ Several writers have suggested the hypothesis that "in an active market, the pace for the whole tends to be set by those firms whose opportunities and whose perspectives about them lead to the most vigorous competitive action, or those subject to the most urgent pressures of necessity, which have similar effect." J. M. Clark, "The uses of Diversity: Competitive Bearings of Diversities in Cost and Demand Functions", American Economic Review, 48:474-482, 1958.
Finally, the currently popular topics of bargaining power and negotiated prices are related to certain characteristics of market structure and conduct.\(^{28}\) The growth of large food retailer organizations has been accompanied by an increasing amount of vertical conflict. Dominance on one end of the distribution process, however, frequently encourages a grouping of organizations on the other end in an attempt to use countervailing economic and political power. Agricultural producers and processors, for example, might conceive of the distribution function as another process which is better accomplished under integrated control and organization.\(^{29}\) Thus, groups of agricultural producers or processors may organize to negotiate with other large organizations or otherwise increase the degree of control over the entire process of production and distribution. "Power", according to Palamountain, "has come to rival economic factors as the governing element in the vertical relationships of distribution."\(^{30}\)

In summary, the growing size and scope of operations of food processing firms has important repercussions on farmers through the primary markets for farm products. Acquisition of smaller farms, expansion of product lines and ownership of plants in more than one food industry subgroup have additional repercussions on brand labeling and advertising. The product demand functions and market share relationships of individual firms are affected by these changes in industry structure. Price, moreover, becomes a less important variable in explaining changes in the level of output and sales as firms become larger.\(^{31}\) Knowledge of consumer preferences, however, becomes highly useful in market and product development activities of these larger firms. Some further implications of the changing consumer market are examined in the next discussion dealing with the effects of income changes and advertising on the consumption of farm products.


Relation Between Income Level and Income Elasticity

Alternative Engel Curves. It is not uncommon to hear or to read that the income elasticity of demand for food in this country declines with rising consumer income. Common as the assertion is, there seems to be no published theoretical or empirical work which would verify or reject the assertion, with one recent exception.1

One place to turn in studying the relation between income level and income elasticity is the literature on Engel's Law. As I understand it, Engel's Law merely states

\[
\frac{X}{Y} = f(Y), \quad f(Y) > 0, \quad f'(Y) < 0,
\]

where \(X\) = food expenditure per capita or per household member, \(Y\) = disposable income similarly measured and \(f'(Y) = \frac{df(Y)}{dY}\). The relation between income elasticity of expenditure and Engel's Law is

\[
\frac{dE_{XY}}{dY} = \frac{Y^2}{X} f''(Y) + f'(Y) \left[ \frac{Y}{X} - \frac{Yf''(Y)}{[f(Y)]^2} \right],
\]

where \(E_{XY}\) = income elasticity of food expenditures and \(f''(Y) = \frac{d^2f(Y)}{dY^2}\). The relation between Engel's Law and marginal propensity to spend on food is

\[
\frac{d^2X}{dY^2} = Yf''(Y) + 2f'(Y) .
\]

\[
\frac{dE_{XY}}{dY} \leq 0 \quad \text{if} \quad f''(Y) \leq 0, \quad \text{or} \quad f''(Y) > 0 \quad \text{but}
\]

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\[
\frac{Y^2}{X} f''(Y) - f'(Y) \left[ \frac{Y - Yf'(Y)}{X} \right] - \frac{1}{f(Y)^2} \left( f(Y) \right)^2 \\
\frac{d^2X}{dY^2} < 0 \text{ if } f''(Y) < 0, \text{ or if } f''(Y) > 0 \text{ but } Yf''(Y) < \frac{1}{2f'(Y)}
\]

X might be defined as \( X = P \cdot Q \) where \( P \) = average price paid and \( Q \) = quantity purchased. Now \( E_{XY} = E_{QY} + E_{PY} \) where \( E_{QY} \) = income elasticity of demand (income elasticity of quantity) and \( E_{PY} \) = income elasticity of price. And \( \frac{dE_{XY}}{dY} = \frac{dE_{QY}}{dY} + \frac{dE_{PY}}{dY} \). Hence, even if we know that \( \frac{dE_{XY}}{dY} \geq 0 \) this tells us little about \( \frac{dE_{QY}}{dY} \), the effect of income on income elasticity of demand.

In view of the importance for long-range agricultural policy of the question of the magnitudes of \( \frac{dE_{XY}}{dY}, \frac{dE_{QY}}{dY} \) and \( \frac{dE_{PY}}{dY} \) this is an area to which some research resources might profitably be allocated: What is the relation between income level and income elasticities or marginal propensities? Tornqvist, 2 S. J. Prais, 3 and Aitchison and Brown 4 have suggested procedures that would be relevant to such a study.

