

The changing food-at-home budget: 1980 and 1992 compared

Consumers appear to have made changes to their diet between 1980 and 1992; many have replaced red meat with poultry and have reduced their consumption of eggs

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In the 1960s, it was wheat germ and yoga. In the 1970s, it was granola and jogging. In the 1980s, it was oat bran and aerobics. Every decade appears to have had its own prescription for good health, and the 1990s are no exception. The news continually reports findings from medical studies that link foods with health conditions, either good or bad. For instance, studies have linked the consumption of cruciferous vegetables to a reduced risk of certain types of cancer, polyunsaturated fats to lower levels of total blood cholesterol, and monounsaturated fats to lower “bad” cholesterol and maintenance levels of “good” cholesterol.¹ Americans are advised to lower their consumption of red meats and to increase the amount of fiber and complex carbohydrates they consume by eating more breads, rice, pasta, and fresh fruits and vegetables.

But are consumers following this advice? Evidence from the U.S. Department of Agriculture suggests that some changes in dietary patterns have occurred recently.² For instance, per capita consumption of red meat fell 10 percent between 1980 and 1992, while per capita consumption of poultry rose 48 percent over the same period.³ Per capita consumption also increased for fish (19 percent), flour and cereal products (29 percent), dairy products (4 percent),⁴ fresh fruits (14 percent), and fresh vegetables (18 percent).⁵ The 15-percent increase in per capita consumption of fats and oils from 1980 (57.2 pounds) to 1992 (65.6 pounds) was due to a 23-percent increase in con-

sumption of vegetable fats (44.8 pounds to 55.2 pounds), combined with a 15-percent decrease in consumption of animal fats (12.3 to 10.4 pounds per capita).

But there is a limitation to the data: because the figures cited rely on estimates of food disappearance, they may not accurately reflect changes in actual food intake. For example, the report overstates turkey consumption, because an increasing amount of the supply of turkey is used for pet foods.⁶ Similarly, consumption of fats and oils may not be accurately measured, because the figures include waste grease from restaurants. After use in deep frying, waste grease is utilized in animal and pet foods, as well as in industrial operations, and is also sold for export, amounting to about 9 percent of the 1992 disappearance of fats and oils.⁷ Furthermore, it is not clear from the figures how Americans are consuming these foods. The increase in fresh vegetable consumption may be in part due to the proliferation of salad bars in grocery stores and of fast-food and other restaurants.⁸ And changes in fat consumption may also be due to changes at fast-food establishments, and to the use of salad oils at salad bars.⁹

Although any improvement in diet is good, it is more important to look at patterns in food eaten at home, for several reasons. First, most families eat more meals at home (where the family has more control over the ingredients used) than away from home.¹⁰ Furthermore, the figures cited

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above do not make clear who is purchasing the foods: are changes observed in the population in general or only in certain segments of the population? As the report says, "Data from the periodic NFCS [Nationwide Food Consumption Survey] and Consumer Expenditures [sic] Survey conducted by the Bureau of Labor Statistics are more useful for measuring the effect of socioeconomic and demographic characteristics on food consumption behavior."¹¹ Because the NFCS is conducted only about once every 10 years (most recently, in 1987–88), data from the continuing Consumer Expenditure Surveys are an attractive alternative.¹²

Many authors have modeled demand for major food groups as it relates to consumer characteristics.¹³ Some have looked at demand for selected food items, such as dairy products.¹⁴ Others have examined income or other elasticities for specific food items.¹⁵ One article attempts, at least in part, to compare the consumption of fruits and vegetables with levels of intake suggested by various sources from the U.S. Department of Agriculture to see how far away consumers of different demographic backgrounds are from consuming the recommended intake.¹⁶ But a search of the literature revealed no publications that address two critical issues, which are examined in this article: How have nationwide consumption patterns changed, if at all, over time? and How aware are consumers of nutritional issues, and, to the extent of their awareness, do consumption patterns appear to be consistent with consumers' knowledge of nutrition?

The discussion that follows examines data from the Diary portion of the 1980 and 1992 Consumer Expenditure Surveys and newly published results from the Diet and Health Knowledge Survey (DHKS), a national survey of nutritional attitudes conducted by the U.S. Department of Agriculture's Agricultural Research Service. First, using the Consumer Expenditure data, shares of total food spending for several demographic groups are analyzed for differences over time. An index is described that accounts for the influence of price changes on shares and that estimates the change in quantities of specific foods consumed relative to all food consumed. Second, logistic regressions are performed to see if the probability of purchasing certain types of food has changed for different groups. The demographic characteristics examined include the age of the reference person,¹⁷ family income level,¹⁸ race, and the marital status of the reference person. Third, regressions using the Heckman two-stage procedure are performed to estimate income elasticities of selected food groups for different demographic groups. At the same time, results from the DHKS are also cited to ascertain the level of nutritional awareness attained by different demographic groups. These data help explain changing patterns. For example, if older consumers were found to be the group most concerned about saturated-fat and cholesterol intake, it would not be surprising to see their expenditures for eggs decrease-

ing over time. This article likely represents the first time that results from the DHKS have been linked to another nationwide survey (the Consumer Expenditure Survey) to investigate changing food expenditure patterns.

The data

Consumer Expenditure Survey data. The Diary component of the Consumer Expenditure Survey is composed of reports from more than 5,000 consumer units¹⁹ annually. Participating families receive a diary for two consecutive 1-week periods in which they record expenditures for many different items. Purchases of food for home consumption are documented in great detail. In 1980, 10,433 diaries were available for study; in 1992, 11,713 diaries were. Each observation represents one family's response for 1 week. Dividing the number of observations by 2 yields an approximate count of unique families.²⁰ All observations are treated independently. The results are weighted to represent the total population of about 85 million families (including single persons) in 1980 and 100 million families in 1992. Unless otherwise specified, the sample described includes all families participating in the 1980 and 1992 surveys.

Report on attitudes toward nutrition. Between April 1989 and May 1992, the Department of Agriculture conducted the DHKS for the first time. This survey was "designed so that individuals' attitudes and knowledge about healthy eating...could be linked with their food choices and nutrient intakes."²¹ The survey interviews main meal planners or preparers in U.S. households, who are asked specific questions designed to find out their knowledge and attitudes about dietary issues.²² For example, respondents are asked, "In your opinion, should your diet be lower or higher in saturated fat or is it just about right compared with what is most healthful?"²³ The data are broken out by several demographic groupings, including age, income, race, and gender.

One important fact about the DHKS is that it is the first survey designed to link dietary attitudes and food consumption on a nationwide basis. Because it is a recent source of data, it is not yet possible to see whether knowledge about nutrition has changed over any length of time on a national basis.²⁴ However, combined with results from the Consumer Expenditure Survey, the DHKS data may be used both to confirm that families in the later period are at least aware of what they should be eating and to investigate whether expenditure patterns are moving in that direction.

Shares analysis

In this section, five major food groups are considered: cereal and bakery products; meat, poultry, fish, and eggs; dairy prod-

Table 1. Changes in food purchases, all consumer units, 1980 and 1992

Item	1980	1992	Percent change in CPI, 1980-92	Share index
Consumer units (thousands)	85,188	100,082	...	...
Income before taxes ¹	\$17,985	\$33,407	...	...
Average number of persons	2.7	2.5	...	...
Age of reference person	46.1	47.4	...	...
Number in consumer unit:				
Persons under age 18 .....	.8	.7	...	...
Earners	1.4	1.4	...	...
Average weekly expenditures for:				
Food at home	\$33.22	\$49.99	...	...
Cereal and bakery products	4.27	7.90	...	...
Meat, poultry, fish, and eggs	11.43	13.22	...	...
Dairy products	4.47	5.80	...	...
Fruits and vegetables	4.92	8.24	...	...
Other food at home	8.11	14.84	...	...
Share of food at home (percent):				
Food at home	100.0	100.0	54.8	...
Cereal and bakery products	12.9	² 15.8	80.6	1.05
Cereal and cereal products	4.2	² 5.4	82.1	1.09
Bakery products	8.7	² 10.4	79.5	1.03
Meat, poultry, fish, and eggs	34.4	² 26.4	42.3	.83
Beef	13.2	² 8.1	34.5	.71
Pork	7.3	² 6.0	56.0	.82
Other meats	4.6	² 3.6	41.3	.86
Poultry	4.5	4.7	40.2	1.15
Fish and seafood	2.8	2.9	73.4	.92
Eggs	1.9	² 1.1	22.2	.73
Dairy products	13.5	² 11.6	41.4	.94
Fresh milk and cream	7.1	² 5.1	36.4	.82
Other dairy products	6.4	6.5	48.3	1.06
Fruits and vegetables	14.8	16.5	89.3	.91
Fresh fruits	4.3	² 4.9	117.2	.81
Fresh vegetables	4.2	² 4.9	99.9	.90
Processed fruits	3.5	² 3.9	67.7	1.03
Processed vegetables	2.8	2.9	55.0	1.03
Other food at home	24.4	² 29.7	43.9	1.31
Sugar and other sweets	3.6	² 3.9	47.1	1.14
Fats and oils	2.9	2.8	45.4	1.03
Miscellaneous foods	8.8	² 14.8	67.6	1.55
Nonalcoholic beverages	9.2	² 8.2	25.1	1.10

¹ Complete income reporters only.

² Change in share is statistically significant at the 95-percent confidence level.

ucts; fruits and vegetables; and other food at home. Subcomponents of each major food group are shown in tables 1 through 5. A detailed breakdown of the subcomponents appears in the appendix.

The share index. The Diary survey results do not include information on quantities of food purchased—only the level of expenditure for each item is available. Because it is not possible to directly compare quantities purchased over time using these results, alternative methods must be utilized to

ascertain whether food-purchasing habits have changed. One method is to examine how the total food budget is allocated. Although a Student's *t*-test on the shares²⁵ might seem appropriate at first, such a test does not conclusively indicate whether food purchases are changing. For example, if the price of butter doubles, and, as a result, the average family purchases half the quantity it usually purchases, then the share of the food budget spent on butter does not change, assuming that there are no changes in other food prices or quantities purchased. So price changes must be incorporated into the analysis. In order to do this, a share index is proposed to measure relative changes in the amount of food purchased. This index compares shares over time after they are adjusted using the Consumer Price Index (CPI),²⁶ which measures price changes in detail for many goods and services, including food at home. Therefore, price changes for specific food items can be compared with the change in overall food-at-home prices. (See chart 1.) If the share of total food expenditures for a particular food item in 1992 is different from the share found in 1980, and if the difference cannot be accounted for by price changes alone, then, at least relative to total food purchased, the amount of the specific food item purchased must have changed over time.

The computation of the share index is straightforward. Table 1 shows that meat, poultry, fish, and eggs accounted for 34.4 percent of total expenditures on food at home in 1980. The figure dropped to 26.4 percent in 1992. During that time, the price of meat, poultry, fish, and eggs rose 42.3 percent, compared with 54.8 percent for all food at home. This means that meat, poultry, fish, and eggs cost 1.423 times more in 1992 than they did in 1980, while all food at home cost 1.548 times more in 1992 than in 1980. If the quantities purchased of meat, poultry, fish, and eggs and of total food at home remained constant, then the share in 1992 should have been about 92 percent of the 1980 level ($1.423/1.548 = 0.919$). That is, if the quantities remained unchanged, meat, poultry, fish, and eggs should have

accounted for about 31.6 percent of the food budget in 1992. Because they accounted only for 26.4 percent, however, the quantities purchased of meat, poultry, fish, and eggs declined relative to total food consumption. In fact, the share (26.4 percent) was only about 83 percent of its expected value in 1992; hence, the share index is shown as 26.4/31.6, or 0.83.

The share index is easy to interpret. If it is greater than unity, the quantity purchased of the specific item has risen relative to the total quantity of food purchased. If the share index is less than unity, the quantity purchased of the specific item has fallen relative to the total quantity of food purchased. Subtracting 1 from the level of the index also shows by what percent the specific quantity has changed relative to that of all food. Thus, as shown in table 1, the food group consisting of meat, poultry, fish, and eggs accounted for about 17 percent less of total food in 1992 than it did in 1980. Cereal and bakery products, with a share index of 1.05, increased 5 percent relative to total food quantities purchased over the same period. It is worth emphasizing that the index does not measure absolute changes in quantities. For example, if the average family purchased twice as much meat, poultry, fish, and eggs in 1992 than in 1980, but 3 times as much of all other foods, the index is less than unity. Still, the measure is important in that it shows how the family purchased certain items relative to all food. And because it controls for price changes, it elimi-

nates false interpretations that might arise from looking at changes in the share of total food alone, even if the changes are statistically significant. For example, the shares the average family devoted to fresh fruits and fresh vegetables each rose almost 1 percent from 1980 to 1992, but relative to all food purchased, the quantities actually declined substantially—10 percent for fresh vegetables and 19 percent for fresh fruits. (These and other annual changes in the share index are shown in chart 2.)

For ease of analysis, terms relating to food purchases and food consumption are used interchangeably to denote relative changes, as described by the share index. Changes of 5 percent or more, as indicated by the share index, are considered analytically significant.

