



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

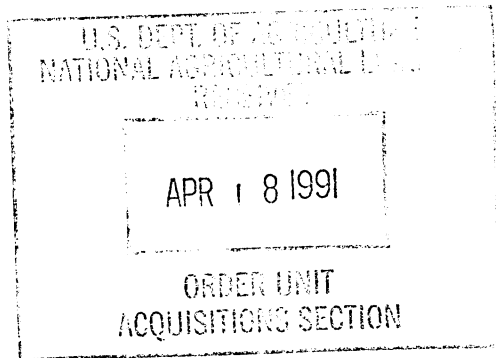
AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

FOOD DEMAND ANALYSIS  
Implications for Future Consumption

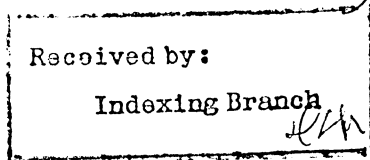
Edited by  
Oral Capps, Jr. and Benjamin Senauer

Sponsored by  
The S-165 Southern Regional Research Committee  
and  
The Farm Foundation



Department of Agricultural Economics  
Virginia Polytechnic Institute and State University  
Blacksburg, Virginia 24061

August 1986



## Table of Contents

Preface	vii
Acknowledgments	xii
MARKET DEMAND FUNCTIONS	
S.R. Johnson, Richard D. Green, Zuhair A. Hassan, and A.N. Safyurtlu	1
Individual Consumer Demand	2
Market Demand	5
Empirical Results for Market Demand Systems	13
Structural Dynamics	18
Scaling and Translating	22
Conclusions	25
GLOBAL BEHAVIOR OF DEMAND ELASTICITIES FOR FOOD: IMPLICATIONS FOR DEMAND PROJECTIONS	
Michael K. Wohlgenant	35
Methodology	36
Data and Estimation Procedure	39
Econometric Results	41
Implications for Demand Projections	44
FOOD EXPENDITURE PATTERNS: EVIDENCE FROM U.S. HOUSEHOLD DATA	
Chung L. Huang and Robert Raunikaar	49
The Linear Expenditure Model	51
The Data and Estimation Procedure	53
The Statistical Results	54
Implication and Application	61
Conclusion	63
PROJECTING AGGREGATE FOOD EXPENDITURES TO THE YEAR 2000	
Kuo S. Huang and Richard C. Haidacher	67
Abstract	67
Model Specifications	69
Empirical Estimation Results	71
Applications of the Estimated Model	75
Summary	83
DISCUSSION	
Joseph Havlicek, Jr.	87

IMPLICATIONS OF FACTORS AFFECTING FOOD CONSUMPTION	
Robert Raunikar and Chung L. Huang	91
Historical Perspective	92
Changing Explanatory Factors	93
Spatial and Temporal Effects	98
Implications and Conclusions	102
IS THE STRUCTURE OF THE DEMAND FOR FOOD CHANGING?	
IMPLICATIONS FOR PROJECTIONS	
Reuben C. Buse	105
The Model	107
The Analytical Model	110
The Results	113
Summary and Conclusions	124
THE EFFECTS OF HOUSEHOLD SIZE AND COMPOSITION	
ON THE DEMAND FOR FOOD	
David W. Price	131
Procedures	132
Changes in the Age-Sex Equivalent Food Population	
Over Time and Projections to the Year 2000	142
ROLE OF INTEGRATED DECISION THEORY IN CONSIDERING	
FUTURE FOOD CONSUMPTION PATTERNS OF THE ELDERLY	
Dorothy Z. Price	149
Decision Making Theories	149
Nutrition and the Elderly	151
Discussion of Empirical Study	153
Implications for the Future	157
EFFECTS OF INCREASING ELDERLY POPULATION	
ON FUTURE FOOD DEMAND AND CONSUMPTION	
Ronald A. Schrimper	163
Changes in Economic Well Being of the Elderly	164
Saving and Aggregate Expenditure Behavior	164
Expenditure Survey Evidence	165
Effects of Household Characteristics on Expenditure Patterns	167
Away-From-Home Food Expenditures	168
At-Home Food Expenditures	170
Evaluation of Elderly Diets	172
Implications on Future Demand for Food	173
COMMENTS: FOOD DEMAND ANALYSIS:	
IMPLICATIONS FOR FUTURE CONSUMPTION	
Lester H. Myers	177
General Factors Affecting Demand	178
Structure Change	179
Age Distribution and Family Size Changes	180
Impacts of an Increasing Proportion of Elderly People	181
Summary	183

