How Do We Value Fat? The Case of Ground Beef

This study investigates consumer willingness to pay for saturated fat. Fat intakes through a relatively homogeneous source are analyzed using two nationally representative food intake surveys. It appears as though consumers are willing to pay to reduce fat, and fat is reduced as household incomes increase.

Michael S. Finke, The Ohio State University [1]

Introduction

A number of studies have found that consumers reduced their demand for certain foods high in saturated fat during the 1980s (Eales and Unnevehr, 1988; Kim and Chern, 1993; Wang and Jensen, 1994). Consumers appear to have reacted to public and private information that effectively made saturated fat a stigmatized nutrient.

Traditional nutrient valuation analysis is explored. An attempt is made to reduce variation in food price caused by non-nutrient factors in order to provide a more precise estimate of willingness to pay for saturated fat. Data from three different national food surveys collected within a ten year time period are included to explore possible changes in the willingness to pay for saturated fat in food.

Background

Previous attempts to uncover the real effect food nutrients have upon how consumers value food has drawn on characteristic theory (Eastwood, 1986) and the technique of hedonic analysis. People are assumed to weigh the component food nutrients when deciding what they are willing to pay for a food item. The hedonic technique tests how much variation in food price is due to variation in nutrient content. Capps and Schmitz (1991), in a comparison of analyses using the 1977 Nationwide Food Consumption Survey (NFCS), find the hedonic price per gram of fat to be both negative (-1.95 cents) and positive (0.25 cents) depending on the season in which the data was collected. The power of hedonic analysis to predict how much a consumer is willing to pay for the addition or subtraction of a food nutrient is reduced by the complexities of the food market. Foods differ by a number of characteristics including taste, convenience, appearance, or familiarity that affect the decision to buy. In addition, price might have as much to do with supply as it does with demand. For example, despite being limited in taste, convenience, and especially appearance, escargot is priced much higher than soy grits (another protein food). Rather than modeling the effect nutrients have upon prices in the entire food system, a more precise estimate of willingness to pay for a component food nutrient may be possible if some of the noise caused by other sources of price variation is eliminated.

Choice of Food Product

Red meat has consistently accounted for over 33 percent of the saturated fat in the U.S. food supply (Raper, Zizza, and Rourke, 1992). Despite findings that fat content is associated with decreased willingness to pay for beef (Wang et al., 1995), the most expensive cuts of meat are often the most tender - largely a result of high intramuscular fat. Differences in supply and flavor may account for much of the variation of meat pricing.

Rather than risk the inaccuracy of nutrient valuation when comparing stew meat to fillet, ground beef is chosen as a more ideal food from which to determine whether and to what extent consumers are willing to pay for the removal of fat. Ground beef essentially differs only in content of fat and lean. Since millions of tons of grass-fed lean ground beef are imported from Australia to complement the supply of grain-fed American ground beef, supply of both lean and higher-fat ground beef is abundant. Both are easy to prepare, free of brand names, and contain essentially the same micronutrient (vitamin and mineral) content.

Price Estimation

Finding a price for a nutrient using the hedonic model involves estimating an equation that

captures the variation in price that coincides with variation in nutrient content. Such an equation would look like:

$$P_F = \alpha_1 + B_1N_{F1} + B_2N_{F2} + ... + B_nN_{Fn} \qquad (1)$$

where price is viewed as a function of the nutrients (N) each unit of food (F) contains. Normally, these implicit prices are estimated for each household and a demand system created for each nutrient that includes these implicit prices.

Since the only major difference in the nutrient content of ground beef is fat content, we can bypass the complete hedonic price estimation procedure. A ratio of total fat (grams of fat/grams of protein) can be created as a measure of leanness. Quantities of fat and lean are calculated at cooked weight. Therefore, fat lost in the cooking process does not enter into the price equation. It is theorized that demand for leaner meat, represented by this ratio (R), is influenced by price (P), income (I), and demographic characteristics (D) for family I:

$$R_i = \alpha_1 + B_1P_i + B_2I_i + B_3D_i \qquad (2)$$

A price difference between lean and fatty ground beef will be reflected in the coefficient for P. A positive coefficient will mean that households are willing to pay more to eat ground beef with a higher fat content. A positive coefficient for I will imply that as household income increases so does the preference for higher fat ground beef. Positive coefficients for demographic characteristics will imply that a preference shift exists for households within that category toward consumption of higher-fat ground beef.