Overview. Tables 1 through 5 show that, for most demographic groups, the share indexes for cereal and bakery products and for other food at home indicate an increase in relative purchases of these products between 1980 and 1992, while for all other food items (meat, poultry, fish, and eggs; dairy products; and fruits and vegetables), the indexes indicate a relative drop in purchases. In most cases, the index for cereal and cereal products is larger than the index for bakery products; similarly, the index for other food at home appears to derive its large magnitude from strong increases in purchases

Chart 1. Changes in CPI food price indexes, 1980–92

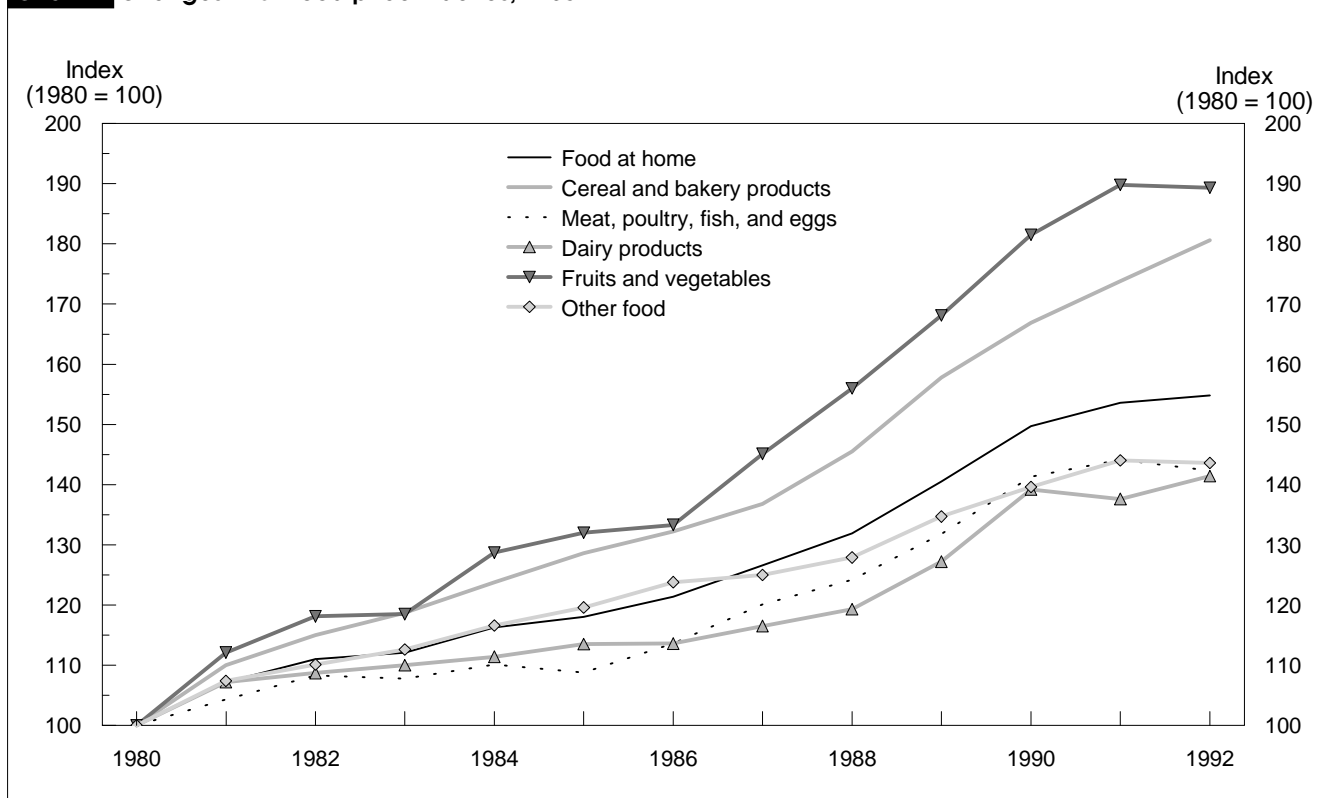


Table 2. Food purchases, by age of reference person, 1980 and 1992

Item	Under 35 years		35 to 64 years		65 and older		Share index		
	1980	1992	1980	1992	1980	1992	Under 35 years	35 to 64 years	65 and older
Consumer units (thousands)	29,092	28,716	39,568	49,713	16,528	21,654	...	...	...
Income before taxes ¹	\$16,975	\$28,500	\$22,450	\$42,807	\$9,108	\$19,624	...	...	...
Average number of persons	2.5	2.5	2.5	2.9	1.7	1.7	...	...	...
Age of reference person	26.8	27.6	46.5	47.2	73.0	74.1	...	...	...
Number in consumer unit:									
Persons under age 18 .....	.9	.9	1.0	.9	.1	.1	...	...	...
Earners	1.4	1.4	1.7	1.7	.5	.5	...	...	...
Average weekly expenditures for:									
Food at home	\$27.91	\$41.70	\$39.86	\$58.30	\$26.65	\$41.92	...	...	...
Cereal and bakery products	3.51	6.54	5.19	9.16	3.40	6.81	...	...	...
Meat, poultry, fish, and eggs	9.47	10.68	13.88	15.99	9.03	11.14	...	...	...
Dairy products	3.91	4.90	5.34	6.78	3.38	4.75	...	...	...
Fruits and vegetables	3.85	6.36	5.85	9.43	4.60	8.00	...	...	...
Other food at home	7.17	13.22	9.60	17.35	6.23	11.23	...	...	...
Share of food at home (percent):									
Food at home	100.0	100.0	100.0	100.0	100.0	100.0	...	...	...
Cereal and bakery products	12.6	² 15.7	13.0	² 15.7	12.8	² 16.2	1.07	1.04	1.08
Cereal and cereal products	4.4	² 5.9	4.1	² 5.3	4.1	² 5.2	1.14	1.10	1.08
Bakery products	8.2	² 9.8	8.9	² 10.4	8.7	² 11.1	1.03	1.01	1.10
Meat, poultry, fish, and eggs	33.9	² 25.6	34.8	² 26.7	33.9	² 26.6	.82	.83	.85
Beef	13.9	² 8.2	13.2	² 8.2	12.2	² 7.5	.68	.72	.71
Pork	6.9	5.6	7.6	² 6.0	7.2	6.5	.81	.78	.90
Other meats	4.4	² 3.4	4.8	² 3.7	4.2	3.5	.85	.84	.91
Poultry	4.4	4.7	4.4	4.7	5.0	4.7	1.18	1.18	1.04
Fish and seafood	2.4	2.6	3.0	3.1	3.1	3.0	.97	.92	.86
Eggs	1.8	² 1.0	1.9	² 1.0	2.1	² 1.2	.70	.67	.72
Dairy products	14.0	² 11.7	13.4	² 11.6	12.7	² 11.3	.91	.95	.97
Fresh milk and cream	7.4	² 5.5	7.1	² 5.0	6.5	² 5.3	.84	.80	.93
Other dairy products	6.6	6.3	6.3	6.7	6.2	6.1	1.00	1.11	1.03
Fruits and vegetables	13.8	15.3	14.7	² 16.2	17.3	² 19.1	.91	.90	.90
Fresh fruits	3.5	4.2	4.4	4.8	5.5	6.0	.86	.78	.78
Fresh vegetables	3.9	4.7	4.3	² 4.8	4.8	5.4	.93	.86	.87
Processed fruits	3.5	3.6	3.2	² 3.7	4.3	4.7	.95	1.07	1.01
Processed vegetables	2.9	2.8	2.7	2.9	2.7	2.9	.96	1.07	1.07
Other food at home	25.7	² 31.7	24.1	² 29.8	23.4	² 26.8	1.33	1.33	1.23
Sugar and other sweets	3.5	3.7	3.6	² 3.9	3.6	² 4.2	1.11	1.14	1.23
Fats and oils	2.8	2.4	2.9	2.8	3.2	3.2	.91	1.03	1.06
Miscellaneous foods	10.5	² 16.9	8.4	² 14.8	7.0	² 12.0	1.49	1.63	1.58
Nonalcoholic beverages	8.8	8.7	9.3	² 8.3	9.6	² 7.3	1.22	1.10	.94

¹ Complete income reporters only.

² Change in share is statistically significant at the 95-percent confidence level.

of miscellaneous foods, probably because miscellaneous foods include frozen meals, which proliferated in the 1980s. More varieties became available during that period, including meals that were marketed as being gourmet-style foods or low in calories. Also, an increase in ownership of microwave ovens²⁷ and an increase in dual-income families,²⁸ making leisure time more valuable and prepared foods more affordable,²⁹ coincided during the period, rendering frozen meals a timesaving, convenient, and, therefore, attractive option for many families. Finally, the share of the food budget allocated for eggs was cut by about half for most groups between 1980

and 1992, a reduction that is consistent with results from the Department of Agriculture stating that "U.S. per capita egg consumption has declined steadily since the end of World War II from an all-time recorded high of 403 eggs in 1945"³⁰ to (a preliminary estimate of) 234 eggs in 1992.³¹ (See chart 2.)

Although the majority of these changes are in more healthful directions, consumption patterns in two food groups—fish and seafood, and fruits and vegetables—declined unexpectedly for most demographic groups. The percentage of all families reporting expenditures on fish and seafood was fairly stable around a mean of 28 percent from 1980 through 1990.

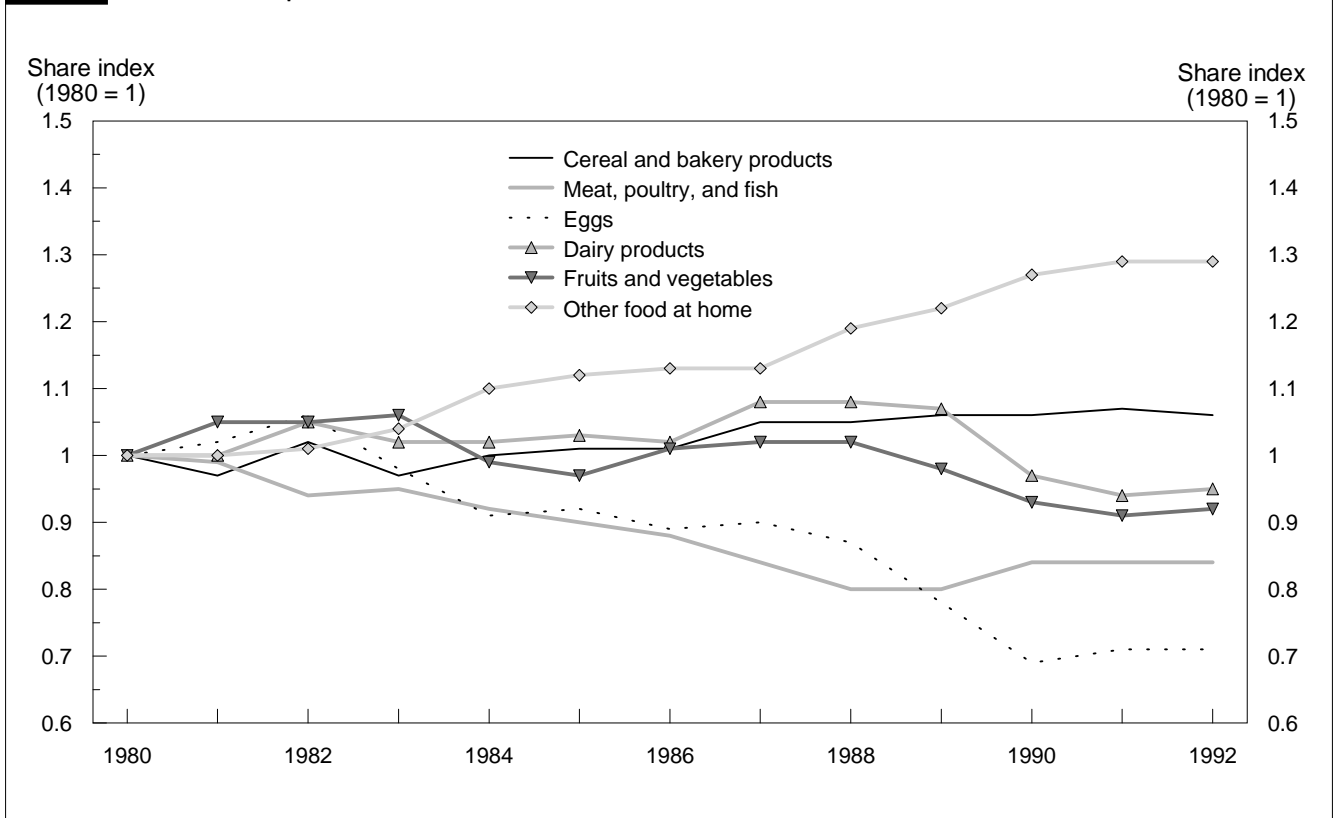
However, the percentage fell from 28.2 percent in 1990 to 24.9 percent in 1992. The drop may have been due to an increase in prices over this period: fish and seafood prices rose 3.4 percent, compared with a price hike of 2.7 percent for beef and decreases of 1.5 percent for pork and 0.8 percent for poultry. To the extent that poultry and fish are substitutes,³² it makes sense that families would purchase less fish and seafood and more poultry, given an increase in fish prices and a decrease in poultry prices. Evidence from other surveys also shows declining purchases of fish and seafood from 1990 through 1992. For example, the Bureau of Economic Analysis Personal Consumption Expenditure Survey, which measures expenditures of individuals and nonprofit institutions; the *Supermarket Business* annual survey of food manufacturers, packers, wholesalers, and retailers; and the *Progressive Grocer* study of stores with annual food sales of at least \$2 million each show decreasing real weekly expenditures on fish and seafood from 1990 to 1992 (9.8 percent, 8.3 percent, and 15.2 percent, respectively).³³ Data from the Department of Agriculture show that fish and seafood consumption was 12.4 pounds per capita in 1980, peaked in 1987 at 16.1 pounds per capita, and dropped to 14.7 pounds in 1992.

Data on fruits and vegetables are more intriguing. The share index for total expenditures on fruits and vegetables (includ-

ing processed fruits and vegetables) indicates a decrease in purchases for all demographic characteristics examined, although the percentage of all families reporting such expenditures increased slightly from 1980 (75 percent) to 1992 (78 percent). The share index for fresh fruits and vegetables was found to decline in every case examined, although the increase in the percentage of all families reporting expenditures on fruits and vegetables was about 7 percent for fresh fruits and fresh vegetables alike. However, the share indexes agree with data from the NFCS, which show a decrease in average annual household food use, measured in pounds per 21-meal equivalent person. Specifically, consumption of fresh fruits decreased from about 150 pounds in 1977–78 to about 147 pounds in 1987–88. Consumption of fresh vegetables (including potatoes, for consistency with the Consumer Expenditure Survey) fell from about 214 pounds to 185 pounds over the same period.³⁴

But how can the percentage of families reporting increase, yet the amounts consumed decrease? To explain this phenomenon, families can be categorized into *new* purchasers and *continuing* purchasers. New purchasers are those who were not likely to purchase fresh fruits and vegetables in 1980, but who were more likely to purchase them in 1992. Continuing purchasers are those who were likely to purchase fresh fruits

Chart 2. Consumer expenditure share indexes, 1980–92



and vegetables regardless of the year. Two factors are undoubtedly at work. First, new purchasers are induced to purchase, perhaps because of a greater awareness of the relationship of the consumption of fresh fruits and vegetables to health. Second, by contrast, continuing purchasers, perhaps reacting to the fact that prices of fruits and vegetables have increased faster than prices of any other foods (see chart 1), cut back on purchases of fruits and vegetables. Now, if the new purchasers are a small fraction of all purchasers, then their average purchase must be large to counteract even a small decrease in average purchases by continuing purchasers, or else average purchases will decline for the population. Evi-

dence from the Consumer Expenditure Survey data shows that this is indeed what happened. The real (that is, inflation-adjusted) mean weekly expenditure for fresh fruits in 1980 was \$1.70, compared with \$1.33 in 1992. Only bananas showed an increase in real mean expenditures, from \$0.26 to \$0.36. This is not so surprising, because the price increase for bananas (53 percent) was by far the smallest of all fresh fruits. (Oranges had the largest increase, 143 percent.) Fresh vegetables showed a similar decline in real mean weekly expenditures, from \$1.78 in 1980 to \$1.54 in 1992. Although expenditures for potatoes decreased only \$0.01 (2.9 percent), expenditures for lettuce decreased \$0.06 (23.1 percent), to-