POPULATION SCALE, COMPOSITION, AND INCOME EFFECTS ON PER CAPITA AND AGGREGATE BEEF CONSUMPTION: A TEMPORAL AND SPATIAL ASSESSMENT	
Patricia K. Guseman and Stephen G. Sapp	185
Procedures	186
Projections of U. S. Beef Consumption	196
Projections of Beef Consumption by Demographic Market Area	199
Summary and Conclusions	208
ORANGE AND GRAPEFRUIT JUICE DEMAND FORECASTS	
Mark G. Brown and Jong-Ying Lee	215
Demand Factors	216
Demand Specifications	220
Data and Variables	222
Results	223
Summary	227
ANALYSIS OF CONVENIENCE AND NONCONVENIENCE FOOD EXPENDITURES BY U. S. HOUSEHOLDS WITH PROJECTIONS TO THE YEAR 2000	
Oral Capps, Jr. and Joanne M. Pearson	233
Definitions of Convenience and Nonconvenience Foods	234
Model Development	234
Data and Procedures	239
Empirical Results	241
Projections	246
A SYSTEMATIC ANALYSIS OF HOUSEHOLD FOOD CONSUMPTION BEHAVIOR WITH SPECIFIC EMPHASIS ON PREDICTING AGGREGATE FOOD EXPENDITURES	
James C. O. Nyankori	251
Theoretical Basis: Household Resource Allocation Behavior	251
Data	253
Empirical Model	257
Empirical Results	261
IMPLICATIONS FOR FOOD DEMAND OF CHANGES IN COMPETITIVE STATE WITHIN MARKETING CHANNELS	
Barry W. Bobst	269
Disequilibrium Market Theory	269
Implications for Demand Analysis	271
Realism of Market Disequilibrium	272
Application of PAMEQ to Beef Markets	274
Implications for Demand Analysis in 2000	278
FOOD DEMAND ANALYSIS (DISCUSSION)	
Joseph C. Purcell	281
Comments on Papers	281
Concluding Comment	283
INDEX	285

Comments: Food Demand Analysis:  
Implications For Future Consumption

Lester H. Myers<sup>1</sup>

INTRODUCTION

The authors of the five papers included in this section of the Symposium are to be commended for the time and effort they invested in their papers and presentations. One cannot help but be impressed with the research underlying the reports and with the amount of valuable information being made available.

While trying to structure my comments, I found myself going back to the classical model of consumer demand, which is static and relates to the individual consumer. For obvious reasons, empirical demand research either has to rely on market aggregates for basic observations or the results have to be expanded to market level implications, or both. Also, for business and public policy planning purposes the results are useful only if they contain implications for consumption at some future period of time. To respond to these empirical requirements, it is necessary to make rather strict assumptions about how the nature of preference functions differs between individuals and over time.

In order to minimize the effects of these assumptions on the empirical estimates of demand parameters, we typically identify subgroups of the population for which, we believe, the preference functions are relatively homogeneous. Things begin to become a bit hazy when one reflects on the process used to subdivide the population into more homogeneous groups. Economic theory postulates certain properties concerning the shape of the consumer's utility function and states that the function is unique for each individual. It is largely up to other disciplines; e.g., sociology and psychology, to offer insights into what factors cause individuals to have different or similar preferences.

Unfortunately, many of the factors identified as being potentially important to individual preferences are empirically non-measurable. Therefore, we are forced to define observable variables which we assume will proxy for the actual sociological, physical, and psychological factors. These 'proxies' are referred to as socioeconomic and demographic characteristics of the individual or household. They are

---

<sup>1</sup> Chief, Food Marketing and Consumption Economics Branch, National Economics Division, Economic Research Service, U.S. Department of Agriculture.

well known and include geographic location, urbanization, family size, age, income level, education, race, ethnic background, etc.

