



# HEALTH, NUTRITION AND FOOD DEMAND



Edited by W.S. Chern and K. Rickertsen



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# **HEALTH, NUTRITION AND FOOD DEMAND**

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# Preface

Over the last two decades, increasing concerns about health risks related to diets have had significant impacts on food-consumption patterns in the USA and Europe. The desire to improve diets in general and nutrient intakes in particular and the accompanying difficulties have received much attention among economists, nutritionists, health professionals, food producers and policy makers. The purpose of this book is to discuss the likely impacts of health information on the demand for various foods in various countries and among various socio-economic groups. Furthermore, effects of other types of information, such as food scares related to mad cow disease and advertising, are discussed. We hope that this book will be a useful reference for researchers and analysts in the food industry and government and that it can be used as a supplementary textbook in courses in applied microeconomics, consumer demand, health economics and food consumption and nutrition.

The book is based on the papers presented in the Mini-Symposium on 'Effects of Health Information on the Demand for Food: EU and US Experiences' organized as part of the XXIV International Conference of Agricultural Economists sponsored by the International Association of Agricultural Economists (IAAE), held in Berlin, Germany, 13–18 August 2000. Most of the European chapters contain results from the EU-supported research project 'Nutrition, Health and the Demand for Food'. Researchers from France, Germany, Norway, Scotland and Spain participated and we hope that the analyses from these countries provide a representative European perspective. As an additional source of information, each of the European chapters includes a brief review of food-demand studies in the respective countries and a discussion of changes in food-consumption patterns during the last 20 years of the 20th century.



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# Introduction

**WEN S. CHERN<sup>1</sup> AND  
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There is a widely held belief that concerns about diet-related consequences for health have altered the landscape of food-consumption patterns in many industrialized countries. Analysts have frequently attempted to validate this belief and to provide empirical evidence on the subject. However, the economics literature has shown that it is very difficult to quantify precisely the impacts. Therefore, each chapter in this book attempts to discover whether information on health and nutrition have had any significant impacts on food demand. The book also includes a wide range of topics dealing with the methodology and econometric modelling of the impacts of health and nutrition information on the demand for various foods in different countries.

For the agricultural industry, policy makers and consumer groups, it is important to understand and quantify the impacts of health concerns on food demand because of the critical role of consumer preference in determining the future course of agricultural production, marketing and trade. We believe that a comparison of research findings between the USA and Europe will provide useful insights into the measurement of health-risk concerns and health information and, furthermore, their impacts on food demand. It is our hope that analysts from other parts of the world can adopt the methodologies used in this book.

The lessons from the USA and Europe on the changing patterns of nutrition and food intakes can be used to aid the food and nutrition policies in other developed countries, such as Japan, and in developing countries, such as Brazil, China and India. This topic is of growing importance given the dietary changes already occurring in the newly industrialized countries of East Asia, such as Singapore, South Korea and Taiwan. By using appropriate tools, such as nutrition-education campaigns, these countries may be able to lessen the adverse health impacts of dietary changes that occur with rapid income growth. For the

remainder of this chapter, we shall summarize the main contributions of each chapter.

American food choices have been affected by health and nutrition information related to diets as well as by the traditional demand variables, such as income and prices. In Chapter 2, Wen Chern first reviews the historical trends of food intakes and food expenditures by American households for the last 20 years of the 20th century. He points out that, over this period, American households have improved their diets by eating more cereals, poultry, fruits and vegetables, and drinking more low-fat milk. Furthermore, Americans have been eating less red meat, particularly beef, and drinking less whole milk. On the other hand, Americans love cheese, ice cream and fast food, so have had a hard time cutting down the consumption of sugar, fats and oils, and have not managed to add much more seafood to their dinner plates. In accord with human nature, Americans are often inconsistent with respect to healthy eating. Chern attempts to quantify the impacts of health information related to fat and cholesterol on food consumption in the USA. He reviews and suggests appropriate conceptual frameworks on how to incorporate health concerns in a neoclassical demand model. Chern discusses the methodology of constructing the monthly fat and cholesterol information indices based on the numbers of articles published in medical journals and in the popular press, such as the *Washington Post*. One very innovative feature of this methodology is the assumption that any published article has only a finite duration as a useful source of health information to consumers. This methodology is used in constructing the similar European indices used in several European studies included in this book. His econometric model and results clearly show that consumers' health-risk concerns, as measured by his fat- and cholesterol-information index, have affected American food choices in the direction of healthier diets. Medical research has certainly played a very important role in helping Americans to improve their diets.