Table 3. Food purchases and family income, 1980 and 1992

Item	Low income		Middle income		High income		Share index		
	1980	1992	1980	1992	1980	1992	Low income	Middle income	High income
Consumer units (thousands)	22,642	26,148	22,894	26,184	21,731	26,209	...	...	...
Income before taxes ¹	\$5,270	\$9,232	\$15,597	\$26,143	\$33,749	\$64,784	...	...	...
Average number of persons	2.0	1.9	2.8	2.5	3.4	3.1	...	...	...
Age of reference person	50.7	51.5	41.8	45.8	42.6	44.4	...	...	...
Number in consumer unit:									
Persons under age 18 .....	.5	.5	.9	.7	1.1	.9	...	...	...
Earners .....	.7	.7	1.4	1.4	2.0	2.0	...	...	...
Average weekly expenditures for:									
Food at home	\$23.42	\$35.61	\$34.78	\$49.29	\$47.19	\$67.38	...	...	...
Cereal and bakery products	3.17	5.55	4.51	7.72	5.92	10.85	...	...	...
Meat, poultry, fish, and eggs	7.55	9.93	12.02	12.92	16.73	16.78	...	...	...
Dairy products	3.19	4.22	4.63	5.86	6.36	7.63	...	...	...
Fruits and vegetables	3.66	6.10	4.93	7.88	6.69	11.12	...	...	...
Other food at home	5.85	9.81	8.70	14.90	47.19	67.38	...	...	...
Share of food at home (percent):									
Food at home	100.0	100.0	100.0	100.0	100.0	100.0	...	...	...
Cereal and bakery products	13.5	² 15.6	13.0	² 15.7	12.5	² 16.1	.99	1.04	1.10
Cereal and cereal products	4.9	5.6	4.5	² 5.5	3.7	² 5.3	.97	1.04	1.22
Bakery products	8.6	² 9.9	8.5	² 10.2	8.8	² 10.8	.99	1.04	1.06
Meat, poultry, fish, and eggs	32.2	² 27.9	34.6	² 26.2	35.5	² 24.9	.94	.82	.76
Beef	10.1	² 8.2	13.8	² 8.3	14.9	² 7.6	.93	.69	.59
Pork	7.4	7.0	7.2	6.1	7.5	² 5.1	.94	.84	.67
Other meats	4.5	² 3.5	4.6	² 3.8	4.4	² 3.4	.85	.90	.85
Poultry	5.3	5.1	4.4	4.4	4.0	4.6	1.06	1.10	1.27
Fish and seafood	2.6	2.6	2.8	2.4	3.0	3.3	.89	.77	.98
Eggs	2.3	² 1.3	1.9	² 1.1	1.7	² .9	.72	.73	.67
Dairy products	13.6	² 11.9	13.3	11.9	13.5	² 11.3	.96	.98	.92
Fresh milk and cream	7.7	² 5.8	7.3	² 5.5	6.7	² 4.6	.86	.86	.78
Other dairy products	5.9	6.1	6.0	6.4	6.8	6.7	1.08	1.11	1.03
Fruits and vegetables	15.6	17.1	14.2	16.0	14.2	² 16.5	.90	.92	.95
Fresh fruits	4.6	4.9	3.9	² 4.8	4.2	² 5.0	.76	.88	.85
Fresh vegetables	4.4	4.9	4.3	4.6	3.9	² 5.0	.86	.83	.99
Processed fruits	3.7	4.1	3.2	² 3.8	3.5	3.8	1.02	1.10	1.00
Processed vegetables	3.0	3.2	2.8	2.8	2.6	2.7	1.07	1.00	1.04
Other food at home	25.0	27.5	25.0	² 30.2	24.3	² 31.2	1.18	1.30	1.38
Sugar and other sweets	3.8	3.9	3.6	3.9	3.6	² 4.2	1.08	1.14	1.23
Fats and oils	3.3	² 2.8	3.0	3.0	2.7	2.6	.90	1.06	1.03
Miscellaneous foods	8.2	² 12.7	8.9	² 14.9	9.2	² 16.0	1.43	1.55	1.61
Nonalcoholic beverages	9.6	² 8.1	9.5	8.5	8.9	8.3	1.04	1.11	1.15

¹ Complete income reporters only.

² Change in share is statistically significant at the 95-percent confidence level.

tomatoes \$0.05 (18.5 percent), and other fresh vegetables \$0.14 (15.1 percent). When real mean weekly expenditures are divided by the percentage of consumer units reporting expenditures, to find the average real expenditure for those who actually purchased fresh fruits or vegetables, the results are even more convincing. Average weekly expenditures for families that reported purchases of fresh fruit declined from \$3.35 in 1980 to \$2.29 in 1992, while expenditures for fresh vegetables decreased from \$3.28 to \$2.52. Even bananas showed a small decrease in weekly expenditure (\$0.03) when values for those reporting expenditures are compared. The fact that the percentage of families reporting increased, while average expenditures for fruits and vegetables decreased, underscores the importance of using both a share index and logistic regression to get a fuller picture of how purchases are changing.

Age. Age is expected to have a strong relationship to food expenditures, although which group is expected to eat more foods that are currently described as healthful is not clear a priori. Older persons have different health concerns than younger persons and so may be more inclined to eat carefully. But older persons also may find that lifelong eating habits are difficult to change. Surprisingly, when the share indexes are examined by age, few differences in the direction of change are found. (See table 2.) In almost every case, if the index indicates a change in one direction for one age group, it indicates a change in the same direction for all three groups. For example, purchases of beef, pork, fish, and eggs declined for all age groups, while purchases of poultry increased. One notable exception is the share index for fats and oils, which indicates a 9-percent decrease in relative consumption for the youngest group and an increase of 6 percent for the oldest group. This difference is particularly interesting when it is compared with analogous results from the DHKS: only 40.6 percent of meal planners older than 60 years thought that their diet should be lower in fat, compared with 60.3 percent of those under 39 years.³⁵

Income. Level of income also is related to food expenditures.³⁶ Families with lower incomes have less flexibility than higher income families to adjust their food expenditure patterns should prices of foods change. In addition, reference persons of families with lower incomes have lower average levels of education, so they may not be as informed about health issues.³⁷

In almost every case, the share indexes for the highest income group indicate a change in a more healthful direction. (See table 3.) For example, the largest increase in purchases of cereals and cereal products (22 percent) was associated with this group. Although each group showed a decrease in its share index for meat, poultry, fish, and eggs, the share index was smallest for the high-income group (0.76), followed

by the middle- (0.82) and low-income groups (0.94). The indexes for beef and pork indicate a substantial drop in consumption for the high- and middle-income groups and a much lesser decline for the low-income group. Similarly, poultry consumption rises for each group, but the most for the high group. The fish and seafood index indicates the smallest drop for the high-income group (2 percent), but the largest for the middle-income group (23 percent). And while egg purchases decreased more than one-fourth for the low- and middle-income groups, they decreased by one-third for the high-income group. The index for fresh milk and cream shows the *largest* decrease in consumption for the high-income group, while the index for other dairy products shows that purchases increased *least* for the high-income group. The index for fresh fruits indicates decreased consumption for all groups, with the highest income group showing the smallest decline; by contrast, the index for fresh vegetables decreased more than one-eighth for the low- and middle-income groups, but showed virtually no change for the high-income group.

These findings are generally consistent with attitudes revealed by the DHKS. For example, middle-income families (defined in that survey as having income 1.31 to 3.50 times the poverty line) and high-income families (those with incomes greater than 3.5 times the poverty line) are the least likely to think that they have sufficient fiber in their diets: only 34 percent of meal planners in low-income families thought that their diets lacked fiber, compared with more than 40 percent of middle- and high-income families' meal planners.³⁸ Furthermore, the higher the family's income, the more likely the meal preparer was to have heard of health problems related to lack of fiber: less than 40 percent of low-income families' meal preparers had heard of such problems, compared with 52 percent of middle-income and 61 percent of high-income families' meal planners.³⁹ As these results show, low-income families cut back more on fresh fruits and vegetables than do the other groups and fail to increase their expenditures on cereal and bakery products, unlike the other groups.

The findings regarding meat expenditures are less easily reconciled with nutritional awareness. For example, when the meal planner is asked, "Should your diet be lower or higher in fat or is it just about right compared to what is most healthful,"⁴⁰ high- (56 percent) and middle-income (57 percent) meal planners are more likely than low-income families (47 percent) to think that their diet should be lower in fat; but when the meal planner is asked specifically about saturated fat,⁴¹ less than half (42 percent to 46 percent) think that their diets should include less, regardless of income. On the other hand, there appears to be a positive relationship between level of income and knowledge of links between saturated fats and health problems:⁴² about half of the low-income group is aware of these links, compared with less than two-thirds of

Table 4. Food purchases by single persons, 1980 and 1992

Item	Single persons, 1980			Single persons, 1992			Share index	
	Men	Women	t-statistic	Men	Women	t-statistic	Men	Women
Consumer units (thousands)	9,289	13,556	...	11,799	17,089	...	...	...
Income before taxes ¹	\$11,932	\$7,462	...	\$21,290	\$16,318	...	...	...
Average number of persons	1.0	1.0	...	1.0	1.0	...	...	...
Age of reference person	41.3	53.2	...	42.9	55.6	...	...	...
Number in consumer unit:								
Persons under age 18 .....	.0	.0	...	.0	.0	...	...	...
Earners .....	.8	.5	...	.8	.5	...	...	...
Average weekly expenditures for:								
Food at home	\$12.55	\$13.90	...	\$22.75	\$24.93	...	...	...
Cereal and bakery products ...	1.57	1.72	...	3.47	3.97	...	...	...
Meat, poultry, fish, and eggs	3.75	4.24	...	5.88	5.87	...	...	...
Dairy products	1.63	1.86	...	2.81	2.93	...	...	...
Fruits and vegetables	2.13	2.71	...	3.89	4.88	...	...	...
Other food at home	3.47	3.36	...	6.70	7.28	...	...	...
Share of food at home (percent):								
Food at home	100.0	100.0	...	100.0	100.0	...	...	...
Cereal and bakery products ...	12.5	12.4	-.09	15.3	15.9	.43	1.05	1.10
Cereal and cereal products ..	3.5	3.7	.35	4.9	4.9	.03	1.19	1.13
Bakery products	10.7	8.6	-1.71	10.4	11.0	.52	.84	1.10
Meat, poultry, fish, and eggs	29.9	30.5	.18	25.8	23.5	-.95	.94	.84
Beef	10.2	9.6	-.35	8.1	6.4	-1.81	.91	.77
Pork	6.5	5.8	-.43	5.0	5.6	.78	.76	.96
Other meats	3.3	4.2	1.51	3.7	3.1	-1.22	1.23	.81
Poultry	4.1	² 5.8	2.08	5.0	4.6	-.52	1.35	.88
Fish and seafood	3.6	3.2	-.47	3.0	2.6	-.83	.74	.73
Eggs	2.1	2.0	-.20	1.1	1.4	1.31	.66	.89
Dairy products	13.0	13.4	.30	12.4	11.8	-.46	1.04	.96
Fresh milk and cream	6.9	5.9	-1.30	5.9	4.7	-1.47	.97	.90
Other dairy products	6.1	² 7.5	2.01	6.5	7.0	.73	1.11	.97
Fruits and vegetables	17.0	19.5	.98	17.1	19.6	1.40	.82	.82
Fresh fruits	4.1	² 6.5	3.57	5.1	6.1	1.50	.89	.67
Fresh vegetables	6.0	5.6	-.18	4.7	5.7	1.64	.61	.79
Processed fruits	4.2	4.5	.39	4.4	4.6	.23	.97	.94
Processed vegetables	2.7	2.9	.54	2.9	3.2	.65	1.07	1.10
Other food at home	27.6	24.2	-1.31	29.5	29.2	-.10	1.15	1.30
Sugar and other sweets	3.9	3.7	-.24	3.2	4.1	1.88	.86	1.17
Fats and oils	2.0	² 3.1	2.68	2.4	2.9	1.33	1.28	1.00
Miscellaneous foods... ..	9.3	7.8	-1.33	14.6	14.2	-.29	1.45	1.68
Nonalcoholic beverages	12.4	² 9.5	-2.08	9.3	8.1	-1.23	.93	1.06

¹ Complete income reporters only.

² Difference in shares by gender is statistically significant at the 95-percent confidence level.

middle-income families and slightly more than three-fourths of high-income families. When the meal planner is asked about the link between fat (without specifying whether it is saturated) and health problems,⁴³ the numbers increase for each group, but the relationship is still apparent: now, 2 out of 3 low-income families say that they have heard of a link, compared with 7 out of 10 middle-income families and 8 out of 10 high-income families.

Gender and race. Because gender and race characteristics can be broken into two groups (male and female; blacks, on

the one hand, and white and other races, on the other), these groups can be compared easily within a year, as well as across years. It is assumed that each group faces the same prices within the same year; therefore, a *t*-test is useful in comparing the groups within a year. For comparison within a group across years, the share index is useful.

1. Gender. In the Consumer Expenditure Survey, it is not clear that the reference person is making the decisions about grocery purchases for the family, or even if the reference person exerts a great deal of influence in those decisions. Fur-

thermore, changes in family composition over time may influence purchasing decisions. By contrast, because a single person is the sole decisionmaker for his or her “family,” differences in purchases by gender are likely the result of differences in taste or other influences that vary by gender. However, regression analysis is still necessary to achieve the greatest degree of certainty that gender influences food consumption, because incomes and other demographics may differ for single men and women.

Table 4 shows differences in expenditure shares for single males compared with single females. The *t*-statistics indicate that there were few statistically significant differences in expenditure shares by gender in 1980 and none in 1992. Yet, when *t*-statistics are compared across time (not shown in the table), single women are seen to have had significant changes in their share of expenditures for cereal and bakery products (the share increased), meat, poultry, fish, and eggs (decreased), and other food at home (increased), while single men have no significant changes in share over time for any major food category. This “paradox” can be resolved by considering the variances in expenditures for single men and women. If single women have a lower variance in expenditures than single men do, then smaller changes in shares over time for women will be statistically significant, while those for men will not. And in comparisons by gender over the same period, the larger variance in shares for men means that the difference in shares by gender must also be large to be statistically significant. These facts suggest that in both 1980 and 1992, the average single person, regardless of gender, followed certain dietary habits, but that single men were more likely than single women to deviate from those habits.

Nevertheless, there are some interesting differences in share indexes when single men and women are compared. Both sexes exhibit a decrease in purchases of meat, poultry, fish, and eggs, but the share index for women (0.84) is 10 points lower than for men (0.94). This difference is due in part to the fact that women cut back on all meat purchases, while men increased their consumption of poultry and other meats. The index for fruits and vegetables is the same for both sexes (0.82), but men cut back less on fresh fruits and more on fresh vegetables, while women did just the opposite. Similarly, women increased their purchases of sugar and sweets, while leaving their consumption of fats and oils unchanged, whereas men decreased their purchases of sugar and sweets and increased their consumption of fats and oils.

The DHKS does not break out data by family size, but it does have data comparing the knowledge and attitudes of male and female meal planners. Some differences in these two groups’ perceptions of diet are worth noting.

The percentage of women (55 percent) who believe that their diets should be lower in fat is slightly larger than the percentage of men (51 percent) who believe similarly.⁴⁴

Women (51 percent) are also much more likely to believe that their diets are too high in sugar and sweets than are men (38 percent).⁴⁵ This difference is especially noteworthy, considering that the share index for women rose 17 points from 1980 at the same time the index for men fell 14 points. Men and women are probably closest in attitudes on fiber, with nearly 40 percent of each group believing that their diets should be higher in fiber and about 54 percent to 55 percent believing that their fiber intake is “about right.”⁴⁶

2. Race. Although only single individuals are examined by gender of the reference person, families can be examined by race of the reference person. Table 5 shows that, except for beef and other meats, shares spent for meat, poultry, fish, and eggs differ significantly by race, regardless of the year (1980 or 1992) the survey was conducted. Blacks spent larger shares than whites and others on pork, poultry, fish and seafood, and eggs in either year. However, both groups consumed less of most meat products in 1992 than in 1980, with two exceptions: whites and others increased their consumption of poultry, and blacks increased their consumption of fish and seafood. Changes in the consumption of other foods are not clearly related to race. The indexes indicate that whatever changes there were were in the same direction and similar in magnitude for most items, even at the subcomponent level.