Tornqvist has proposed an Engel curve for necessities of the form 5

\[
(4) \quad X(\text{or } Q) = \frac{aY}{Y + b}
\]

This question yields an income elasticity estimate of \( b/(Y + b) \); it declines with rising income. A corollary to the hypothesis \( \frac{dE_{QY}}{dY} < 0 \) is that \( E_{QY} \) becomes zero at some high level of income. Consumption at this point would represent the satiation level of consumption. In equation (4) this satiation level is at a consumption level of \( a \); that is, (4) has an upper limit of \( a \) (which is reached only at an infinitely large income).

2/ Referred to in Herman Wold, Demand Analysis, (New York: John Wiley and Sons), 1953.


Prais concluded that a typical Engel curve may be described by the semi-logarithmic equation 6/

\[ X = a + b \log Y, \]

and that quality changes, as measured by price, are satisfactorily described by

\[ P = h + k \log Y. \]

Dividing (5) by (6),

\[ Q = \frac{a + b \log Y}{h + k \log Y}. \]

Q has a maximum value of b/k.

Aitchison and Brown propose an equation of the form 7/

\[ Q = \int_{-\infty}^{z} \frac{-t^2}{\sqrt{2\pi}} \mathrm{e}^{-\frac{t^2}{2}} \mathrm{d}t \]

where K = a satiation level of consumption,

\[ z = a + b \log Y. \]

They fit the equation in the form

\[ Q = K \Lambda(aYb) + u \]

where u is the random residual term and \( \Lambda(aYb) \) is the standardized log-normal distribution function at aYb and is related to the standardized (zero mean and unit variance) normal distribution function by \( \Lambda(aYb) = N \log(aYb) \).

Graphic analysis indicated that b = 1 for the food products with which they were dealing.

The income elasticity = 0 for (8) or (9) when the saturation level of consumption is reached, at Q = K, and income elasticity continuously increases as income declines. \( E_{QY} = 1 \) when Q = 0.38K. Aitchison and Brown conclude

\[ 6/ \text{Prais, op. cit.} \]

\[ 7/ \text{Aitchison and Brown, op. cit.} \]
that (10) gives superior fits to semilogarithmic equations, which in turn give superior fits to logarithmic equations.

Published results for the United States. The nearest thing we have in this country to a study of the relation between income level and income elasticity is a recent study by Rockwell. 8/ Utilizing data from the 1955 Household Food Consumption Survey, he divided farm and nonfarm households into three income classes as follows: 9/

Family disposable money income, 1954.

<table>
<thead>
<tr>
<th>Family income class</th>
<th>Nonfarm households</th>
<th>Farm households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0-$3,399</td>
<td>0-$1,499</td>
</tr>
<tr>
<td>Medium</td>
<td>$3,400-$4,999</td>
<td>$1,500-$3,499</td>
</tr>
<tr>
<td>High</td>
<td>$5,000 and over</td>
<td>$3,500 and over</td>
</tr>
</tbody>
</table>

Approximately one-third of the farm households were in each farm income class, and one-third of the nonfarm households were in each nonfarm income class.

Within each of these six classes a linear regression was computed

\[ X \text{ (or } Q) = a + bY + cN \]

where \( X, Q \) and \( Y \) are per person and \( N \) is household size. Elasticities were computed at the mean values of the variables for each of the six classes.

Some results from this study are presented in Tables 1 and 2. Table 3 presents some elasticities derived from Tables 1 and 2. Tables 4 and 5 present some comparisons of the income elasticities in Tables 1 and 2. In reading these latter three tables, keep in mind that there is no way of determining from published data how many of these differences are statistically significant. Many of the differences shown are probably not statistically significant.

In Table 3, \( E_{py} > 0 \) in 72 cases and \( E_{py} < 0 \) in 11 cases. If we assume the nonsignificant values in Tables 1 and 2 to be zero, \( E_{py} > 0 \) in 48 cases and \( E_{py} < 0 \) in 8 cases. This apparent tendency for consumers to pay somewhat

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8/ Rockwell, op. cit.

9/ Ibid., pp. 42-43.
higher prices as incomes rise deserves further study for its possible implications for primary agricultural adjustment and for marketing firm behavior. How much of the higher price goes for quality variation over which the farmer has some control and from which he can receive higher prices, e.g., grade A over grade B eggs? How much goes for quality variation over which the processors or marketing firms have control and from which they receive higher prices?