The effects of health information on the demand for foods have rarely been studied using European data. In Chapter 3, Rickertsen and von Cramon-Taubadel summarize the effects of health information that were found in a European Union (EU) project including France, Germany, Norway, Scotland and Spain. These countries vary considerably as regards diet and mortality rates from diet-related illness, such as heart disease. For example, the consumption of vegetable products is higher in Mediterranean than in northern Europe, and the mortality rates from coronary heart disease are high in Scotland and Norway and low in Spain and France. A two-stage demand model is estimated using a separability structure, commodity aggregation and functional form as similar as possible across countries. However, there are important differences in the data and sample periods used. As in

many previous studies, the health-information index is based on the Medline database and a new index, based on the number of articles dealing with fats, cholesterol and the diet in English-language medical journals, is developed. Price and expenditure elasticities are calculated. Rickertsen and von Cramon-Taubadel find that it is difficult to discover any European pattern. There is a wide spread in the values of the own-price elasticities for all goods except for the group 'other goods' and a surprisingly high number of expenditure-elastic food groups and types of meat in different countries. It is impossible to draw clear conclusions regarding the impact of health information on the demand for food in general and meat in particular in the EU. A consistent positive or negative effect of health information on the demand for any specific goods is not found. Several of the significant health-information effects are unexpected, indicating that the common model may be too restrictive. Most of the participating countries have been able to produce more plausible results, as discussed in later chapters, by deviating from the model presented in Chapter 3.

The next three chapters cover US experiences dealing with health, nutrition and food demand in a cross-sectional context. In Chapter 4, Jayachandran Variyam deals with the intakes of several key macronutrients by American adults. Specifically, he attempts to estimate the impacts of educational attainment on the intakes of total fat, saturated fat, cholesterol and fibre. His study deviates from the previous literature in the field by estimating the impacts of education and other social and demographic factors on different segments of the intake distribution rather than means. He does so by employing the quantile regression method. Quantile regression provides a useful method when we are interested in the impacts among demographic groups with varying intakes and thus different potential health risks. His database is obtained from the Continuing Survey of the Food Intakes by Individuals (CSFII) for 1994–1996 provided by the US Department of Agriculture (USDA). This is one of the most important databases in the USA for doing nutrient-intake analyses. Since the study's focus is on the impact of education, Variyam reports only the regression results related to the education variable. His findings suggest that education not only affects the intakes of the key macronutrients in the USA, but also has stronger impacts on the households in the upper tail of the intake distribution. That is, education appears to have a stronger impact on the intakes of fat, saturated fat and cholesterol in the 75th and 90th percentiles than in the 10th or 25th percentiles. This information is important because the health risks are higher for those people in the 75th or 90th percentiles of the intake distribution.

In Chapter 5, Sung-Yong Kim, Rodolfo Nayga and Oral Capps investigate the impacts of label use on diet quality in the USA. Health information is assumed to be provided by food labels, and thus using



food labels is similar to getting health information on food. The study is based on the healthy eating index (HEI) developed by the USDA. The USDA has been attempting to monitor the American dietary trends and needed a measure of dietary quality. The HEI was developed to measure dietary quality for individuals or the nation as a whole. Kim *et al.* model the HEI as a function of label use by the types of food label. They also specify a probit model for estimating the probability of label use simultaneously with the dietary quality measured by the HEI. They use data from the 1994–1996 USDA CSFII and the Diet and Health Knowledge Survey (DHKS). These are important surveys conducted by the USDA for monitoring the nutrition status of people in the USA. Thus this study uses the same database as that used by Variyam in Chapter 4. The main findings include the significant impacts of label uses on dietary quality. They also reinforce the previous finding in Chapter 4 that education is important for achieving a more healthy diet. This chapter also provides a detailed investigation of the patterns of label uses and their impacts on dietary quality among different demographic groups. Despite the importance of demographic characteristics, the results related to demographic variables are not always transparent. For example, it is not clear why non-Hispanic people are less likely to use label information. Furthermore, why would male users of nutrient claims have higher HEIs than female label users, but male non-label users have lower HEIs than female non-users?

Kamhon Kan and Steven Yen, in Chapter 6, model health information, health knowledge and egg consumption in a recursive simultaneous-equations system. Basically, they assume that information affects health knowledge, which, in turn, affects egg consumption in both consumption participation and quantities consumed. Thus there are four equations in the system. As in Chapters 4 and 5, they use data from the 1994–1996 CSFII and data from the DHKS. However, Kan and Yen construct the information and knowledge variables differently from the previous authors. Health information is a binary variable based on whether or not the survey respondent has heard about the health effect of cholesterol. The knowledge variable, on the other hand, is measured by the relative importance of choosing a low-cholesterol diet simply because eggs contain more dietary cholesterol than most other foods. Many typical demographic variables, such as education, age, sex, race and ethnicity, are included. Since these survey data do not contain information on prices, no prices are included and this is, of course, a typical problem of using the USDA CSFII data. Among the main findings are: (i) health information as defined does affect health knowledge; (ii) health knowledge affects only the participation in egg consumption, not the level of consumption; and (iii) education affects information positively, but affects knowledge and participation negatively. Similarly to the attempt in Chapter 5, Kan and Yen treat

health information and knowledge as endogenous in the food-intake decision. This methodology will be evaluated further in the last chapter of this book.