The fact that black families spend larger shares than white and other families for meat products is interesting when taken in conjunction with the DHKS results.⁴⁷ Meal preparers in black families are more likely than meal preparers in white families to respond that their saturated fat intake should be lower (48 percent, compared with 43 percent), and the same holds true for cholesterol intake (48 percent, compared with 40 percent). This may indicate that at least the meal preparers are aware of the problem, even if habits are hard to break.

Logistic regression results

Even when accompanied by the share index, share analysis does not give a complete picture of changes in food consumption patterns. Changes in one segment of a group can affect the average share, even though not all members of that group are changing their patterns. For example, suppose that in 1980, families whose reference person is under age 35 ate mostly meat and a few vegetables at every meal, while single persons under age 35 ate only meat and no vegetables. Suppose further that in 1992, families under age 35 ate less meat and more vegetables, while singles under age 35 continued to eat only meat. Then, in the absence of price changes, the share for consumers under age 35 should rise for vegetables and fall for meat. Yet in this example, only families, and not single persons, reap the benefits of the inclusion of more vegetables in their diet. *Logistic regression*, or *logit*,⁴⁸ is used to estimate

the probability that a particular family will purchase a certain type of food, given the family's characteristics. If such an analysis were performed on a group of data described in the current example, the results would likely predict a higher probability of purchasing vegetables for families whose reference person is under age 35 and no change in probability for single persons. Whether the predicted probability of families purchasing vegetables would *actually* increase is an open question. The reason is that it does not matter how much a family purchases: all positive expenditures on vegetables are recorded as a "yes," the family purchased vegetables, on the survey. So if, in 1980, the family purchased a small amount of

vegetables every week, and in 1992, it purchased a large amount of vegetables every week, the probability of purchasing vegetables does not change, even though the quantity purchased does. Still, logit analysis offers some insight into food-purchasing patterns. The way the data are collected, an increase in the probability of purchasing suggests that more families are reporting purchases of the food and is thus a good indicator of whether consumption is increasing due to an increase in the number of families that purchase the food, rather than an increase in the number of purchases by families that already consume the food regularly.

Because the logit procedure is a form of regression analy-

Table 5. Food purchases and race of reference person, 1980 and 1992

Item	Race of reference person, 1980			Race of reference person, 1992			Share index	
	White and other	Black	t-statistic	White and other	Black	t-statistic	White and other	Black
Consumer units (thousands)	76,163	9,026	...	88,754	11,328	...	...	...
Income before taxes ¹	\$18,601	\$12,860	...	\$34,486	\$24,612	...	...	...
Average number of persons	2.6	2.9	...	2.5	2.7	...	...	...
Age of reference person	46.3	44.4	...	47.6	45.6	...	...	...
Number in consumer unit:								
Persons under age 18 .....	.7	1.1	...	.7	.9	...	...	...
Earners	1.4	1.3	...	1.4	1.3	...	...	...
Average weekly expenditures for:								
Food at home	\$33.81	\$28.17	...	\$22.75	\$24.93	...	...	...
Cereal and bakery products ..	4.35	3.57	...	8.09	6.45	...	...	...
Meat, poultry, fish, and eggs ..	11.41	11.58	...	13.10	14.14	...	...	...
Dairy products	4.65	2.94	...	6.07	3.69	...	...	...
Fruits and vegetables	5.03	4.07	...	8.39	7.05	...	...	...
Other food at home	8.36	6.01	...	15.37	10.66	...	...	...
Share of food at home (percent):								
Food at home	100.0	100.0	...	100.0	100.0	...	...	...
Cereal and bakery products ...	12.9	12.7	.15	15.9	15.4	-.56	1.06	1.04
Cereal and cereal products ..	4.1	4.9	-1.29	5.4	6.1	-1.81	1.12	1.06
Bakery products	8.8	7.8	1.25	10.5	² 9.2	1.99	1.03	1.02
Meat, poultry, fish, and eggs ...	33.7	² 41.1	-2.20	25.7	² 33.7	-5.26	.83	.89
Beef	13.5	11.1	1.74	8.0	8.9	-1.49	.68	.92
Pork	7.0	² 10.9	-3.38	5.7	² 8.6	-4.59	.81	.78
Other meats	4.6	5.0	-.65	3.5	4.1	-.75	.83	.90
Poultry	4.2	7.8	-4.41	4.6	² 6.1	-3.49	1.21	.86
Fish and seafood	2.8	² 3.8	-2.07	2.8	² 4.6	-3.70	.89	1.08
Eggs	1.8	² 2.6	-2.98	1.0	² 1.3	-3.08	.70	.63
Dairy products	13.8	² 10.4	2.59	11.9	² 8.8	5.84	.94	.93
Fresh milk and cream	7.2	6.0	1.36	5.3	² 3.9	4.09	.84	.74
Other dairy products	6.5	² 4.4	3.74	6.6	² 4.9	4.90	1.06	1.16
Fruits and vegetables	14.9	14.4	.28	16.4	16.8	-.39	.90	.95
Fresh fruits	4.4	3.8	1.17	4.9	4.9	-.07	.79	.92
Fresh vegetables	4.3	4.2	.07	4.9	4.6	1.01	.88	.85
Processed fruits	3.5	3.7	-.47	3.8	4.0	-.45	1.00	1.00
Processed vegetables	2.8	2.8	.03	2.8	3.3	-1.44	1.00	1.18
Other food at home	24.7	21.3	1.63	30.1	² 25.4	3.35	1.31	1.28
Sugar and other sweets	3.5	3.7	-.26	4.0	3.5	1.95	1.20	1.00
Fats and oils	2.9	2.8	.35	2.8	2.8	-.01	1.03	1.06
Miscellaneous foods	8.9	² 6.9	2.27	15.1	² 11.7	4.02	1.57	1.57
Nonalcoholic beverages	9.3	8.0	1.50	8.3	7.5	1.51	1.10	1.16

¹ Complete income reporters only.

² Difference in shares by race is statistically significant at the 95-percent confidence level.

sis, several demographic characteristics can, in effect, be held constant, and predictions can be made for specific families. For example, the probability that a family in the middle-income group whose reference person is 35 to 64 years old and black purchases fruits and vegetables can be predicted. The characteristics that might be examined in assessing this probability are family income, composition, and size; participation in the food stamp program; whether the family lives in an urban area; the month in which the family participated in the survey (because some food items, such as fresh fruits, may be available only seasonally or, like poultry, may be purchased more frequently at holiday time regardless of other characteristics); and the age, race, and education of the reference person. The number of adults and children (that is, persons less than 18 years old) are included separately as continuous variables, while all other variables are binary. A variable for the square of the number of children is also included to account for potential nonlinear relationships between the number of children and the probability of purchasing a particular food. For example, if milk is deemed a good food for children, but not so important for adults, then a family consisting of a husband and wife with one child is expected to have a much higher probability of purchasing dairy products than a family of only a husband and wife. But a husband and wife with two children is not expected to have a substantially higher probability of purchasing milk than a family with one child.

By using these characteristics, a “standard” or “control” family can be described, against which other families can be compared. For example, if the effect of age on the probability of purchasing is the characteristic to be isolated, one can compare the control family with another family with identical characteristics except for age. In this way, the impact of age on probability can be more carefully measured. For these purposes, the control group is defined as a family

- consisting of a husband, wife, and one child;
- in the middle-income group;
- living in an urban area;
- not participating in the food stamp program;
- participating in the Diary survey in the spring (April, May, or June); and
- whose reference person is 35 to 64 years old, not black, and never attended college.

The predicted probability for each characteristic is shown for 1980 and 1992 in tables 6 through 8. For example, table 6 shows that the probability that a family in the control group purchased cereal and bakery products in 1980 was 95.8 percent. A family whose reference person was under 35, but was otherwise identical to the control family, was 2.8 percent less likely to purchase cereal and bakery products that year. (That is, the probability of that family’s purchasing those products

in 1980 was 93.0 percent.) In 1992, the control group’s probability was down slightly (94.5 percent), but the probability of the family whose reference person was under 35 making such purchases was virtually unchanged (92.7 percent). Presenting the results in this manner facilitates comparisons across time and demographic groups.

The specification of the logit equation is

$$Y = a_1 + a_2D_{1992} + b_iX_i + (b_jD_{1992}X_i), \quad (1)$$

where

Y equals 1 if a purchase occurs and 0 otherwise;

a_1 , b_i , and b_j are parameter estimates;

D_{1992} is a dummy variable, coded 1 for 1992 data and 0 for 1980 data; and

X_i is the i th characteristic for each family (for example, age, income level, and so forth).

Using the results of equation (1), tables 6 through 8 show the various probabilities that the control family made a purchase of a certain kind in 1980 and 1992. These probabilities are calculated with the formula

$$P = 1 / \{ 1 + \exp[-1(a_1 + a_2D_{1992} + b_iX_i + [b_jD_{1992}X_i])] \}, \quad (2)$$

where

P is the probability of the family’s purchasing a given food; and

all other symbols are as in equation (1).

Thus, from table 6, the probability that a single man who otherwise fits into the control group purchased cereal and bakery products in 1980 is calculated by adding the value of the intercept (2.5555), the parameter estimate for single men (−1.3905), and the parameter estimate for the number of adults in the family (0.1628); summing these factors (which yields 1.3278); multiplying by negative 1 and exponentiating (that is, taking $\exp[-1.3278]$); adding 1 to the result (yielding 1.2651); and taking the reciprocal of this value. After all these operations, P is estimated to be 0.7905, or about 79 percent. If the family consists of a husband and wife only, then the parameter estimate for married couples (−0.2679) is added instead of the value for single males, and the parameter estimate for the number of adults is doubled, because there are two adults present. Similarly, the addition of a child⁴⁹ changes the equation, through the change in both the number of children and the square of the number of children, and the family type variable must change accordingly; that is, if the family is in the control group, no family type parameter estimate is added; however, if the family consists of a single parent with children, the parameter estimate for single parents must be included, and the number of adults must be adjusted accordingly. In each case, the results presented in tables 6 through 8 are calculated with the composition of the family taken into account.

Table 6. Probabilities of purchasing cereal and bakery products; beef, pork, and other meats; and poultry, all consumer units, 1980 and 1992

Characteristic	Cereal and bakery products				Beef, pork, and other meats				Poultry			
	Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control group	3.1358	-0.2949	95.8	94.5	2.0803	-0.3940	88.9	84.4	-0.1277	-0.1660	46.8	42.7
Intercept ¹	⁵ 2.5555	-0.5869	95.9	94.5	⁵ 1.4871	⁵ -0.8120	89.0	84.5	⁵ -0.4477	-0.2877	47.1	43.0
Age (35 to 64):												
Under 35	⁵ -.5463	⁵ .2525	93.0	92.7	⁵ -.5176	⁵ .1694	82.7	79.2	⁵ -.3302	⁵ .1916	38.7	39.4
65 and older	⁵ .3762	-0.0603	97.1	95.9	⁵ .2578	-0.1550	91.2	85.7	⁵ .1924	-0.1582	51.6	43.5
Income (middle tercile):												
Lowest tercile	⁵ -.2675	-0.0369	94.6	92.7	⁵ -.2730	⁵ .2109	85.9	83.5	-0.0901	.1706	44.6	44.7
Highest tercile	⁵ -.2426	.2076	94.8	94.3	⁵ .0598	-0.0887	89.5	84.0	-0.0631	.1464	45.2	44.8
Incomplete reporter	⁵ -.4870	⁵ .4236	93.4	94.1	⁵ -.3645	⁵ .2788	84.8	83.2	.0027	⁵ .1883	46.9	47.4
Family composition (husband and wife with children): ²												
Single man	⁵ -1.3905	⁵ .6076	79.0	81.7	⁵ -.9977	⁵ .8323	67.1	70.0	⁵ -.6555	.0483	27.0	23.6
Single woman .....	.1446	.0938	81.3	85.0	.0546	⁵ -.3041	68.3	64.6	.1811	-0.1004	30.7	25.1
Husband and wife only	-0.2679	.0871	93.2	91.8	-0.2090	.2322	84.8	79.8	-0.1152	.0278	41.5	38.0
Single parent	⁵ -.4383	.2058	92.7	90.9	⁵ -.3476	.1052	81.9	75.1	-0.1725	.0561	39.9	36.0
Other family	⁵ -.4942	-0.0825	93.3	90.6	⁵ -.3335	.1535	85.2	81.9	.0057	-0.1751	47.0	38.6
Family size (two adults, one child):												
Number of adults ³ .....	.1628	.1478	96.4	95.9	⁵ .2221	.1171	90.9	88.3	⁵ .1096	.0567	49.5	46.8
Number of children ⁴	⁵ .2807	-0.0138	96.6	95.5	⁵ .1875	⁵ .1930	89.6	87.3	⁵ .1194	-0.0081	48.4	45.3
Square of number of children	-0.0260	.0102	...	...	⁵ -.0385	-0.0092	...	...	-0.0186	.0164	...	...
Race (white and other):												
Black	-0.1586	.1382	95.2	94.4	.0323	.0572	89.2	85.5	⁵ .6868	⁵ -.2538	63.6	53.5
Education (no college):												
Some college	-0.0700	-0.1941	95.5	92.9	⁵ -.2097	-0.1445	86.7	79.1	⁵ -.1390	.0238	43.4	39.9
College graduate	-0.0241	-0.1378	95.7	93.6	-0.1382	⁵ -.3193	87.5	77.4	.0353	-0.0890	47.7	41.4
Degree of urbanization:												
Rural .....	.2018	.0488	96.6	95.7	-0.0686	.0316	88.2	83.9	-0.0877	-0.0697	44.6	38.9
Food stamp program:												
Participates .....	.2271	-0.3786	96.7	93.6	.0071	.0068	89.0	84.6	.0699	-0.0272	48.6	43.8
Month surveyed:												
January, February, or March .....	.0523	-0.0068	96.0	94.7	⁵ -.1660	.1728	87.2	84.5	-0.0667	.1590	45.2	45.0
July, August, or September .....	.1572	-0.1503	96.4	94.5	.0081	.0217	89.0	84.8	-0.0306	.1750	46.1	46.3
October, November, or December	-0.1070	.1321	95.4	94.6	⁵ -.1877	.0886	86.9	83.0	-0.0952	.1530	44.5	44.1

¹ Predicted probability is calculated for an increase of 0.01 in the intercept.

² Predicted probability is calculated with family size taken into account. For example, a single-person consumer unit consists of one adult and no children. A single-parent consumer unit consists of one adult and one child.

³ Predicted probability is calculated for a husband and wife with two children, one of whom is at least 18 years old.

⁴ Predicted probability is calculated for a husband and wife with two children, both of whom are under 18 years old. Because the increase in the number of children also affects the square of the number of children, the entire change is included in the value listed for the number of children.

⁵ Parameter estimate is statistically significant at the 95-percent confidence level.