The figures in Table 1 might be called income elasticities of value of consumption; this differs from income elasticity of expenditures since value includes gifts and home-produced food. The income elasticity of total value of consumption falls with rising incomes among nonfarm households; it rises and then falls among farm households. In dealing with smaller aggregates than all food, Table 4 shows that elasticity falls in about as many cases as it rises in moving from one income class to a higher income class. There would appear to be quite a few groups of commodities which are not going to encounter declines in the national average income elasticity of demand as consumer incomes rise over time, at least not for many years.

Temporal developments in the distribution of income are a relevant factor in making projections as to national average income elasticities of demand. This includes distribution by socio-economic class, as well as size distribution. For example, the data in Table 5 suggest that there are differences between the income elasticities of farm and of nonfarm families.

Relation Between Income Elasticity at Retail and at the Farm. It may be worthwhile to consider the relation between changes in income elasticity of demand at the retail level and changes in the derived income elasticity of demand at the farm level.

Assume a perishable commodity for which net imports are negligible. Then the same quantity will be sold by marketing firms as is sold by farmers. Assume the product is sold by farmers to marketing and processing firms and is sold by them in turn to consumers. Let the farmer's supply equation be

\[(11) \quad S(Q, P_f, Z_g) = 0,\]

the marketing firm's behavior equation be

\[(12) \quad M(Q, P_f, P_r, Z_M), 0,\]

and the consumer demand function be

\[(13) \quad D(Q, P_r, Y, Z_D) = 0.\]
Table 1. Income elasticities of demand, based on value of consumption at home per person, for all households, one week, spring 1955.

<table>
<thead>
<tr>
<th>Item</th>
<th>Nonfarm household by family income class</th>
<th>Farm household by family income class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>All foods and beverages</td>
<td>0.25</td>
<td>0.21</td>
</tr>
<tr>
<td>Milk and milk products, excluding butter</td>
<td>0.18</td>
<td>-0.04</td>
</tr>
<tr>
<td>Fats and oils, excluding bacon and salt pork</td>
<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>Flour and other cereal products</td>
<td>-0.13</td>
<td>-0.08</td>
</tr>
<tr>
<td>All meat</td>
<td>0.39</td>
<td>0.30</td>
</tr>
<tr>
<td>All poultry</td>
<td>0.29</td>
<td>0.53</td>
</tr>
<tr>
<td>All eggs</td>
<td>0.17</td>
<td>0.16</td>
</tr>
<tr>
<td>Sugars and sweets</td>
<td>0.00</td>
<td>0.15</td>
</tr>
<tr>
<td>Potatoes and sweet potatoes</td>
<td>0.08</td>
<td>-0.02</td>
</tr>
<tr>
<td>Other fresh vegetables</td>
<td>0.20</td>
<td>0.66</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>0.18</td>
<td>0.14</td>
</tr>
<tr>
<td>Frozen fruits and vegetables except frozen potatoes</td>
<td>0.69</td>
<td>0.75</td>
</tr>
<tr>
<td>Canned fruits and vegetables except potatoes and sweet potatoes</td>
<td>0.25</td>
<td>-0.08</td>
</tr>
<tr>
<td>Fruit and vegetable juices</td>
<td>0.27</td>
<td>0.30</td>
</tr>
<tr>
<td>Dried fruits and vegetables</td>
<td>0.15</td>
<td>0.19</td>
</tr>
<tr>
<td>All beverages</td>
<td>0.40</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Footnotes to Table 1.

1/ Approximately the quantity of fluid milk to which the dairy products are equivalent in calcium.

2/ Not significantly different from zero at the 10 percent level.

3/ Includes home-canned and -frozen vegetables that were brought into the home in fresh form.

4/ Includes home-canned and -frozen fruits that were brought into the home in fresh form.

5/ Includes both commercially and home dried products. Dried weight basis.
Table 2. Income elasticities of demand, based on quantity consumed at home per person, for all households, one week, spring 1955. *a*