While this estimation procedure is useful when identifying which households prefer leaner and fattier meat independent of price and income, interpreting coefficients can be difficult. The ratio may be more easily envisioned as the "lean percentage," though some fat is lost in the cooking process. The coefficient for price can be seen as the difference in price that one could expect between lean and regular ground beef when shopping during the survey period.
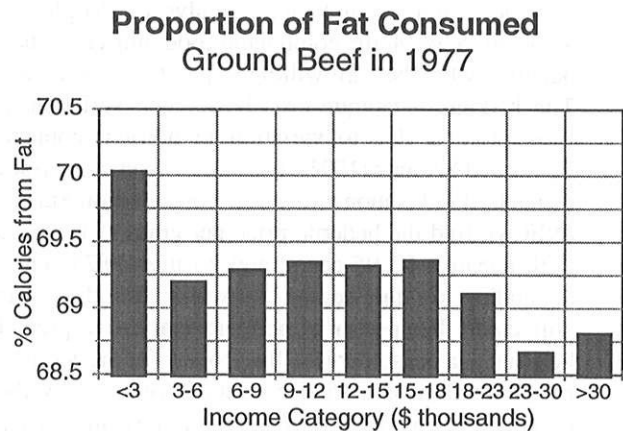
Data

The 1977-78 and 1987-88 household portion of the Nationwide Food Consumption Survey contain data on quantity and money value paid for foods from which price estimates may be obtained. Households that did

not consume ground beef during the study period were excluded. Of the 4,495 households surveyed in the 1987-88 NFCS, 3,124 are retained in this analysis, as are 2,425 of the approximately 3,302 households in the 1977-78 NFCS.
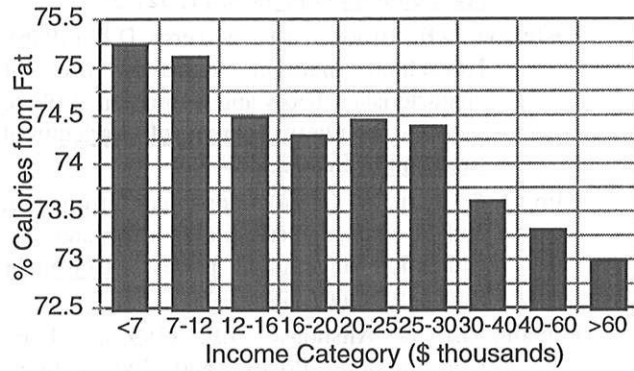
Since vitamin and mineral content is assumed constant, information on micronutrient content is not included. Trace carbohydrates found in some ground beef are also excluded since quantities are nearly immeasurable. Data on region, income, urbanization, and race of families are included as possible determinants of nutrient preference. Education is not included due to the difficulty in assigning a value of education to data that contain race and nutrient content in the 1987-88 NFCS. Race and ethnicity are broken down into three groups--blacks, whites, and others. Regions included are Northeast, Midwest, West, and South. Household urbanization is segmented into urban, suburban, and non-metropolitan. The log of income is used as a more accurate representation of the non-linear relationship hypothesized to exist between income and consumption of relatively less fatty ground beef.

Results

Price is found to vary negatively with the ratio of fat to protein. Leaner meat is more expensive. More interestingly, a number of characteristics aside from price significantly influence the demand for leaner ground beef. As household incomes increase, the proportion of lean in ground beef demanded rises in both the 1977-78 and 1987-88 surveys[2]. The following graphs illustrate this pattern:

Proportion of Fat Consumed
Ground Beef in 1977

Proportion of Fat Consumed
Ground Beef in 1987

Variables	1977-78	1987-88
Log Income	-0.011** (0.003)	-0.023** (0.004)
Suburban (reference Urban)	0.006 (0.008)	-0.004 (0.008)
Non-metropolitan	0.026** (0.008)	0.010 (0.009)
Northeast (reference South)	-0.063** (0.008)	-0.038** (0.009)
Midwest	-0.024** (0.008)	-0.039** (0.008)
West	-0.029** (0.009)	-0.028** (0.009)
White (reference Black)	-0.028** (0.010)	-0.067** (0.011)

* indicates 95 percent confidence interval

** indicates 99 percent confidence interval

Although the lowest-income households eat the most fat and the wealthiest eat the least fat as a proportion of calories from ground beef in both surveys, data show the inverse relationship between income and leanness to be more pronounced in the 1987-88 NFCS.

Suburban households are found to prefer fattier meat no more or less than urban households. In the 1977-78 NFCS, non-metropolitan (mainly rural) households are found to have a preference for a greater proportion of fat, although this preference is not significant in the 1987-88 survey.