Calculating results for 1992 is slightly more complicated. The parameter estimates for that year actually represent the *difference* between the expected estimates for 1980 and 1992. Therefore, parameter estimates for 1992 must be added to their 1980 counterparts before a probability for 1992 families can be calculated. Further, calculations for single women require an additional step, regardless of the year. A dummy variable, coded 0 if the consumer unit consists of more than one

person and 1 if the consumer unit consists of a single person, is included in each model. A separate dummy variable, coded 0 if the consumer unit consists of more than one person or a single man and 1 if the consumer unit consists of a single woman, is also included in each model. Under this specification, the parameter estimate for the first dummy variable represents the estimated value for single men in 1980. The parameter estimate for single women represents the difference

between the expected estimates for single men and single women in 1980. Therefore, if single women in 1980 are considered, the parameter estimates for single men in 1980 (-1.3905) and single women in 1980 (0.1446) must be added before calculating the probability of purchasing any food item. If single women in 1992 are considered, the parameter estimates for single men in 1980 and 1992 must be added to the parameter estimates for single women in 1980 and 1992 before calculating a probability.

The five major food groups examined in the previous section are too restrictive for the present purpose in some cases. For example, the category of meat, poultry, fish, and eggs contains a mix of items that nutritionists would not consider to be equal in health benefit. Poultry and many varieties of fish and seafood are lower in fat than comparable servings of beef or pork. Eggs are high in saturated fat and cholesterol and are consumed in different ways than other meat products. They may be eaten for their own sake (for example, hard boiled or scrambled), as a major, visible ingredient in other foods (for instance, a spinach soufflé or quiche), or as a not-so-visible ingredient in yet other foods (say, cakes or egg noodles). If kept at the aggregate level, substitutions within the meat, poultry, fish, and eggs group would be missed. So if families were eating less red meat and more poultry, it would appear that the probability of purchasing meat, poultry, fish, and eggs had not changed much, even though the probability of purchasing red meat had declined and the probability of purchasing poultry had increased. For these reasons, the major food groups analyzed are cereal and bakery products; beef, pork, and other meats; poultry; fish and seafood; eggs; dairy products; fruits and vegetables; fats and oils; and other foods (defined as other food at home minus fats and oils).

Before logits are run, families that do not report purchases of groceries (about 11 percent) are omitted from the sample. This is done to avoid bias: if no one in the family buys groceries in the first place, then the probability that the family buys any specific food item is zero. Also omitted are families for whom no Diary placement date could be found (less than 3 percent of the total sample). Placement dates are used to determine the season in which the expenditures are made.

Logistic regressions are not weighted to reflect the population. Preliminary experiments show that weighting does not radically alter the probabilities derived from the parameter estimates, although it does substantially reduce the standard errors associated with the estimates. All but two parameter estimates are statistically significant at the 99-percent confidence level when the weighted regression results are analyzed. Therefore, to err on the side of caution in finding statistically significant results, the regressions are not weighted. Table 9 shows the characteristics of the average family included in the sample for each year. The statistics in the table are unweighted.

General results. For some food groups, such as cereals and bakery products, the predicted probabilities of purchasing them change little over time. For others, such as eggs, the change is dramatic. But the common result seems to be that if one demographic group experiences a change in a certain direction, most other groups do also, at least where parameter estimates are statistically significant.

The control group. Before examining changes by specific segments of the population, changes in the control group's probability of purchasing any item are described, to give a sense of how probabilities are changing for the "average" or "typical" family.

The control group exhibits statistically significant decreases in the probability of purchasing items from four food groups: beef, pork, and other meats (5 percent); fish and seafood (6 percent); eggs (14 percent); and dairy products (4 percent). Changes in probability are not found to be statistically significant for any other food groups.

The foregoing groups contain foods that are high in saturated fat (dairy products), cholesterol (seafood),⁵⁰ or both (eggs; and beef, pork, and other meats). The DHKS shows that 54 percent of all main meal planners believe that their diets should be lower in fat, and this may be one reason for the decreased probabilities of purchasing the aforementioned foods. When asked about saturated fat specifically, only 44 percent of respondents to the survey think that their diet should be lower in this food component, compared with 48 percent who think that it is about right. Similarly, when asked about cholesterol, only 41 percent think that their diet should have less of it, compared with 53 percent who think that it is about right.⁵¹

Age. For families whose reference person is under age 35, many statistically significant changes occurred from 1980 to 1992. Beef, pork, and other meats (4 percent), fish and seafood (5 percent), and dairy products (3 percent) all exhibited moderate decreases in the said family's probability of purchasing them.⁵² The family's probability of purchasing poultry rose slightly (1 percent). These findings are consistent with results of the DHKS which indicate that, of all meal preparers, those under age 39 are most likely to believe that their diet should be lower in fat (60 percent) and, specifically, saturated fat (52 percent). The Department of Agriculture's tables show a decreasing relationship between age and percent of meal planners who believe that their diets should be lower in fats.⁵³ For example, only 41 percent of those 60 years and older believed that their diet should be lower in total fat, and just 34 percent believed that it should be lower in saturated fat.

One possible explanation for this trend is that, as consumers get older, they become more concerned about fat intake

and so lower their consumption accordingly; thus, fewer older consumers think that their diet should be lower in fats. This finding is consistent with DHKS results which show an increasing relationship between the age of the meal planner and the percentage of the group that places a high importance on lim-

iting fat (especially saturated fat) and cholesterol intake.⁵⁴ But this explanation is not consistent with the logit result that families 65 and older were more likely to purchase beef, pork, and other meats; poultry; eggs; dairy products; and fats and oils than were younger families in both years. However, the esti-

Table 7. Probabilities of purchasing fish and seafood; eggs; and dairy products, all consumer units, 1980 and 1992

Characteristic	Fish and seafood				Eggs				Dairy products			
	Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control group	-0.5714	-0.2795	36.1	29.9	.4102	-0.5722	60.1	46.0	3.1674	-0.6809	96.0	92.3
Intercept ¹	⁵ -.8459	⁵ -.4739	36.3	30.1	.0904	⁵ -.9378	60.4	46.2	⁵ 2.6929	⁵ -1.0167	96.0	92.4
Age (35 to 64):												
Under 35	⁵ -.2079	.0237	31.4	26.2	⁵ -.3154	.1282	52.4	41.4	⁵ -.5215	⁵ .3387	93.4	90.9
65 and older	⁵ .2040	-.1020	40.9	32.1	⁵ .2277	-.0944	65.4	49.3	⁵ .3175	⁵ .0286	97.0	94.4
Income (middle tercile)												
Lowest tercile	⁵ -.1444	.1643	32.8	30.3	-.0482	.0102	59.0	45.0	⁵ -.2691	.0126	94.8	90.3
Highest tercile .....	.0763	-.0131	37.9	31.3	.0359	-.0622	61.0	45.3	.1795	-.1209	96.6	92.7
Incomplete reporter	-.0709	.1407	34.5	31.4	⁵ -.1587	⁵ .2635	56.3	48.6	⁵ -.2399	⁵ .2737	94.9	92.6
Family composition (husband and wife with children): ²												
Single man	⁵ -.5233	.0701	22.2	17.0	⁵ -.7515	.2944	35.5	25.4	⁵ -1.3349	⁵ .7175	80.8	78.6
Single woman .....	.0113	.0892	22.4	18.4	-.0518	.1732	34.3	27.8	⁵ .1994	-.0021	83.7	81.7
Husband and wife only	-.1500	.1180	31.7	27.2	-.1094	.0951	52.6	39.9	-.2760	.2800	92.9	89.7
Single parent	-.1369	-.1187	30.5	21.6	⁵ -.2837	.2531	51.6	39.7	-.3580	.4545	93.9	91.2
Other family	⁵ -.1652	-.0152	32.4	26.3	-.0753	-.0649	58.3	42.5	⁵ -.3944	.0569	94.1	89.6
Family size (two adults, one child):												
Number of adults ³	⁵ .1130	.0715	38.7	33.9	.0621	⁵ .1645	61.6	51.6	.0805	.1601	96.3	93.9
Number of children ⁴ .....	.0534	.0479	37.0	32.0	⁵ .2263	.0335	63.3	50.4	⁵ .3777	-.0120	96.6	93.9
Square of number of children	-.0049	.0035	...	...	⁵ -.0307	.0031	...	...	⁵ -.0642	.0276	...	...
Race (white and other):												
Black	⁵ .2511	-.0254	42.1	34.9	-.0032	.0821	60.0	47.9	⁵ -.6210	-.0551	92.7	85.9
Education (no college):												
Some college .....	.0487	-.0307	37.2	30.3	-.0302	-.0869	59.4	43.1	-.0644	-.1446	95.7	90.7
College graduate	⁵ .2059	.0518	41.0	35.6	.0732	⁵ -.3388	61.9	39.5	.0360	-.1591	96.1	91.4
Degree of urbanization:												
Rural	⁵ -.3414	.1737	28.6	26.5	⁵ -.2426	.1732	54.2	44.2	-.0211	.1447	95.9	93.2
Food stamp program:												
Participates .....	.1222	-.1586	39.0	29.2	⁵ .1889	.0712	64.5	52.5	.1602	⁵ -.4159	96.5	90.3
Month surveyed:												
January, February, or March	⁵ .1879	-.0827	40.5	32.2	.0838	-.0213	62.1	47.5	-.0881	.2138	95.6	93.2
July, August, or September	-.0061	.0033	36.0	29.9	.0512	.0199	61.3	47.7	.0052	.1469	96.0	93.3
October, November, or December	⁵ -.1325	.1047	33.1	29.3	.0836	.0505	62.1	49.3	-.1157	.0646	95.5	91.9

¹ Predicted probability is calculated for an increase of 0.01 in the intercept.

² Predicted probability is calculated with family size taken into account. For example, a single-person consumer unit consists of one adult and no children. A single-parent consumer unit consists of one adult and one child.

³ Predicted probability is calculated for a husband and wife with two children, one of whom is at least 18 years old.

⁴ Predicted probability is calculated for a husband and wife with two children, both of whom are under 18 years old. Because the increase in the number of children also affects the square of the number of children, the entire change is included in the value listed for the number of children.

⁵ Parameter estimate is statistically significant at the 95-percent confidence level.

mated probabilities of purchasing these foods for families in the 65-and-older age category at least were lower in 1992 than they were in 1980.⁵⁵

Eggs are particularly interesting to study. Older families showed a large decrease (16 percent) in the probability of purchasing eggs, while younger families exhibited a smaller, but still notable, decrease (11 percent) over the 2 survey years. However, older families were more likely to purchase eggs regardless of the year (65 percent in 1980 and 49 percent in 1992) than either the control group (60 percent and 46 percent) or younger families (52 percent and 41 percent). The difference may reflect the difficulty of breaking lifelong habits. Overwhelming majorities of main meal planners are aware of the relationships between fat and cholesterol intakes and health problems.⁵⁶ For example, regardless of age, more than three-fourths of respondents had heard that fat intake is related to health problems. More than 6 out of 10 had heard that saturated fat intake, in particular, is related to health problems. Similarly, 7 out of 8 of those under 60 (and nearly as many at least age 60) responded that they were aware of a relationship between health problems and cholesterol. When asked specifically which health problem they had heard about being related to fat or cholesterol intakes, once again, large majorities mentioned heart disease. But the older family members grew up when eggs were considered a quintessential part of any healthful breakfast, while the younger family members grew up hearing about the relationship of cholesterol to heart disease. So, if the younger families are raising their children to be concerned about egg consumption, the relationship of egg consumption to age will probably continue; that is, all families will decrease consumption, but older families will continue to purchase eggs more frequently than younger families, with the gap between older and younger families continuing to shrink. (The difference in the probability of purchasing eggs between older and younger families was 13 percent in 1980, but only 8 percent in 1992.)

One bright spot for older consumers is that they have a higher probability of purchasing fruits and vegetables than younger consumers have. In 1980, the predicted probability of older consumers purchasing food from this group (94 percent) was 4 percentage points higher than that of the control group and 11 percentage points higher than that of the under-35 group. There is no indication that the predicted probabilities changed from 1980 to 1992 for any age group.

Income. Relations are less strong by income group than by age group. Middle- and high-income families appear to have similar probabilities. For no food group is the high-income parameter estimate statistically significant, regardless of year.

But for some food items, low-income families had significantly different probabilities from other income groups. Low-income families were slightly less likely (by 1 percent) to pur-

chase cereal and bakery products than were control group families, at least in 1980. They were also less likely to purchase fish and seafood (by 3 percent), dairy products (1 percent), fruits and vegetables (2 percent), fats and oils (8 percent), and other foods (1 percent) than the control group was in 1980. However, only for beef, pork, and other meats was their probability statistically significantly lower than the control group's in both 1980 (3 percent) and 1992 (1 percent). The DHKS results show a smaller spread across income groups in concerns about fat and cholesterol intake than they do for age groups,⁵⁷ so it is not surprising that there is very little difference in probabilities of purchasing among income groups. Similarly, the spread across income groups in the percentage of each group that thinks its fiber intake is about right (2 percent) is much less than that for age groups (24 percent).⁵⁸

Gender. For the most part, probabilities of purchasing food do not differ significantly by gender. Further, single women do not have many coefficients that are statistically significant. In fact, the only statistically significant difference they exhibit is for purchasing beef, pork, and other meats. Single men showed a statistically significant increase in the probability of purchasing these foods, from 67 percent in 1980 to 70 percent in 1992. By contrast, single women exhibited a decrease from 68 percent to 65 percent. Single women were more likely to purchase fats and oils in 1980 than single men were (the predicted probabilities were 36 percent and 29 percent, respectively), and neither group showed a statistically significant decrease from these percentages in 1992. The DHKS shows that women are slightly more concerned about fat intake than are men.⁵⁹ For example, 55 percent of female meal preparers believe that their diet should be lower in total fat, compared with 52 percent of male meal preparers. Similarly, 42 percent of female preparers believe that their intake of cholesterol should be reduced, compared with 39 percent of male preparers. Slightly more than half of each group think that their intake is about right, but still, a larger percentage of female preparers (53 percent) than male preparers (51 percent) agrees with that statement.

Other differences within and across time are worth noting. For example, single women had a higher probability of purchasing dairy products in 1980, although both single women and single men had lower probabilities in 1992. (Only the men's decline, however, was statistically significant.) Far more women (41 percent) than men (25 percent) believe that their diets need more calcium,⁶⁰ and this belief may be a factor in explaining the difference.