<table>
<thead>
<tr>
<th></th>
<th>Nonfarm households by family income class</th>
<th>Farm households by family income class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Milk and milk products, excluding butter</td>
<td>0.08</td>
<td>-0.072</td>
</tr>
<tr>
<td>Fats and oils, excluding bacon and salt pork</td>
<td>-0.022</td>
<td>-0.082</td>
</tr>
<tr>
<td>Flour and other cereal products</td>
<td>-0.36</td>
<td>-0.142</td>
</tr>
<tr>
<td>All meat</td>
<td>0.27</td>
<td>0.20</td>
</tr>
<tr>
<td>All poultry</td>
<td>0.17</td>
<td>0.52</td>
</tr>
<tr>
<td>All eggs</td>
<td>0.12</td>
<td>0.122</td>
</tr>
<tr>
<td>Sugars and sweets</td>
<td>-0.10</td>
<td>-0.012</td>
</tr>
<tr>
<td>Potatoes and sweet potatoes</td>
<td>0.012</td>
<td>0.062</td>
</tr>
<tr>
<td>Other fresh vegetables</td>
<td>0.16</td>
<td>0.30</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>0.23</td>
<td>0.052</td>
</tr>
<tr>
<td>Frozen fruits and vegetables except frozen potatoes</td>
<td>0.66</td>
<td>0.66</td>
</tr>
<tr>
<td>Canned fruits and vegetables except potatoes and sweet potatoes</td>
<td>0.20</td>
<td>-0.102</td>
</tr>
<tr>
<td>Fruit and vegetable juices</td>
<td>0.21</td>
<td>0.34</td>
</tr>
<tr>
<td>Dried fruits and vegetables</td>
<td>-0.23</td>
<td>0.092</td>
</tr>
</tbody>
</table>

Footnotes to Table 2.

1/ Approximately the quantity of fluid milk to which the dairy products are equivalent in calcium.

2/ Not significantly different from zero at the 10 percent level.

3/ Includes home-canned and -frozen vegetables that were brought into the home in fresh form.

4/ Includes home-canned and -frozen fruits that were brought into the home in fresh form.

5/ Includes both commercially and home dried products. Dried weight basis.
Table 3. Income elasticities of price: income elasticity of value from Table 1 minus income elasticity of quantity from Table 2. a/

<table>
<thead>
<tr>
<th></th>
<th>Nonfarm households by family income class</th>
<th>Farm households by family income class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Milk and milk products, excluding butter</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>Fats and oils excluding bacon and salt pork</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Flour and other cereal products</td>
<td>0.23</td>
<td>0.06</td>
</tr>
<tr>
<td>All meat</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>All poultry</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>All eggs</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Sugars and sweets</td>
<td>0.10</td>
<td>0.16</td>
</tr>
<tr>
<td>Potatoes and sweet potatoes</td>
<td>0.07</td>
<td>-0.08</td>
</tr>
<tr>
<td>Other fresh vegetables a/</td>
<td>0.04</td>
<td>0.36</td>
</tr>
<tr>
<td>Fresh fruit</td>
<td>-0.05</td>
<td>0.09</td>
</tr>
<tr>
<td>Frozen fruits and vegetables except frozen potatoes</td>
<td>0.03</td>
<td>0.09</td>
</tr>
<tr>
<td>Canned fruits and vegetables except potatoes and sweet potatoes</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>Fruit and vegetable juices</td>
<td>0.06</td>
<td>-0.04</td>
</tr>
<tr>
<td>Dried fruits and vegetables a/</td>
<td>0.38</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Footnotes to Table 3.

1/ Approximately the quantity of fluid milk to which the dairy products are equivalent in calcium.

2/ $E_{X_Y}$ from Table 1 or $E_{Q_Y}$ from Table 2 or both not significant at the 10 percent level.

3/ Includes home-canned and frozen vegetables that were brought into the home in fresh form.

4/ Includes home-canned and -frozen fruits that were brought into the home in fresh form.

5/ Includes both commercially and home dried products. Dried weight basis.
Table 4. Comparisons of income elasticities by income groups. 

<table>
<thead>
<tr>
<th></th>
<th>Farm households</th>
<th>Nonfarm households</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_{EXY} &gt; M_{EXY}$</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>$M_{EXY} &gt; H_{EXY}$</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>$L_{EXY} &gt; E_{XY}$</td>
<td>6</td>
<td>9</td>
<td>$15\frac{37}{32}$</td>
</tr>
<tr>
<td>$E_{QY} &gt; M_{QY}$</td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>$M_{QY} &gt; H_{QY}$</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>$L_{QY} &gt; Q_{QY}$</td>
<td>6</td>
<td>4</td>
<td>$10\frac{32}{32}$</td>
</tr>
<tr>
<td>$E_{QY} &gt; M_{QY}$</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>$M_{QY} &gt; H_{QY}$</td>
<td>5</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>$L_{QY} &gt; Q_{QY}$</td>
<td>4</td>
<td>8</td>
<td>$12\frac{32}{32}$</td>
</tr>
<tr>
<td>$E_{QY} &lt; M_{QY}$</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>$M_{QY} &lt; H_{QY}$</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>$L_{QY} &lt; Q_{QY}$</td>
<td>5</td>
<td>6</td>
<td>$11\frac{31}{31}$</td>
</tr>
</tbody>
</table>