The next four chapters deal with the European experiences. Even though there are many studies of German food demand, none of them, to our knowledge, have been published in English. In Chapter 7, Susanne Wildner and Stephan von Cramon-Taubadel fill this gap. Food demand evolved in different environments in East Germany (EG) and West Germany (WG) prior to 1989. Nevertheless, the importance of meat in the food budgets of both EG and WG was considerable prior to reunification and remains so today. The share of meat and processed meat in food expenditure was 25% in EG and 21% in WG in 1998. A demand model is used to test the possible linkages between the dissemination of health information and the demand for different types of meat. Meat is expected to be especially responsive to health information and many health campaigns are geared towards reducing the intake of animal fats. The health-information index discussed in Chapter 3 is also used in Chapter 7. Furthermore, two additional indices are developed. The first index is based on publications in English by German scientists, while the second index also includes German-language publications. A linear approximate almost ideal demand system (AIDS) is estimated. Five groups of meat (beef and veal, pork, poultry, sausage and other processed meats, and fish and fish products) are studied. The analysis is based on monthly data covering the 1991 to 1998 period. The demand of a 'standard household' consisting of a married couple with two children and middle income is studied. They find that, with the exception of poultry in EG, the two German indices have no significant impact on meat demand in either EG or WG. The health-information index discussed in Chapter 3 is significant in three of the five equations in both EG and WG. Significant health-information effects appear to be stronger in WG than in EG. Fish and fish products appear to have benefited at the expense of pork from the dissemination of cholesterol- and fat-related information. These results are plausible. Fish is regarded as a healthy food while pork is considered less healthy due to its cholesterol content and the poorer composition of its fatty acids.

Chapter 8 is about France. Even though the French mortality rates from cardiovascular diseases are among the lowest in the world, this group of diseases is still the primary cause of mortality, causing 32 deaths out of 100. Véronique Nichèle estimates the impact of information about fat and cholesterol on food demand. The main differences from the French model described in Chapter 3 are related to the selected demand system and data set. The quadratic almost ideal demand system (QUAIDS) is estimated in Chapter 8. This system is a generalization of the AIDS, which is consistent with non-linear Engle

curves. Furthermore, pooled microdata from the French National Food Survey are used. Household data enhance the empirical analysis in several ways. First, food products are aggregated into 15 food groups according to high and low fat content. Secondly, the inclusion of sociodemographic variables allows the investigation of the impact of household characteristics on the demand. Thirdly, the estimated price effects are more reasonable than the rather unexpected results for France found in Chapter 3. The quadratic expenditure terms are less important than the linear expenditure terms; however, they are significant for 13 of the 15 food groups, indicating that the QUAIDS specification is appropriate. Substantial health-information effects are found. Fat and cholesterol information has a negative impact on the demand for beef, other meats, eggs and butter and, to a lesser extent, on the demand for pork and vegetables. A positive impact is found on the demand for meat products, milk, yoghurt, oils and grain products. The demand for poultry, fish, cheese and fruits is relatively unaffected by health information. Most of the results are plausible. The negative effects for beef, pork, other meats, eggs and butter are as expected. However, the negative effect on vegetable demand is unexpected. The demand for oils benefits from increased health information at the expense of the demand for butter. The positive effect on milk demand is related to the change in the composition of milk demand. The consumption of whole milk has decreased while the consumption of low-fat and non-fat milk has increased.

A Spanish study is presented in Chapter 9. We note first that it is likely that consumers make their decisions not only in terms of final food products but also in terms of food nutrients. Ana Angulo, Jose Gil, Azucena Gracia and Monia Ben Kaabia develop and estimate a demand system with food quantities as dependent variables and income, prices, sociodemographic variables and nutrient content of different food groups as explanatory variables. Their approach is related but not identical to Lancaster's approach (see Chapter 2). A demand system based on the generalized addilog demand system (GADS) is developed. They use the Spanish Quarterly National Expenditure Survey for 1995 and study the demand for six broad food groups (cereals and potatoes; meats; fish; fruits and vegetables; dairy products and eggs; and oils, sugar and other food products), including six nutrients (carbohydrates, lipids, proteins, vitamins, minerals and fibre) in the model. A likelihood-ratio test suggests that nutrient composition of food is important and should be included. As expected, total expenditure elasticities are positive and own-price elasticities are negative. Furthermore, the inclusion of nutrients causes the expenditure elasticities for relatively healthy products to increase and, except for dairy products and eggs, the own-price elasticities to become more elastic. The own-nutrient elasticities suggest that the demand for cereals and potatoes is positively