Also, single men appear to have a substantially lower probability of purchasing fruits and vegetables than single women have, regardless of the year. (The parameter estimates for single men and women were statistically significant in 1980, but not in 1992. This finding indicates that single men and

Table 8. Probabilities of purchasing fruits and vegetables; fats and oils; and other foods, all consumer units, 1980 and 1992

Characteristic	Fruits and vegetables				Fats and oils				Other foods			
	Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)		Parameter estimate		Predicted probability (percent)	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Control group	2.1767	0.0546	89.8	90.3	0.2866	-0.0652	57.1	55.5	2.5529	0.4246	92.8	95.2
Intercept ¹	⁵ 1.4008	.1546	89.9	90.4	-.2612	.1620	57.4	55.8	⁵ 1.7735	.3610	92.8	95.2
Age (35 to 64):												
Under 35	⁵ -.5749	.1145	83.2	85.5	⁵ -.3041	-.0947	49.6	45.6	⁵ -.1627	.1397	91.6	95.0
65 and older	⁵ .5780	.1751	94.0	95.2	⁵ .2651	-.1133	63.5	59.2	-.1022	.2504	92.1	95.8
Income (middle tercile):												
Lowest tercile	⁵ -.2408	.0413	87.4	88.4	⁵ -.2019	.1087	52.1	53.2	-.0340	⁵ -.2761	92.5	93.5
Highest tercile .....	.1258	.1232	90.9	92.3	.0144	-.0075	57.5	55.7	.1174	-.1838	93.5	94.8
Incomplete reporter	⁵ -.2616	.1655	87.2	89.4	⁵ -.2136	.1559	51.8	54.1	⁵ -.5344	.0974	88.3	92.7
Family composition (husband and wife with children): ²												
Single man	⁵ -.7800	.0827	71.6	75.1	⁵ -.8205	.0995	29.3	32.2	⁵ -.7289	.1805	79.0	86.0
Single woman	⁵ .5454	.0349	81.3	84.3	⁵ .3145	-.0782	36.2	37.5	.1090	.1779	80.8	89.1
Husband and wife only .....	.0223	-.0233	88.4	88.5	-.1349	⁵ .2906	50.2	55.1	⁵ -.3119	.2528	88.3	92.6
Single parent	-.0221	-.1153	86.4	86.4	⁵ -.3719	.0480	42.9	45.6	-.3273	.1244	87.5	92.7
Other family	-.1069	-.0920	88.8	88.4	⁵ -.2279	.0715	51.5	51.6	⁵ -.5403	⁵ .4517	88.2	94.7
Family size (two adults, one child):												
Number of adults ³	⁵ .3027	-.0580	92.3	92.2	⁵ .2019	⁵ -.1280	62.0	57.3	⁵ .2812	-.0529	94.4	96.1
Number of children ⁴	⁵ .1906	.0081	90.9	91.6	⁵ .1566	.0403	60.0	58.6	⁵ .2465	.1998	93.8	96.2
Square of number of children	-.0201	.0079	...	...	-.0126	-.0115	...	...	-.0295	-.0304	...	...
Race (white and other):												
Black	⁵ -.1822	.1956	88.0	90.4	⁵ -.2168	.1464	51.7	53.8	⁵ -.4001	-.0614	89.6	92.5
Education (no college):												
Some college .....	.0933	⁵ -.2226	90.6	89.1	.0093	⁵ -.2030	57.3	50.7	.1561	-.1286	93.8	95.3
College graduate	⁵ .3670	-.1054	92.7	92.4	.0271	⁵ -.1678	57.8	52.0	.1000	.0247	93.4	95.7
Degree of urbanization:												
Rural	⁵ -.2467	⁵ .2872	87.3	90.7	⁵ .1941	-.0620	61.8	58.7	-.0436	⁵ .3348	92.5	96.3
Food stamp program:												
Participates	⁵ -.2500	.0129	87.3	88.0	-.1209	.0281	54.1	53.2	-.0722	-.0040	92.3	94.8
Month surveyed:												
January, February, or March	-.0445	-.0015	89.4	89.9	⁵ .2225	⁵ -.2519	62.5	54.8	.1290	-.1662	93.6	95.0
July, August, or September .....	.1069	-.0444	90.8	90.8	⁵ .1400	-.0899	60.5	56.7	⁵ .1906	⁵ -.3147	94.0	94.5
October, November, or December	-.0803	-.0775	89.1	88.8	.0382	.0322	58.0	57.2	.1640	-.2192	93.8	94.9

¹ Predicted probability is calculated for an increase of 0.01 in the intercept.

² Predicted probability is calculated with family size taken into account. For example, a single-person consumer unit consists of one adult and no children. A single-parent consumer unit consists of one adult and one child.

³ Predicted probability is calculated for a husband and wife with two children, one of whom is at least 18 years old.

⁴ Predicted probability is calculated for a husband and wife with two children, both of whom are under 18 years old. Because the increase in the number of children also affects the square of the number of children, the entire change is included in the value listed for the number of children.

⁵ Parameter estimate is statistically significant at the 95-percent confidence level.

women had different probabilities of purchasing fruits and vegetables in 1980, but that single men cannot be said with an acceptable degree of statistical confidence to have had a different probability of purchasing the same than single women had in 1992. Further, the change over time in the probability of singles purchasing fruits and vegetables is statistically sig-

nificant, regardless of gender.) In 1980, the probability of single men purchasing fruits and vegetables was 72 percent, compared with 81 percent for single women. In 1992, the figures were 74 percent and 85 percent, respectively. So, although in 1992, single men appear to have purchased fruits and vegetables more frequently than they did in 1980, they still ap-

pear not to have caught up to the frequency with which single women purchased items from this food group in 1980. Even so, about 54 percent of male meal preparers and 55 percent of female meal preparers believe that they are getting adequate fiber. About the same amount of men (38 percent) and women (39 percent) believe that they should consume more fiber.⁶¹ By contrast, women are more likely to believe that they are consuming adequate amounts of vitamin C (62 percent) than men are (57 percent). However, about one-third of each group believe that their diet should be higher in vitamin C. (Approximately 9 percent of men either did not know whether their diet was adequate in vitamin C, did not answer the question, or thought that their intake of vitamin C should be lower, compared with 4 percent of women.)

Race. There do not appear to be any changes across time in the probability of purchasing food that can be linked to race. Only poultry has a statistically significant coefficient for race, in 1992. Therefore, except for poultry, black families' probabilities of purchasing food in 1992 were not statistically distinguishable from those of white and other families in that year. However, black families were more likely to purchase fish and seafood, and less likely to purchase dairy products, fruits and vegetables, fats and oils, and other foods, than the control group was, at least in 1980.

Although this relationship leads to no discernible pattern by race, there are clear differences in nutritional attitudes by race. For example, about 8 percent more black meal preparers believe that their diet should be lower in fat and cholesterol than do white meal preparers.⁶² Also, more black meal preparers (44 percent) than white meal preparers (39 percent) believe that their diet should be higher in fiber. However, blacks are less likely to be aware of the relationship between health problems and certain foods. For example, 68 percent of black meal preparers associated fat intake with health problems, compared with 80 percent of white meal preparers; and 54 percent of black meal preparers named heart disease as an illness related to fat intake, compared with 67 percent of white meal preparers.⁶³ Similarly, 6 out of 8 black meal preparers had heard of links between cholesterol and health problems, compared with 7 out of 8 white meal preparers.⁶⁴ Clearly, the link between knowledge of nutrition and expenditures by race warrants further investigation.

Family size and composition. Although the DHKS does not provide information on the size of the meal preparer's family or the meal preparer's marital status, it is nonetheless interesting to examine expenditures for families of differing size and composition.

Single persons have smaller probabilities of purchasing specific goods than the control group has. This is to be expected, because the control group consists of married couples

with one child. With families, there are more members to be satisfied, and the more members present, the more likely is the probability of purchasing different items, for two reasons: first, families may consume certain foods more quickly than singles do, so that they need to replace these foods more frequently; and second, more family members means more tastes for the shopper to satisfy.

But how much does the addition of a child to a family change the probabilities, compared with an adult? For some goods, the answer is "not much." For example, the probability of purchasing cereal and bakery products was about 93 percent for the single-parent family in 1980, compared with 96 percent for the control group. Adding one child to a control group family raises the probability to 97 percent. But if an adult instead of a child is added to the control group family, there is no statistically significant difference produced by the addition. Further, there is no evidence to support a change in these patterns for 1992.

For other expenditures, the differences are more noticeable. For instance, married couples with no children show a smaller decrease (4 percent) than the control group does in the probability of purchasing fish and seafood, while other families show a decrease similar to that of the control group. Single parents show a larger decline (9 percent). Married couples with no children and single parents have a smaller probability of purchasing fish and seafood than the control group has in both 1980 and 1992. For other families, the probability is about the same as that of the control group in 1980, but is smaller than the probability of the control group in 1992.

Other characteristics. Most of the other characteristics tested (degree of urbanization, participation in the food stamp program, and month surveyed) show few statistically significant parameter estimates and no real discernible patterns. However, one characteristic warrants a brief mention: education. It seems reasonable to assume that, the more educated a person is, the more exposure the person has had to issues involving health and nutrition. Therefore, one could expect to observe some differences in expenditure patterns for persons with different levels of education. Indeed, some such differences are observed in the logit results. For example, the probability of purchasing beef, pork, and other meats decreases substantially—about 10 percentage points—for college graduates from 1980 to 1992.⁶⁵ Families whose reference person is a college graduate also show declines in the probability of purchasing eggs and fats and oils. Once again, the DHKS results show that meal preparers with at least some college are more likely to believe that their diets should be lower in total fat (including saturated fat) than meal preparers with less education believe.⁶⁶ Those with at least some college are also much more aware of relationships between the intake of certain nutrients and health problems.⁶⁷ For example, 86 percent of those

with some college are aware of links between total fat intake and health problems, compared with 73 percent of those whose last grade attended was any of grades 9 through 12 and 67 percent of those whose last grade attended was grade 8 or lower. Similarly, more than 9 out of 10 meal preparers with some college were aware of the relationship between cholesterol intake and health problems, compared with 8 out of 10 whose highest grade attended was high school and 7 out of 10 whose highest grade attended was grade 8 or lower.

Income elasticities

One important economic measure is income elasticity. In this article, income elasticity is used to show by what percent expenditures for a selected food group are expected to increase, given a 1-percent increase in income. An increase in income elasticity over time indicates that it takes less of an increase in income to induce a purchase of a particular item than it did before. Also important, but not estimated here, are price elasticities, which show the effect of a 1-percent increase in price on expenditures for a commodity. In addition, price elasticities show whether goods are complements of, or substitutes for, each other. (For example, if expenditures for coffee decrease when tea prices fall, the goods are substitutes.) The reason price elasticities are not estimated in what follows is that the Consumer Expenditure Survey lacks data on prices.⁶⁸ However, the analysis that is presented does control for price changes over time.

Income elasticity can be estimated by using regression results. However, before regressions can be performed, several factors must be taken into account.

First, if prices for selected food items change at a different rate than incomes, changes in income elasticities will not be accurately measured. For instance, if prices rise faster than incomes, it may appear that a given expenditure has increased for the same level of income, yet the family may actually be consuming less of the product. For this reason, both expenditures and incomes are adjusted for inflation before one performs a regression. To achieve these adjustments, each individual expenditure is divided by the level of the CPI for that item in the appropriate year, with the resulting "real" expenditures aggregated to the food group level. Thus, 1980 expenditures for apples are divided by 0.921 before being added to (real) expenditures for other fruits and vegetables. (The appendix to this article has a complete listing of individual foods and the deflators for each year.) Income is divided by the CPI for all goods and services. By regressing real expenditures on real income (with base year 1982–84), a "real" Engel curve is estimated. The estimated relationship between income and expenditures is then used to calculate income elasticities.

Second, a method of regression must be selected. Although all families buy food at home of some type at some time or another, not all families buy each kind of food all the time.

Table 9. Characteristics of families included in logistic regressions

Variable	1980	1992
Number		
Sample	9,055	10,186
Adults	1.9	1.9
Persons less than age 18 .....	.8	.8
Percent		
Age:		
Under 35	33.6	28.0
65 and older	19.3	20.7
Income group:		
Low income	27.6	23.9
High income	27.2	29.4
Incomplete reporters	18.1	19.9
Type of family:		
Single man	9.9	10.0
Single woman	16.1	14.5
Husband and wife only	21.7	21.9
Single parent	5.0	6.1
Other family	12.8	16.3
Race:		
Black	11.7	9.7
Education:		
Some college	21.2	23.3
College graduate	18.6	25.4
Degree of urbanization:		
Rural	12.5	10.6
Food stamp program:		
Participant	7.4	7.5
Month surveyed:		
January, February, or March	21.3	24.6
July, August, or September	23.0	21.3
October, November, or December	34.3	32.1
Reporting purchases of:		
Cereal and bakery products	88.1	89.2
Beef, pork, and other meats	74.9	73.0
Poultry	38.9	40.1
Fish and seafood	31.2	28.5
Eggs	50.8	40.2
Dairy products	88.0	87.0
Fruits and vegetables	83.9	86.8
Fats and oils	48.5	46.0
Other food at home	87.5	91.2

Some families would choose not to purchase some kinds of foods, even if they were available for very low prices or even if they were given away free of charge. Unfortunately, there is no way to identify whether families are true nonconsumers of a certain food or whether they just did not happen to purchase the food during the survey's 2-week reference period for some other reason. If conventional ordinary least squares regressions are run only on families with positive expenditures, biases will result, because some "would-be" purchasers are thrown out with the "never" purchasers. Several methods are available to adjust for this problem. The method used in this article is the Heckman two-stage procedure.⁶⁹ In this method,

a probit regression is run to estimate the probability that a family would purchase the food in question. Results of this regression are manipulated to create a variable, called the inverse of Mill's ratio. The second stage is an ordinary least squares regression of expenditures for those who made a purchase on selected variables, including the inverse of Mill's ratio. One major advantage of the Heckman procedure over its competitors (such as Tobit models) is that the variables can differ from the first to the second stage, making the Heckman procedure much more flexible. Because the second stage is performed using ordinary least squares, the coefficients are directly interpretable; no adjustment is necessary before using them in further analysis, as would be necessary with Tobit models.⁷⁰

Third, once a model is selected, it is important to make sure that relevant coefficients are unbiased and efficient. Because income data are often found to be nonnormally distributed, some correction for heteroskedasticity is in order. Accordingly, the income data in the second stage are subjected to a Box-Cox transformation,⁷¹ the standard formula for which is

$$X(\lambda) = (X + 1)^\lambda,$$

where

X is the variable to be transformed (income before taxes in this case) and λ is a parameter obtained through estimation.

However, as Box and Cox point out, the variable need only be raised to the power of λ if it is to be used in a regression.⁷² For convenience in interpreting results, this simplification is used. In these models, the value of λ , estimated by using a maximum-likelihood technique described by Scott and Rope,⁷³ is found to be one-fourth. Therefore, in the second stage, instead of regressing expenditures directly on income, expenditures are regressed on the fourth root of income.

Fourth, not all families provide information on even one major source of income. For this reason, the sample is limited to complete income reporters before λ is estimated and before first- or second-stage regressions are run. Because the focus of the analysis set forth in this article is contingent upon having appropriate income values, omitting the incomplete reporters from the regression is presumably the best solution to the problem. This omission eliminates the excess variation that would result from their inclusion; the only other solution would be to greatly complicate the regression equation by adding appropriate main effects and interaction terms to control for this variation.