$^a$/ Excluding "all foods and beverages" value. $E_{XY}$ = income elasticity of value; $E_{QY}$ = income elasticity of quantity consumed. Superscripts L, M and H represent low, medium and high income families. Nonsignificant values in Tables 1 and 2 assumed to be zero.
Table 5. Comparison of farm and nonfarm income elasticities within comparable income groups. a/

<table>
<thead>
<tr>
<th></th>
<th>Low income families</th>
<th>Medium income families</th>
<th>High income families</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{QY}^N &gt; E_{QY}^F$</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>18</td>
</tr>
<tr>
<td>$E_{QY}^N &lt; E_{QY}^F$</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>$E_{XY}^N &gt; E_{XY}^F$</td>
<td>10</td>
<td>8</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>$E_{XY}^N &lt; E_{XY}^F$</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>15</td>
</tr>
</tbody>
</table>

a/ Excluding "all foods and beverages" value. $E_{XY}$ = income elasticity of value; $E_{QY}$ = income elasticity of quantity. Superscripts N and F refer to nonfarm and farm families. Nonsignificant values in Tables 1 and 2 assumed to be zero.
\[ Q = \text{quantity exchanged}, \]
\[ P_f = \text{farm price}, \]
\[ Z_s = \text{other factors affecting supply}, \]
\[ P_r = \text{retail price}, \]
\[ Z_M = \text{other factors affecting marketing firm's behavior}, \]
\[ Y = \text{consumer income}, \]
\[ Z_D = \text{other factors affecting consumer demand}. \]

If \( M \) and \( D \) are of such form that it is possible to eliminate \( P_r \), the derived demand equation can be obtained from them as \( m(Q, P_f, Y, Z_D, Z_M) \).

Consumer income elasticity of demand is \( E_{QY} = \frac{\partial Q}{\partial Y} \left( \frac{\partial Q}{\partial P_f} \right)_{M, D} \). Derived income elasticity of demand is \( e_{QY} = \frac{\partial Q}{\partial Y} \left( \frac{\partial Q}{\partial P_f} \right)_{M, D} \). The relation between the two is

\[
e_{QY} = \frac{E_{QY}}{1 - \left( \frac{\partial P_r}{\partial Q} \right)_{M, D}} - \left( \frac{\partial Q}{\partial P_r} \right)_{M, D} \left( \frac{\partial Q}{\partial Y} \right)_{M, D} \]

We are interested in the relation between changes in \( E_{QY} \) and changes in \( e_{QY} \).

Define:

\[
E(e_{QY}/E_{QY}) = \frac{\partial e_{QY}}{\partial E_{QY}} \frac{E_{QY}}{e_{QY}}
\]

Then

\[
\frac{\partial e_{QY}}{\partial E_{QY}} = \left[ 1 - \left( \frac{\partial P_r}{\partial Q} \right)_{M, D} \left( \frac{\partial Q}{\partial P_r} \right)_{M, D} \right] + \left[ E_{QY} \left( \frac{\partial P_r}{\partial Q} \right)_{M, D} \frac{\partial}{\partial E_{QY}} \left( \frac{\partial Q}{\partial P_r} \right)_{M, D} \right]
\]

\[
= \frac{(1 - AB) + \left( \frac{E_{QY}}{M} \right) AC}{(1 - AB)^2}
\]
If \( Q \) does not appear in \( M \), i.e., the retail price firms desire to charge (and the desired marketing margin) is unaffected by the quantity passing through the marketing sector,

\[
E_e = \text{EQY} \quad \text{and} \quad E(e_{QY}/E_{QY}) = 1.
\]

If \( Q \) appears in \( M \), we must consider what happens to \( C \), the slope with respect to price of the demand curve, as income rises and income elasticity falls. It seems reasonable to believe that \( C \) will be much less than one in absolute value, if not zero. There is evidence that \( e_{QY} \) is much less than one for most farm products. If \( A \) is also less than one, \( AC e_{QY} \) is the product of three fractions, all small, and will be almost zero. Generally \( B < 0 \) and \( A > 0 \). Hence, \( E(e_{QY}/E_{QY}) < 1 \) and derived income elasticity at the farm level declines at a slower rate than consumer income elasticity.