There appears to be a strong preference for fattier ground beef in the South. Northeasterners appear to have the highest preference for leaner meat. Whites have a significantly stronger preference for leaner ground beef than blacks. This preference difference appears to have risen between the 1977-78 and 1987-88 surveys. Members of other races and ethnicities also had a significantly weaker preference for fat than blacks in the 1987-88 NFCS.
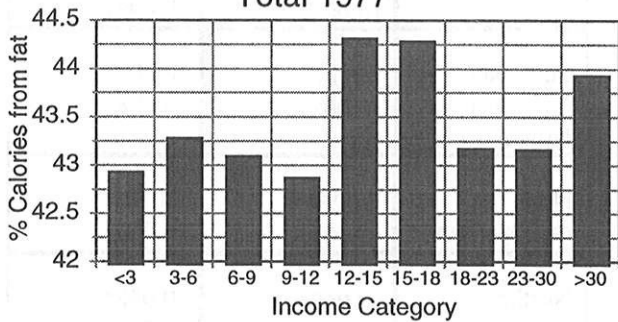
Conclusion

In both survey periods consumers were willing to pay to reduce the fat content in their ground beef. In addition, higher-income households bought ground beef that was leaner. In fact, descriptive data show clearly that in 1987-88 lean content increased as incomes increased.

In essence, the significant coefficient for price makes leanness a normal good. As incomes increase, families want leaner foods and are willing to pay more for them. As information about the relationship between dietary fat and disease has entered the food buying decision, higher-fat foods will inevitably become less desirable. The following graphs highlight this relationship between total fat consumption and income:
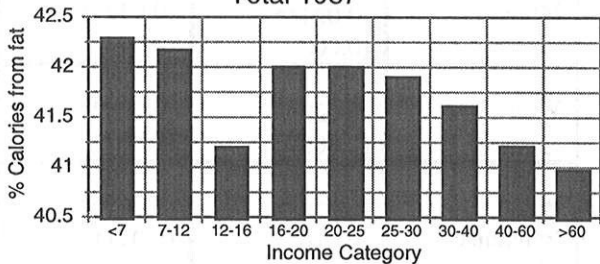
Table 1.

Demand for higher fat ground beef

Variables	1977-78	1987-88
Intercept	1.195** (0.013)	1.744** (0.035)
Price	-0.076** (0.007)	-0.112** (0.007)

Proportion of Fat Consumed
Total 1977

Proportion of Fat Consumed
Total 1987

Overall fat consumption appears to follow the same pattern as fat consumption from ground beef over the ten year period. In the 1987-88 survey, the highest-income households ate the least fat and the lowest-income the most fat as a percentage of calories. Despite a dip among those with a $12 to $16 thousand income, fat as a percentage of calories declines as household earnings rise.

Total fat in the U.S. food supply increase from 156 grams per person per day in 1977 to 165 grams by 1990 (Putnam and Allshouse, 1993). Saturated fat consumption increased by one gram during the same period. If the nutrient content of the food system does not change, nutrition education will decrease demand for less-favored nutrients - changing the their distribution but not improving overall health. These results evidence this pattern.

References

Capps, O., Jr. & Schmitz, J.D. (1991). A recognition of health and nutrition factors in food demand analysis. Western Journal of Agricultural Economics, 16, 21-35.

Eales, J.S. & Unnevehr, L.J. (1988). Demand for beef and chicken products: separability and structural change. American Journal of Agricultural Economics, 71, 521-532.

Eastwood, D.B., Brooker, J.R., & Terry, D.E. (1986). Household nutrient demand: use of characteristics theory and a common attribute model. Southern Journal of Agricultural Economics, Dec., 235-246.

Kim, D. & Chern, W. (1994). Consumer information and the changing preference for fats and oils: estimation of implicit prices. Consumer interests Annual, 39, 43-49.

Putnam, J.J. & Allshouse, J.E. (1993). Food Consumption, Prices, and Expenditures, 1970-1992. Statistical Bulletin No. 867. Washington, DC: Commodity Economics Division, ERS, U.S. Department of Agriculture.

Raper, N.R., Zizza, C., & Rourke, J. (1992) Nutrient content of the U.S. food supply, 1909-1988. Home Economics Research Report No. 50, Washington, DC: U.S. Department of Agriculture.

Wang, G., Fletcher, S.M., Carley, D.H., & Chern, W.S. (1995) Consumer perception of fat and demand for beef in the United States. Consumer Interests Annual, 41, 83-89.

Wang, Q. & Jensen, H. (1994) Do consumers respond to health information in food choices? Models and evaluation of egg consumption. Consumer Interests Annual, 40, 57-64.

Endnotes

1. Ph.D. candidate, Consumer and Textile Sciences, The Ohio State University, 1787 Neil Ave., 43210. Phone: (614) 292-3180. FAX: (614) 292-7536.

2. A logit analysis was also performed using the purchase/non-purchase of highest-fat ground beef as the dichotomous dependent variable. Data from 1977-78, 1987-88, and from the 1994 Continuing Survey of Food Intakes by Individuals showed the probability of buying highest-fat ground beef decreasing with income significantly in all three surveys.