Finally, results from the probit stage are not shown. In general, logit and probit regressions yield similar results. Because the same variables are used in the probit stage and in the logit regressions already described, providing both sets of estimates

would be duplicative.⁷⁴ Also, only the most important second-stage results (that is, those dealing with the expenditure-income relationship) are shown in table 10.⁷⁵

The models. The probit model is identical to the logit model described earlier; the same dependent and independent variables are used in all cases. The second-stage model differs only slightly. First, instead of utilizing a dichotomous dependent variable, the second stage uses a continuous dependent variable (that is, the actual level of expenditures for the food group under study). Second, instead of using binary variables to represent income classes, a continuous income variable is employed (after being transformed as described above). With this variable, one can still estimate income elasticities for each income group (low, middle, or high) by evaluating each elasticity using the mean income for each group. Additionally, the second stage includes several interaction terms used to evaluate whether income elasticities are different both across demographic groups and across time. The interactions are limited to the most basic demographic differences, including age, gender (single male and single female), and race.

Estimating income elasticity. The definition of income elasticity is the ratio of the percent change in quantity purchased to the percent change in income. (In this article, "real" expenditure is used as a proxy for quantity purchased, as described earlier.) Although income elasticities can be positive or negative, in general, they are positive; therefore, goods with positive elasticities are often called "normal" goods. (Those with negative elasticities are often called "inferior" goods.) The larger the absolute value of the elasticity, the more responsive the good or service is to a change in income.

The formula for income elasticity is

$$= \frac{Y}{I} \times \frac{I}{Y},$$

where

Y/I is the rate of change of the expenditure with respect to income;

I is the level of income at which elasticity is evaluated; and Y is the level of the real expenditure at which elasticity is evaluated.

Because a Box-Cox transformation is used on income before the regression is carried out, the value of Y/I is found as follows:⁷⁶

$$Y = a + bI^{0.25};$$

$$Y/I = 0.25bI^{-0.75}.$$

The elasticity then becomes

$$= 0.25bI^{-0.75} I/Y.$$

Simplifying yields

$$= (0.25bI^{0.25})/Y.$$

Results. Table 10 shows the income elasticities derived from the second stage of the regression, plus other information. The first two columns present real weekly expenditures in 1980 and 1992 for purchasers of the food item in each demographic group. The next two columns show the percentage of each demographic group reporting an expenditure for the food item in question. For example, of the 2,655 consumer units in the under-35 age group in 1980 who reported purchasing food at home, 2,214, or about 83 percent, included cereal and bakery products in their grocery baskets. The third set of columns shows real annual income (that is, income before taxes, divided by the Consumer Price Index for all goods and services) in 1980 and 1992, by demographic group. The next set of columns shows the estimated income parameters for each group in each year. (For convenience, all interaction terms have been added as appropriate before inserting them into the tables; see the section titled "Logistic regression results," above, for more details.)

The income elasticities shown in the table require a bit more explanation. According to the formula derived earlier, income elasticity is dependent on both the level of income and the level of expenditure in each year. If these have changed for some reason, how can one be certain that differences in observed elasticities are due to changes in tastes or other factors influencing expenditures, and not just differences in incomes? To correct for this problem as much as possible, real expenditures and real incomes are averaged for each group across time before using them in the income elasticity equations. In that way, differences in elasticity are due solely to differences in the income parameter estimates.

As with the logit models, many parameters are based on interactions across characteristics as well as time and must be added appropriately before calculating elasticities. The parameter estimates are accompanied by footnotes designating their statistical significance. Parameter estimates are considered to be statistically significant on the basis of standard *t*-test results. To say that an estimate is statistically significant means that it is significantly different from zero before addition.⁷⁷

Elasticities calculated from these parameter estimates are analyzed for statistical significance in a different way. The first part of the elasticity equation (Y/I) is calculated by adding parameters appropriately, regardless of their statistical significance. Elasticities in 1980 are considered to be statistically significantly different from zero if the sum of the 1980 parameter estimates does not differ significantly from zero according to an *F*-test. Elasticities in 1992 are analyzed to see whether they are statistically significantly different from the 1980 elasticities, rather than from zero. (That is, if the difference between the estimated effects for 1980 and 1992 is sta-

tistically significant according to an *F*-test, the difference in elasticities is considered to be statistically significant.)

General observations. As expected, the individual food categories are income inelastic in each year; that is, a 1-percent increase in income yields an increase of less than 1 percent in expenditures for each individual food category. Even so, the food categories can be placed into three distinct groups: those for which elasticities increase over time for most groups (cereal and bakery products, fish and seafood, and other food at home); those for which elasticities were positive in 1980 for most groups and do not change over time (beef, pork, and other meats; dairy products; and fruits and vegetables); and those for which elasticities were statistically indistinguishable from zero, regardless of the year (poultry, eggs, and fats and oils). Expenditures in the last group are called "perfectly inelastic," indicating that quantities purchased do not change with income. Expenditures in the other groups are called "necessities," because their elasticities are greater than zero, but less than unity. Those with elasticities less than zero are called "inferior," because a negative elasticity means that expenditures *decrease* as income increases. Although some predicted elasticities fit this category, they are not statistically distinguishable from zero, as noted above. No "luxury" foods (those with elasticities greater than unity) are found. In only one case is a decrease in elasticity found to be statistically significant: fruits and vegetables purchased by families whose reference person is older than 65. Even here, though, the change is just barely significant at the 90-percent confidence level.

Those expenditures with increasing elasticities are especially interesting. The increasing elasticity indicates that the Engel curve has become steeper over time, which, in turn, indicates that it took a smaller increase in income to induce a purchase of the good in 1992 than it did in 1980, at least for the demographic group under study. The best example of this phenomenon is other food at home, which shows an increase in elasticity for almost every demographic group. As mentioned earlier, this is not surprising, due to the ever-changing nature of society. The category contains a substantial amount of "convenience" foods, such as frozen foods and prepackaged meals. Again, the rise of two-earner families, the proliferation of a variety of frozen meals since 1980, and increased ownership of microwave ovens undoubtedly contribute to the increased elasticity of frozen meals.

Age. For most food expenditures, elasticity varies little with age. For example, for cereal and bakery products, estimated elasticities range only from 0.10 (for those under 35) to 0.14 (for those 65 and older) in 1980. In 1992, only the middle group (aged 35 to 64) shows a statistically significant increase in elasticity, although the range of predicted elasticities is -0.18 to 0.19.

But some differences are worth noting. A substantial gap

Table 10. Income elasticity estimates and related information, Heckman second-stage results, complete reporters only, 1980 and 1992

Characteristic	Real weekly expenditures ¹		Percent reporting ²		Real annual income		Parameter estimate <i>l</i> = (<i>β</i> ²⁵)		Income elasticity ³	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Cereal and bakery products										
Age of reference person:										
Under 35	\$5.81	\$5.83	83.4	85.5	\$21,466	\$22,883	⁴ 0.186	⁵ 0.341	⁴ 0.10	0.18
35 to 64	7.77	7.46	91.8	90.6	28,251	32,508	⁵ .277	⁵ .423	⁵ .12	⁴ .18
65 and older	5.02	5.67	90.3	90.0	11,583	16,167	⁵ .284	⁵ .369	⁵ .14	.19
Income group:										
Low	4.80	5.06	83.7	84.9	6,709	7,161	⁵ .277	⁵ .423	⁵ .13	⁴ .20
Middle	6.57	5.98	90.1	89.8	18,961	18,684	⁵ .277	⁵ .423	⁵ .13	⁴ .20
High	8.26	8.37	91.7	91.6	41,481	47,586	⁵ .277	⁵ .423	⁵ .12	⁴ .18
Single person:										
Man	3.33	3.59	73.3	77.6	13,309	17,964	.068	⁵ .277	.05	.22
Woman	3.24	3.77	78.0	82.7	8,820	12,633	.065	⁵ .308	.05	.22
Race of reference person:										
Black	5.69	5.67	87.6	87.3	15,380	19,097	.086	-.014	.04	-.01
White or other	6.71	6.72	88.6	89.2	23,835	27,113	⁵ .277	⁵ .423	⁵ .13	⁴ .20
Beef, pork, and other meats										
Age of reference person:										
Under 35	11.98	9.39	66.7	67.4	22,756	22,729	⁴ .582	.087	⁴ .17	.02
35 to 64	15.82	11.37	81.5	76.1	28,751	32,438	⁵ .571	.236	⁵ .14	.06
65 and older	10.10	9.03	77.3	73.3	12,013	15,979	⁵ .969	.409	⁵ .28	.12
Income group:										
Low	9.27	8.86	66.4	69.1	6,884	7,294	⁵ .571	.236	⁵ .14	.06
Middle	13.94	10.14	77.0	73.3	19,098	18,750	⁵ .571	.236	⁵ .14	.06
High	16.58	11.63	83.0	75.9	41,527	47,096	⁵ .571	.236	⁵ .15	.06
Single person:										
Man	6.93	6.25	53.4	60.7	14,811	17,343	.289	.481	.12	.21
Woman	6.01	5.96	58.3	57.7	9,011	12,075	-.036	.205	-.02	.09
Race of reference person:										
Black	13.48	12.08	75.1	74.9	15,993	18,966	.483	.200	.11	.04
White or other	13.54	10.16	75.5	72.8	24,740	27,182	⁵ .571	.236	⁵ .15	.06
Poultry										
Age of reference person:										
Under 35	4.58	4.59	32.4	36.2	22,113	24,321	.103	.043	.07	.03
35 to 64	5.22	5.57	42.4	41.6	28,622	33,127	.033	⁶ .090	.02	.06
65 and older	3.76	4.54	40.5	37.7	11,424	17,620	.182	-.006	.12	.00
Income group:										
Low	4.05	4.45	35.3	36.3	6,827	7,206	.033	⁶ .090	.02	.05
Middle	4.72	4.75	39.1	37.4	19,053	18,806	.033	⁶ .090	.02	.06
High	5.37	5.82	41.1	43.3	41,707	48,429	.033	⁶ .090	.02	.06
Single person:										
Man	3.31	4.40	23.4	24.5	13,575	23,082	-.017	⁵ .283	-.01	.21
Woman	3.26	3.54	29.1	27.7	8,743	11,843	.012	⁴ .277	.01	.21
Race of reference person:										
Black	5.07	5.02	51.3	50.3	15,872	19,385	-.148	.053	-.08	.03
White or other	4.68	5.11	36.3	38.1	24,844	28,795	.033	⁶ .090	.02	.06
Fish and seafood										
Age of reference person:										
Under 35	3.56	3.38	27.2	25.0	22,382	24,148	.065	⁴ .238	.06	.21
35 to 64	4.65	4.35	34.6	30.3	30,483	36,498	.114	⁵ .439	.09	⁴ .33
65 and older	3.56	3.67	30.9	27.2	12,851	16,932	⁶ .474	⁶ .394	⁶ .36	.30
Income group:										
Low	3.09	3.18	26.0	24.0	6,937	7,226	.114	⁵ .439	.08	⁴ .32
Middle	4.12	3.40	31.1	26.7	19,554	18,793	.114	⁵ .439	.09	⁴ .34
High	4.83	4.84	36.8	32.7	41,842	50,138	.114	⁵ .439	.09	⁴ .33
Single person:										
Man	3.93	3.10	20.3	18.1	15,126	21,060	.268	⁵ .476	.22	.39
Woman	2.86	2.72	21.8	19.9	8,839	12,823	-.031	⁶ .340	-.03	.31

Table 10. Continued—Income elasticity estimates and related information, Heckman second-stage results, complete reporters only, 1980 and 1992

Characteristic	Real weekly expenditures ¹		Percent reporting ²		Real annual income		Parameter estimate <i>I</i> = (<i>P</i> ²⁵)		Income elasticity ³	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Race of reference person:										
Black	4.28	4.41	35.9	31.4	16,610	21,117	.041	⁴ .336	.03	.23
White or other	4.09	3.91	30.7	27.8	26,041	30,330	.114	⁵ .439	.09	⁴ .36
Eggs										
Age of reference person:										
Under 35	1.51	1.26	45.7	36.0	23,014	22,627	-.040	.004	-.09	.01
35 to 64	1.78	1.47	56.0	41.9	29,060	31,280	.001	.040	.00	.08
65 and older	1.47	1.41	50.3	38.6	12,474	16,816	-.014	-.013	-.03	-.02
Income group:										
Low	1.55	1.40	44.7	36.6	6,930	7,272	.001	.040	.00	.06
Middle	1.61	1.36	51.3	39.6	19,159	18,744	.001	.040	.00	.08
High	1.73	1.44	57.8	41.6	41,966	45,668	.001	.040	.00	.09
Single person:										
Man	1.18	1.10	32.6	23.9	14,244	17,780	-.001	.030	.00	.07
Woman	1.14	1.46	34.3	27.2	8,986	11,855	.064	.116	.12	.23
Race of reference person:										
Black	1.89	1.41	52.6	43.2	16,116	19,059	-.010	-.006	-.02	-.01
White or other	1.60	1.40	51.1	39.1	25,254	26,845	.001	.040	.00	.08
Dairy products										
Age of reference person:										
Under 35	5.95	5.34	83.8	84.1	21,792	23,429	⁵ .250	⁵ .167	⁵ .14	.09
35 to 64	7.35	6.57	91.5	88.1	28,587	32,820	⁵ .264	⁵ .166	⁵ .13	.08
65 and older	4.65	4.71	88.6	87.2	11,674	16,109	⁵ .255	⁶ .149	⁵ .15	.09
Income group:										
Low	4.58	4.58	81.8	81.6	6,719	7,253	⁵ .264	⁵ .166	⁵ .13	.08
Middle	6.23	5.58	89.2	87.4	18,983	18,728	⁵ .264	⁵ .166	⁵ .13	.08
High	8.10	6.97	93.8	90.3	41,562	47,794	⁵ .264	⁵ .166	⁵ .13	.08
Single person:										
Man	3.50	3.61	71.4	74.1	13,968	18,859	.142	.116	.11	.09
Woman	3.27	3.43	77.1	78.8	8,963	12,963	.155	.150	.12	.11
Race of reference person:										
Black	4.54	4.25	81.0	78.9	15,677	19,085	.040	-.052	.03	-.03
White or other	6.60	5.99	89.2	87.6	24,074	27,379	⁵ .264	⁵ .166	⁵ .13	.08
Fruits and vegetables										
Age of reference person:										
Under 35	7.11	6.28	76.7	79.9	22,076	23,653	⁵ .317	⁴ .367	⁵ .15	.17
35 to 64	9.17	7.89	87.8	88.6	28,885	33,052	⁵ .379	⁵ .353	⁵ .15	.14
65 and older	6.91	6.54	88.8	92.2	11,819	16,113	⁵ .467	⁴ .219	⁵ .19	⁶ .09
Income group:										
Low	6.13	5.76	78.0	82.3	6,731	7,214	⁵ .379	⁵ .353	⁵ .15	.14
Middle	7.89	6.56	84.4	86.2	19,036	18,761	⁵ .379	⁵ .353	⁵ .15	.14
High	9.91	8.71	89.7	91.0	41,940	47,961	⁵ .379	⁵ .353	⁵ .15	.14
Single person:										
Man	5.18	4.47	63.9	72.2	14,924	19,205	⁴ .301	⁴ .288	⁴ .18	.17
Woman	5.19	4.53	77.8	84.1	8,964	13,024	.215	⁶ .226	.11	.12
Race of reference person:										
Black	7.38	6.60	80.3	85.6	15,891	19,343	⁵ .326	.148	⁵ .13	.06
White or other	8.15	7.22	84.5	86.9	24,304	27,548	⁵ .379	⁵ .353	⁵ .16	.15
Fats and oils										
Age of reference person:										
Under 35	2.38	2.53	41.5	36.7	23,310	23,842	.007	.117	.01	.15
35 to 64	2.78	2.81	54.2	49.8	29,817	32,812	.026	⁵ .076	.03	.09
65 and older	2.14	2.40	50.3	49.0	12,218	16,266	-.056	.058	-.07	⁶ .07