It is tempting to follow this discussion with a discussion of the effect of changes in \( Y \) and \( E_{QY} \) upon \( E_{QY} \), the price elasticity of demand. This question is probably more important to marketing firms than is the question of changes in \( E_{QY} \). I know of nothing in either our theoretical or empirical literature which casts any light on this question.

**Demand for Marketing Services**

The previous section was devoted to a discussion of one common presumption which has not received adequate investigation. This section is devoted to a brief look at another presumption which requires investigation. Actually, it deals with two related ideas which have significance for primary agricultural adjustment and for marketing and processing firms.

One is the hypothesis that we have reached sufficiently high levels of consumer income in this country that income elasticity of demand for food (or farm food products) is less than the income elasticity of demand for food marketing services. The other is the hypothesis that price elasticity of demand for services exceeds the price elasticity of demand for farm foods.
Daly, Burk and Bunker and Cochrane have used national time series data to test the first hypothesis, and each has accepted it. Unfortunately, even though this hypothesis has great intuitive and introspective appeal to me, I cannot accept their conclusions since I cannot accept their methods. Briefly, my objections to their work are that: (1) the series they use to represent "quantity of marketing services" are not measures of quantity of marketing services and (2) their series on "price index for marketing services" does not measure the price of marketing services.

So far as I know, no work has been done to test the second hypothesis. It, too, has intuitive appeal for me.

Perhaps we can get some insight into these two hypotheses from some qualitative considerations. In the next few paragraphs, let us use food to mean a physical item produced on a farm and possessing nutritive value. It is evident that food as such has few if any closely competitive goods, although many foods are substitutes for each other. It is also a product for which humans have a saturation level of consumption beyond which they will not go.

Marketing services, on the other hand, have a number of competitors. An important function performed by marketing services, perhaps the most important one in the mind of the housewife, is the saving in time and effort made possible by their use. This is also the main function performed by many other products and services the housewife can buy. Consequently, marketing services are competitive with all sorts of things, ranging from a second car in the family to electrically operated swizzle sticks and including housemaids and most all electrical appliances. Marketing services are also competitive with leisure time products and services such as books or fishing.


tackle and movies. Meal preparation and leisure time activities are alternative uses of the housewife's time. Further, most people in this country come nearer to achieving a satiation level of food consumption than a satiation level of leisure time. Related to the idea of satiation is the fact that food -- nutrition -- is a physical necessity, whereas marketing services performed by businessmen are not. (The qualifier "performed by businesses" is included to denote that the services may be necessary, but need not be done by firms.)

These considerations lead me to expect that there is a real consumer income level above which the income elasticity of demand for services exceeds the income elasticity of demand for food. The way this manifests itself at the retail level is in a higher income elasticity of demand for those products which combine larger amounts and/or more kinds of services with given amounts of food. What this income level is and what proportion of the families in this country have higher incomes, I do not even hazard a guess. These same considerations also lead me to expect that price elasticity is greater for those products containing more services than for those containing less.

If price and income elasticities of demand are higher for products containing a larger proportion of marketing services, the result might be to raise derived price and income elasticities of demand at the farm while reducing the level of derived demand.

Rewrite equation (14) as

\[
e_{QY} = \frac{E_{QY}}{1 - e_{rQ} E_{Qr}}
\]

where

\[
e_{rQ} = \frac{Q}{P_r} \left( \frac{\partial P_r}{\partial Q} \right)_M
\]

and

\[
E_{Qr} = \frac{P_r}{Q} \left( \frac{\partial Q}{\partial P_r} \right)_D
\]

The relation between the price elasticities of derived and consumer demand is\(^{15/}\)

\[
e_{Qf} = \frac{E_{Qr} e_{rf}}{1 - e_{rQ} E_{Qr}}
\]

\(^{15/}\) Hildreth and Jarrett, op. cit.
where

\[ e_{rf} = \frac{P_f}{P_r} \left( \frac{\partial P_r}{\partial P_f} \right)_M \]

\( e_{rf} \) has been referred to as the elasticity of price transmission. For a constant percentage margin \( e_{rf} = 1 \); for a constant dollar margin or a combined constant dollar and constant percentage margin, \( e_{rf} < 1 \).