For purposes of projecting consumption levels and patterns, the introduction of these factors implies that we can do three things:

- (1) Quantify the impact of an individual factor on the level of consumption for a given food for a "representative" consumer or household;
- (2) Project how the importance of the factor within a given population will change over time; and
- (3) Determine if the marginal impact on the consumption function is constant over time. If not, there is the additional problem of being able to explain and project the coefficient changes.

This introduction summarizes the common nature of the problems addressed in the five papers presented in this section. The commonality constitutes the effort to deal with the identification of critical socioeconomic and demographic variables, the assessment of how these variables impact demand levels, what changes we might expect to see in the absolute magnitude of the identified explanatory variables, and whether or not the effect of a given variable on consumption is stable over time.

#### GENERAL FACTORS AFFECTING DEMAND

Professors Raunikaar and Haung provide a general discussion of the factors usually considered to be important determinants of demand. They then review the projected levels for these factors for the year 2000 and, finally, they provide an illustrative regional projection procedure for shell eggs.

The paper tends to skirt around a myriad of issues related to demand estimation and consumption projections without fully developing many of the thoughts. For example, initially there is considerable discussion of foreign market demand for U.S. products and of some supply considerations. How the authors relate these factors to actual demand projections is never made clear in the paper or presentation. We can only assume that export demand and supply response factors were mentioned because the authors recognize that long run projections of consumption are dependent on assumptions regarding relative prices. Relative prices, of course, depend on prevailing supply conditions, as well as prevailing demand conditions. Although not explicitly mentioned, demand projections also contain embodied implications about resource allocation for the production sector. For many of the farm commodities for which the domestic market is essentially the only market, it seems quite likely that trend productivity growth could easily exceed demand growth, assuming constant real prices. The dairy industry is a prime example. Greater productivity growth rela-

tive to demand growth implies that, over time, resources would have to be diverted out of those industries which rely primarily on domestic markets.

The Raunikaar and Haug paper did set the stage for the following papers by discussing the expected changes in levels of the various identified explanatory factors by the year 2000. Except for the shell egg example, they did not translate the changes in variable levels back to specific implications for food demand.

The shell egg example reports a fairly sophisticated approach for projecting future regional demand levels. The actual regional projections are based on an estimate of future aggregate U.S. shell egg consumption. Therefore, the regional projections can only be evaluated within the context of the 'quality' of the aggregate quantity estimate. Unfortunately, the aggregate projection used in the analysis was not based on a formal demand analysis. Thus, although the procedure seems valid to me, the actual numerical projections would have a more sound base had more effort been spent on developing the aggregate projection.

## STRUCTURE CHANGE

Professor Buse has provided a thorough and innovative conceptual and empirical analysis dealing with two important problems. First, he recognizes the need to incorporate prices into analyses using cross sectional data which have been collected over time. Second, he recognizes the need to allow for changing parameter values over time. These issues represent critical methodological problems when one desires to evaluate the impact of changing socioeconomic and demographic variables on consumption projections.

Professor Buse begins with a two-equation model to explain expenditures for food "k" in a given region. The first equation measures the probability that a household will purchase good "k" as a function of total household income, income sources, seasonal adjustors, and a vector of household characteristics. The second equation explains the budget share of food "k," conditional on the household's decision to purchase good "k," as a function of total food expenditures, income source, a vector of individual food prices, seasonal shifters, and household characteristics.

The major conclusion of the analysis was that, for most food groups, changes in regression coefficients over time are many times more important than changes in variable (prices and income) levels. To accept this conclusion, we obviously have to feel comfortable with the model specification. In that regard, I have three reservations which are discussed below.

First, it seems to me that the decision to purchase or not purchase a given food item is a function of relative and absolute price levels, as well as income levels and household characteristics. This decision is consistent with the hypothesis that there is a threshold



price level, above which an individual consumer will not purchase a given product. The threshold price could vary depending on prices of substitute goods and will vary across individuals. Therefore, I would argue that the first equation in Dr. Buse's model should include a vector of prices as explanatory variables.