Let us assume the combined case and let \( k \) = the constant dollar portion of the margin. As a growing portion of services is combined with a given amount of farm food products, \( k \) can be expected to increase. As \( k \) increases, \( e_{rf} \) falls. If it is assumed, as was suggested above, that increasing \( k \) also increases consumer price and income elasticities, the relation between \( k \) and \( e_{QY} \) is

\[
\frac{\partial e_{QY}}{\partial k} = \frac{D + E_{QY} e_{rQ} \frac{\partial E_{QY}}{\partial k}}{\frac{\partial E_{QY}}{\partial k}} + \frac{D - E_{QY} e_{rQ} \frac{\partial E_{QY}}{\partial k}}{\frac{\partial E_{QY}}{\partial k}} + \frac{E_{QY} e_{rQ} \frac{\partial e_{rQ}}{\partial k}}{\frac{\partial e_{rQ}}{\partial k}}
\]

If \( \frac{\partial E_{QY}}{\partial k} = \frac{\partial E_{QY}}{\partial k} = 0 \), this reduces to

\[
\frac{\partial e_{QY}}{\partial k} = \frac{1}{D} \frac{\partial E_{QY}}{\partial k} + \frac{E_{QY} e_{rQ} \frac{\partial E_{QY}}{\partial k}}{\frac{\partial E_{QY}}{\partial k}} + \frac{E_{QY} e_{rQ} \frac{\partial e_{rQ}}{\partial k}}{\frac{\partial e_{rQ}}{\partial k}}
\]

where \( D = 1 - e_{rQ} E_{Qr} \).

If we were dealing with a purely competitive marketing system, \( e_{rQ} \) would represent the reciprocal of the elasticity of supply. Intuitively it seems like \( \frac{\partial e_{rQ}}{\partial k} < 0 \) since an increase in \( k \) corresponds to an increase in marginal cost. On the above assumptions, the first and last terms in (21) are positive and the second one is negative, and the sum may be positive or negative.
The relation between \( k \) and \( e_Q f \) is

\[
\frac{\partial e_Q f}{\partial k} = \frac{1}{D^2} \frac{\partial E_{Q r}}{\partial k} + \frac{D}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k} \frac{\partial e_{rf}}{\partial k} + \frac{D}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k} + \frac{1}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k} + \frac{1}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k}.
\]

If \( \frac{\partial e_{rf}}{\partial k} = \frac{\partial e_{rf}}{\partial e_{rf}} = 0 \), (22) reduces to

\[
\frac{\partial e_Q f}{\partial k} = \frac{1}{D^2} \frac{\partial E_{Q r}}{\partial k} + \frac{1}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k} + \frac{1}{D^2} \frac{E_{Q r}}{e_{rf}} \frac{\partial e_{rf}}{\partial k}.
\]

On the above assumptions, the first and last terms are negative and the second is positive.

**Advertising**

The last subject I plan to deal with in this paper is the effect of commodity advertising on consumption of farm foods and on farm income. Recent work by Basmann gives some theoretical insight into the problem. He assumes a consumer utility function

\[
u = u(x_1, x_2, \ldots, x_n; \theta_1, \theta_2, \ldots, \theta_n)
\]

in which the \( x_i \) represent quantities of goods and services consumed during a given time period. The \( \theta_i \) are parameters which describe the form of the ordinal utility function; the values of the \( \theta_i \) are assumed to depend on the \( a_j \), where \( a_j \) denotes the advertising expenditures on commodity \( x_j \). Maximizing (24) subject to the budget restraint yields the usual first and second order conditions for individual consumer equilibrium. Differentiating the

equilibrium conditions with respect to \( a_j \) and solving the resulting system of equations yields an expression for shifts in demand with respect to advertising expenditures.

\[
(25) \quad \frac{\partial x_i}{\partial a_j} = -\sum_{h=1}^{n} b_{hj} s_{hi} P_h
\]

where \( s_{hi} \) is the substitution term \( s_{hi} = \frac{\partial u_{hi}}{\partial a_j} \), \( P_h \) is the price of product \( h \) and \( b_{hj} = \frac{\partial u_h}{\partial a_j} \). \( u_h \) is the proportionate change in the marginal utility of \( x_h \) with respect to advertising expenditures on \( x_j \).

If it is assumed that \( a_j \) affects only the marginal utility of \( x_j \), \( b_{jj} > 0 \) and \( b_{hj} = 0 \) for all \( h \neq j \). Then

\[
(26) \quad \frac{\partial x_i}{\partial a_j} = -b_{jj} s_{ji} P_j
\]

If \( x_i \) and \( x_j \) are substitutes, \( s_{ji} > 0 \) and \( \frac{\partial x_i}{\partial a_j} < 0 \); if \( x_i \) and \( x_j \) are complements, \( s_{ji} < 0 \) and \( \frac{\partial x_i}{\partial a_j} > 0 \). From equation (26) the change in market demand is obtained by summing over all individuals in the market:

\[
\sum_{r} \frac{\partial x_{ir}}{\partial a_j} = -b_{jj} \sum_{r} s_{jjr} = dX_j
\]