Second, I had some difficulty relating the price vector specified in the theoretical model with the price variables used in the empirical estimation. The conceptual model suggests a complete set of "k" prices for "k" food groups in the budget share equation. The empirical model includes only two price indicators: price indexes for food at home and for food away from home. The reason given for the difference is that multicollinearity problems prohibited the inclusion of the complete price vector in the actual estimation.

Third, I am concerned with the degree of aggregation across individual foods to arrive at the food groups used in the analysis. Particularly the meat, fish, poultry and egg group seems, in my opinion, to be sufficiently aggregative to cover up important substitution patterns.

I have neither the time, nor do I have the expertise, to definitively evaluate the impact of what I see as three major shortcomings of the model and analytical procedures. My hypothesis is that all three could have the effect of biasing the results toward stronger measures of parameter change and toward underestimates of the impact of changing variable levels. These comments, I think, suggest legitimate areas of inquiry for future model development.

Structural change will continue to be an issue, and we should continue to work on methods to better measure structural change. It is, however, not particularly useful for projection work unless we can explain the cause of structural change and be able to forecast the direction and magnitude of change. Professor Buse had two observation points with respect to parameter change. Consequently zero degrees of freedom are left for determining the causal factors.

The effort to explain parameter change will, I think, lead to the incorporation of additional variables in demand models. Hence, we will likely end up with an expanded set of "fixed" structural coefficients. If the parameter change can be related in a systematic way to observable variables, these variables then enter the model as explicit explanatory variables. Thus, I believe the efforts to measure structural change have their biggest payoff in terms of being diagnostic tools to better specify the demand model.

#### AGE DISTRIBUTION AND FAMILY SIZE CHANGES

The paper by Dr. David Price calls our attention to two changing demographic characteristics of our population. One is the change in age distribution and the second is the change in household size. The objective was to estimate the impact of these changes on the demand

for 34 specific foods and on total food expenditure for 1960 and 1983 and to project the impact to 2000. The procedure used was to estimate age-sex adult equivalent scales and economies of scale coefficients using the 1977-78 USDA Nationwide Food Consumption Survey as the basic data source.

The concept is fairly clear for both measures. For a variety of reasons, persons in different age groups consume different quantities of different specific foods. If one can normalize on one age group, then all other age groups can be expressed in terms of the base group and projected population levels can then be adjusted to a common base; i.e., adult equivalents. Scale economies related to household size stem from the argument that smaller households will tend to have more spoilage and waste and will tend to pay more per unit because of the necessity to purchase smaller sizes. Thus, as family size declines, per capita food expenditures will increase partially as a result of the scale factor. The scale factor is not related directly to food preferences. The scale results for total food expenditures appear quite plausible. The results for individual food quantities seem less plausible. Given that the scale effect on quantity is most likely due to waste and/or spoilage, one would expect the largest scale impact to occur with perishable foods. The largest scale effects were measured for frozen vegetables; canned fruit; cheese; soups, sauces and mixes; fruit and vegetable juices; other sugar products; fresh fruits; and crackers, biscuits, etc. The smallest scale effects were measured for fresh milk and bread and rolls. For 11 out of 28 reported categories, the estimated scale factor showed an inconsistent pattern across household size categories. The variability of the results suggests that one should be cautious in concluding that strict scale coefficients were, in fact, measured.

Nevertheless, Professor Price's research provides useful insights into what food groups will likely benefit from family size and age distribution changes. The results are based on consumption patterns measured in 1977-78. Thus, as was well recognized in the paper, the results should not be viewed as consumption forecasts because of the many factors, other than those explicitly considered, which might cause consumption adjustments.

#### IMPACTS OF AN INCREASING PROPORTION OF ELDERLY PEOPLE

While the importance of an expanding elderly population is mentioned in all of the papers, it is the primary focus of the two papers by Dr. Schrimper and Dr. Dorothy Price, respectively.

Dr. Schrimper argues that we need to go beyond simply projecting changes in numbers of elderly. He suggests that we need to look at the institutional and economic characteristics of this group to fully evaluate future impacts on consumption. Critical factors suggested by Schrimper include:

- (1) The impact of larger numbers of institutionalized persons as the number of people over 85 years of age increases.
- (2) The impact on public policies and programs which provide income, medical care, and housing support for the elderly.
- (3) The marginal propensity to consume for this group vis-a'-vis other age groups and the cross-relationships between food expenditures and other expenditure categories.

The Schrimper paper provides us with a good review of previous research relating to food consumption patterns of the elderly. Beyond that, it provides a stimulus to broaden our perspective toward future demand research. For example, with increasingly large institutionalized populations of elderly, food consumption patterns will be increasingly influenced by diet restrictions and institutional food purchasing behavior. Neither of these has been fully explored within the context of evaluating future demand for specific commodity groups.

Professor Schrimper also mentions the importance of exogenous shocks on the budget share allocated to food. Specifically, he cites results which suggest that, among the elderly, a 3% increase in the health expenditure share results in a 1% decline in the food budget share. As he mentions, this type of analysis is extremely important for evaluating public policy programs. I believe that work in the area of identifying factors affecting aggregate budget shares and the measurement of their impacts for various demographic groups is of vital importance for fully evaluating the impacts of public programs and of large price shocks in other segments of the economy.

Dorothy Price also focuses on the impact of an increasing population of elderly people. Her emphasis, however, is on using information provided by sociological and psychological theories of human behavior. The underlying argument is that economic models are useful for explaining behavior to the point where safety and security needs are met. However, once those needs are fulfilled, psychological, social, self-esteem, and self-actualization needs play major roles in determining behavior and purchase decisions. This paradigm forces us back to the basic utility function and an attempt to explain interpersonal and intertemporal changes in personal preferences.

I appreciate the concepts and agree it is very important to pay more attention to these factors in our demand work. More basic research in this area would, I think, help us define the pertinent socioeconomic and demographic groups in a more meaningful way.

Unfortunately, I'm not convinced the empirical work reported in this paper takes us very far. Reasons for the choice of specific foods included in each of the three nutrient categories are not entirely clear. One wonders why, for example, meats were left out entirely. Why were beet greens included and green beans left out? Does an analysis based on an incomplete set of food choices provide unbiased results?

Perhaps more significant is a lack of explanation of how many of the various explanatory variables were measured. How does one measure "love" or "self esteem" needs? Assuming they are measured accurately, how does one "project" values for these variables for population groups?

Empirically, there appear to be some rather substantial multicollinearity problems. Coefficients for the variable labeled "No. of diet restrictions" and "Diet restriction concerns" appear to be influenced by this problem. Similarly, one suspects that the opposite signs for the household income and food expenditure variables results from multicollinearity problems.

In my opinion, additional work in this area could be of substantial benefit for commodity demand analysis. Perhaps we should spend more effort in determining what characteristics different consuming groups desire in the different food groups and then ascertain their perception of the characteristics embodied within specific foods. Mapping desired characteristics with perceived characteristics might help provide additional insights into why some foods are preferred by some groups of people and not by others.

#### SUMMARY

In summary, I again want to commend the authors on their presentations. Perhaps the most important contribution resulting from an effort to make demand projections is a suggested research agenda. After struggling with these papers, I'm sure we all have a better feel for where we need to focus our research efforts to provide a better analytical framework for consumption projections. Understanding the forces that shape consumer preferences and purchase decisions is critical to evaluating the level and mix of resources needed in the agricultural producing and marketing sector. Recognizing that prices and income levels are dominant factors affecting demand only calls attention to the fact that consumption projections cannot be made solely on the basis of consumer demand relationships. Consumption levels and market prices represent "equilibrium" points between prevailing supply and demand relationships. Thus, quantity-price projections imply a systems analysis which includes the interactive effect of demand, supply, and equilibrium prices.

Finally, I think as a profession we need to put more effort into determining how consumer preferences are changed. Traditionally, economists have viewed preferences as being "exogenous" factors which are not influenced by participants in the food production and marketing system. The real world, I believe, operates under a different set of assumptions. Why else would we have advertising, new packaging development, product form variations, etc.? With the current emphasis of commodity advertising and new product research, those of us involved in demand research must be prepared to answer questions about the

impact of these activities on demand for the specific commodities being promoted and on the demand for other food groups which might be substitutes.