To illustrate how these results might be applied to the study of farm commodity advertising, let us take a simple case. Assume (26) and its underlying assumptions are appropriate. Assume \( p_j \) a constant in order that we need not consider the elasticity of supply nor the partial derivative of (26) with respect to \( p_j \). The results to be obtained would be applicable to this sort of a question: "Farm and retail prices of product \( j \) are now satisfactory or profitable, but we know production is going to increase by about \( dX_j \). How much will need to be spent on advertising in order to maintain farm and retail prices of product \( j \) at their present level?" This is, we want

\[
(27) \quad \sum_{r} \frac{\partial x_{ir}}{\partial a_j} = -p_j \sum_{r} b_{jjr} s_{jjr} = dX_j
\]

Assume

\[
(28) \quad -p_j \sum_{r} b_{jjr} s_{jjr} \approx -Np_j b_{jj} s_{jj}
\]

that is, the sum of the products can be closely approximated by the product of \( N \) and the two means, \( \overline{b}_{jj} = \frac{1}{N} \sum_{r} b_{jjr} \) and \( \overline{s}_{jj} = \frac{1}{N} \sum_{r} s_{jjr} \). Equating

\[
\frac{\partial \sum_{r} x_{jr}}{\partial a_j} = dX_j
\]

\[
(29) \quad -Np_j b_{jj} s_{jj} \frac{\partial a_j}{\partial a_j} = dX_j
\]
or

\[ \frac{\partial}{\partial a_j} \frac{\partial Y_F}{\partial a_j} = 0 \]

where \( Y_F = \sum \left( p_i^F - c_i - a_i \right) X_i \)

and \( p_i^F \) = farm price of product \( i \)

\( c_i \) = farm cost of producing one unit of product \( i \)

\( a_i \) = farm expenditures on advertising product \( i \) divided by the total quantity of \( i \).

\[ \frac{\partial}{\partial a_j} \frac{\partial Y_F}{\partial a_j} = -Np_j b_{jjj} \sum_i \left( p_i^F - c_i - a_i \right) s_{ji} - X_j \geq 0 \]

Solving for the break-even value of \( b_{jjj} \),

\[ b_{jjj} \geq \frac{X_j}{Np_j \sum_i \left( p_i^F - c_i - a_i \right) s_{ji}} \]

This analysis is terribly oversimplified. It assumes infinite supply elasticities and constant marketing margins. The existence of variable margins can be taken into account fairly easily in the analysis, but the existence of non-infinite supply elasticities is more difficult to incorporate into the analysis.

At present we have no empirical information on \( b_{jjj} \) or on \( b_{jjjr} \). We can, however, obtain some information on the \( s_{ji} \) fairly readily. From the theory of consumer behavior,

\[ \frac{\partial x_{ir}}{\partial p_j} = -x_{jr} \frac{\partial x_{ir}}{\partial Y_r} + s_{jir} \]
Aggregating over all individuals, dividing by population, and replacing the first term on the right hand side by an approximation,

\[ (35) \frac{\partial}{\partial p_j} \left( \frac{\sum_r x_{ir}}{N} \right) = \frac{\partial}{\partial Y} \left( \frac{\sum_r x_{ir}}{N} \right) + \frac{\sum_r s_{jir}}{N} \]

From empirical demand analysis, estimates of \( \frac{\sum_r x_{ir}}{N} \) and \( \frac{\partial x_i}{\partial Y} \) can be obtained and (34) can be used to estimate average substitution terms \( \bar{s}_{ji} \).

Having estimates of \( \bar{s}_{ji} \) and \( \bar{s}_{ji} \), and assuming \( dX_j \) is not so large as to result in a change in any of the substitution terms, equation (33) could be solved to obtain the break-even value of \( b_{jj} \). This value of \( b_{jj} \) and larger ones could be checked only on intuitive grounds. If the break-even value or larger values appeared "reasonable" they could be substituted into (30) to obtain an estimate of the necessary advertising expenditure and into (32) to find their effect on farm income.

A more relevant question with respect to income would be, "Will a net increase in income be obtained by the producers of \( X_j \)?" To answer this question would require a more complicated analysis. It would require classifying the producers of \( X_j \) into at least four groups: (1) producers of \( X_j \) only or of \( X_j \) and independent products \( (s_{ji} = 0) \); (2) producers of \( X_j \) and of substitutes \( (s_{ji} > 0) \) only; (3) producers of \( X_j \) and of complements \( (s_{ji} < 0) \) only; (4) producers of \( X_j \), complements and substitutes.
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