Table 10. Continued—Income elasticity estimates and related information, Heckman second-stage results, complete reporters only, 1980 and 1992

Characteristic	Real weekly expenditures ¹		Percent reporting ²		Real annual income		Parameter estimate <i>I</i> = (<i>P</i> .25)		Income elasticity ³	
	1980	1992	1980	1992	1980	1992	1980	1992	1980	1992
Income group:										
Low	2.23	2.36	39.6	40.3	6,897	7,334	.026	⁵ .076	.03	.08
Middle	2.51	2.62	50.5	46.2	19,229	18,807	.026	⁵ .076	.03	.09
High	2.75	2.87	56.7	50.0	41,631	46,715	.026	⁵ .076	.03	.10
Single person:										
Man	1.59	1.95	27.2	27.7	13,784	19,244	.040	.067	.06	.11
Woman	1.74	1.89	34.7	34.3	9,001	12,310	.056	.027	.08	.04
Race of reference person:										
Black	2.49	8.05	41.9	41.9	15,777	19,190	-.016	.048	-.01	.03
White or other	2.55	2.66	49.8	46.2	21,017	27,767	.026	⁵ .076	.03	.09
Other food at home										
Age of reference person:										
Under 35	9.86	12.00	87.4	91.4	21,140	22,881	⁵ .456	⁵ .767	⁵ .13	⁶ .21
35 to 64	12.22	14.49	91.2	92.3	28,480	32,588	⁵ .356	⁵ .894	⁵ .09	⁵ .22
65 and older	7.96	9.59	84.9	90.4	11,717	16,160	.280	⁵ .772	.09	4.24
Income group:										
Low	7.38	8.90	84.1	88.1	6,656	7,117	⁵ .356	⁵ .894	⁵ .10	⁵ .25
Middle	10.91	11.86	89.1	92.6	18,974	18,779	⁵ .356	⁵ .894	⁵ .09	⁵ .23
High	13.36	16.49	92.9	93.7	41,595	47,832	⁵ .356	⁵ .894	⁵ .09	⁵ .22
Single person:										
Man	6.00	7.16	79.3	83.9	13,953	18,264	⁵ .141	⁵ .630	.06	⁶ .27
Woman	5.45	7.06	81.2	87.2	8,911	12,748	⁵ .227	⁵ .733	.09	⁵ .30
Race of reference person:										
Black	8.31	9.86	83.9	87.0	15,536	19,485	.119	.064	.04	.02
White or other	10.93	13.05	89.3	92.1	23,877	27,074	⁵ .356	⁵ .894	⁵ .09	⁵ .24

¹ Mean for those who reported an expenditure for the specific food item.

² Percent of consumer units in each group reporting at least one food expenditure.

³ Elasticity calculated using average of 1980 and 1992 real weekly expenditures and real incomes.

⁴ Statistically significant at the 95-percent confidence level.

⁵ Statistically significant at the 99-percent confidence level.

⁶ Statistically significant at the 90-percent confidence level.

NOTE: For 1980, statistically significant elasticities are different from zero; for 1992, statistically significant elasticities are different from the corresponding 1980 elasticities.

exists between the estimated elasticities of families younger than 65 and families 65 and older for beef, pork, and other meats. The 1980 elasticity for families 65 and older was 0.28, compared with 0.17 for those younger than 35 and 0.14 for the 35- to 64-year-old group. Although no statistically significant change occurred over time, the oldest group still had the largest predicted elasticity, 0.12, compared with 0.06 for the middle group and 0.02 for the youngest group. And although there was some variation in elasticities for other food at home in 1980 (0.13 for the youngest group, 0.09 for the middle group, and an estimate not significantly different from zero for the oldest group), by 1992 all age groups had elasticities in the low 0.20 range, with figures statistically significantly different from their 1980 estimates.

Elasticities for fish and seafood also appear to differ by age. In 1980, only those in the 65-and-older group had a statistically significant elasticity (0.36). In 1992, the middle group had a statistically significant increase in elasticity, which

rose to 0.33. Because the older group does not change significantly over time, one can say the middle age group “caught up” to the older one. The elasticity of the under 35 group was not statistically significant in either year.

Income. There is almost no variation in the elasticity of income by age group. Although the same parameter estimate is used to calculate elasticity regardless of income class (as described earlier), clear differences in real income and real expenditures can be seen for several food groups. So it appears that, because inverse income shares are used to calculate elasticities, conventional shares of income must be similar for the various income groups, a finding confirmed by table 3. Although some differences in shares by income in each year are observed, they are not generally large.

Even so, some trends are interesting. For example, regardless of income, families exhibited statistically significant increases in their purchases of cereal and bakery products, fish

and seafood, and other food at home. Although the 1980 elasticities for other food at home were statistically significantly different from zero, in 1992 they more than doubled for each food group. For fish and seafood, elasticities rose from a value not significantly different from zero to the low 0.30s.

Gender. Elasticities are slightly more complicated to analyze by gender. Except for other food at home, no elasticity appears to have changed over time for either single men or single women. But to interpret the results this way is slightly misleading. Actually, in several cases (cereal and bakery products, poultry, fish and seafood, and fruits and vegetables), the 1992 parameter estimate was statistically significantly different from zero for at least one gender, whereas the 1980 parameter estimate was not statistically significant for that gender. So why does it appear that there was no statistically significant change? It has to do with the question the statistical tests are asked to answer. For example, table 10 shows that, for both single men and women, the estimated elasticity for cereal and bakery products was 0.05 in 1980 and 0.22 in 1992. The 1980 parameter estimate was not statistically significantly different from zero. Although the 1992 parameter estimate was statistically significantly different from zero, it was *not* statistically significantly different from 0.05. Thus, there is no indicator of statistical significance associated with the 1992 elasticity. Given that many elasticities were at least significantly different from zero in 1992, but were not in 1980, the analysis proceeds assuming that a difference from zero implies a change in elasticity.

Single men and women had very similar elasticities for cereal and bakery products, poultry,⁷⁸ and other food at home regardless of the survey year. However, single men appear to have had a higher elasticity for fruits and vegetables than single women did regardless of the year, and also for fish and seafood in 1992. Neither group had a statistically significant elasticity for beef, pork, and other meats; eggs; dairy products; or fats and oils, regardless of the year.

Race. Expenditures by race are subject to the same caveat as those for singles: occasionally, an elasticity was statistically significantly different from zero in 1992, whereas it was not in 1980, but the difference in the estimated elasticities for each year is not itself statistically significant. Even bearing this in mind, however, there are only two expenditures for which black families showed an income elasticity that was both positive and statistically significantly different from zero: fish and seafood (0.23 in 1992) and fruits and vegetables (0.13 in 1980). However, neither of these figures represents a statistically significant change in elasticity over time.

Still, for white and other families, many changes are evident. Elasticities increased for cereal and bakery products, fish and seafood, and other food at home and were significantly

different from zero for beef, pork, and other meats (1980), poultry (1992), dairy products (1980 and 1992), fruits and vegetables (1980 and 1992), and fats and oils (1992). No statistically significant elasticities were calculated for eggs.

HAVE CONSUMER EXPENDITURES ON FOOD AT HOME changed to reflect current nutritional attitudes? To answer that question, this article has analyzed data from the Consumer Expenditure Survey in three different ways. The first compares how shares of the food budget were allocated in 1980 and 1992 for families with different demographic characteristics, including how price changes account for the observed differences. The second uses logistic regressions to see whether the frequency of purchasing specific food items has changed over time and how that frequency relates to demographic characteristics. The third utilizes results from the second stage of a Heckman two-stage regression analysis to estimate income elasticities for various food groups. Data from the new Diet and Health Knowledge Survey are used to analyze current nutritional attitudes by demographic group. These data are generally consistent with changing food expenditure patterns.

On the one hand, consumers are substituting poultry for meats with a higher fat content and are reducing their consumption of eggs. On the other hand, the consumption of fruits and vegetables has declined, although most demographic groups are purchasing fruits and vegetables more frequently. Both the consumption of, and the frequency of purchasing, fish and seafood have declined for most demographic groups. However, this finding is mitigated by the fact that income elasticities for fish and seafood have increased substantially, at least for families in the control group. Apparently, expenditures on fish and seafood increased more rapidly with income in 1992 than in 1980.

Among other interesting changes, single men consumed relatively more poultry in 1992 than in 1980, while single women consumed less; by contrast, single women were more likely to purchase fruits and vegetables than single men were, regardless of the year, although both groups purchased fruits and vegetables more frequently in 1992. Some generational differences were found. For example, families of all ages decreased their egg consumption from 1980 to 1992, but families 65 and older were most likely (and families under 35 least likely) to purchase eggs regardless of the year. Conversely, older families were most likely (and younger families least likely) to purchase fruits and vegetables. Substantial differences by income group were found through an examination of share indexes, with the high-income group exhibiting relatively more healthful changes. However, as regards the frequency of purchasing the various foods, gaps in probability are not generally large across income groups. The largest was for fish and seafood in 1980, with the high-income group about 5 percent more likely to purchase this item than the low-income group.

Race appears to have little relationship to food consumption as measured by share indexes, except for the meat group. Also, blacks are more likely than whites and others to purchase poultry or fish and seafood, and less likely to purchase dairy products or fats and oils, regardless of the year.

Some income elasticities exhibit notable changes over time. Income elasticities for several foods—cereal and bakery products, fish and seafood, and other food at home—have increased for many demographic groups. This rise indicates that a 1-percent increase in income yielded a larger percent increase in expenditures for these items in 1992 than it did in 1980. However, income elasticities for all other foods were generally

stable across the 2 years that the survey was taken. For the most part, income elasticities for beef, pork, and other meats; dairy products; and fruits and vegetables were positive in 1980. However, elasticities for poultry, eggs, and fats and oils were not statistically significantly different from zero in 1980.

In general, the findings indicate that consumers are reacting to the ever-changing news about relationships of food to health, but that some demographic groups respond differently than others. Future work analyzing trends by demographic groups should provide further insight into changing food expenditure patterns, especially as more data on nutritional attitudes and awareness become available. □

Footnotes

¹ “Try These New Secrets: Live Longer and Love Every Day,” *Prevention*, August 1993, p. 73.

² Judith Jones Putnam and Jane E. Allshouse, *Food Consumption, Prices, and Expenditures, 1970–92*, Statistical Bulletin No. 867 (U.S. Department of Agriculture, September 1993).

³ These and the figures that follow are taken from Putnam and Allshouse, *Food Consumption*, table 1, “Major foods: Per capita consumption, 1970–92,” p. 27.

⁴ Unlike the per capita consumption of other foods described here, which was more or less steadily up or steadily down from 1980 through 1992, per capita dairy product consumption reached a low in 1981 (543.2 pounds), rose from 1982 (554.6 pounds) through 1987 (601.2 pounds), and then dropped sharply in 1988 (565.2 pounds), at which level it approximately remained until 1992 (564.6 pounds). Even so, per capita consumption in 1992 was 4 percent higher than in 1981.

⁵ The consumption of both fresh fruits and fresh vegetables dropped from 1989 to 1991, probably due to sharp increases in prices after the 1988 drought. Per capita fresh fruit consumption increased strongly from 1991 (86.6 pounds) to 1992 (95.3 pounds), but that of fresh vegetables declined slightly over the same period, falling from 110.4 pounds to 109.3 pounds.

⁶ Putnam and Allshouse, *Food Consumption*, p. 3.

⁷ *Ibid.*

⁸ “Fruit and Vegetable Consumption,” *Family Economics Review*, vol. 6, no. 2, 1993, p. 24.

⁹ Putnam and Allshouse, *Food Consumption*, p. 18.

¹⁰ The Consumer Expenditure Diary Survey shows that in 1980, 88 percent of all families reported expenditures for food at home, compared with 73 percent for food away from home. In 1992, 90 percent reported expenditures for food at home, compared with 74 percent for food away from home.

¹¹ Putnam and Allshouse, *Food Consumption*, p. 3.

¹² In fact, the Continuing Survey of Food Intake for Individuals (CSFII) has superseded the NFCS to some degree, although it is not a perfect replacement for that survey. As the name implies, the CSFII collects information on what foods individuals actually consumed, but it does not collect household data (including food usage and demographic characteristics) that were formerly available in the NFCS. Furthermore, the CSFII is itself conducted only periodically. The first nationwide sample was collected in 1989–91, and a later sample was collected in 1994–96. The next scheduled surveys will take place starting in 1999.

¹³ See, for example, Ching-Fan Chung, “A Cross-Section Demand Analysis of Spanish Provincial Food Consumption,” *American Journal of Agricultural Economics*, August 1994, pp. 513–21; and Hwang-Jaw Lee, “An Analysis of a Food Demand System for the United States,” *Acci [American Council on Consumer Interests] Proceedings*, Toronto, 1992, pp. 271–78.

¹⁴ Dale M. Heien and Cathy Roheim Wessells, “The Demand for Dairy

Products: Structure, Prediction, and Decomposition,” *American Journal of Agricultural Economics*, May 1988, pp. 219–28.

¹⁵ Chung, “Cross-Section Demand Analysis”; Lee, “Analysis of a Food Demand System”; and Marilyn E. Manser, “Elasticities of Demand for Food: An Analysis Using Non-Additive Utility Functions Allowing for Habit Formation,” *Southern Economic Journal*, July 1976, pp. 879–91.

¹⁶ Susan M. Krebs-Smith, Annetta Cook, Amy F. Subar, Linda Cleveland, and James Friday, “U.S. Adults’ Fruit and Vegetable Intakes, 1989 to 1991: A Revised Baseline for the *Healthy People 2000* Objective,” *American Journal of Public Health*, December, 1995, pp. 1623–29.

¹⁷ The reference person is the first member mentioned by the respondent when asked to “Start with the name of the person or one of the persons who owns or rents the home.” It is with respect to this person that the relationship of the other family members is determined.

¹⁸ The income groups include complete income reporters only. To be classified as a complete income reporter, the family must have reported at least one major source of income (such as wages or salaries, self-employment income, or Social Security income) for at least one of its members, although even complete reporters may not provide a full accounting of income for all levels and sources.

¹⁹ A consumer unit, which is the basic unit of comparison in the Consumer Expenditure Survey, is defined as a single person living alone or sharing a household with others, but who is financially independent; members of a household related by blood, marriage, adoption, or some other legal arrangement; or two or more persons living together who share responsibility for at least two of three major types of expenses—food, housing, and other expenses. For convenience, the terms “consumer unit” and “family” are used interchangeably throughout the article.

²⁰ Although an attempt is made to keep all participating families in the sample for both weeks, some families are available only for 1 week. Thus, dividing by 2 underestimates the number of unique families participating.

²¹ *Nutritional Attitudes and Dietary Status of Main Meal Planners/Preparers, 1989–91*, Agricultural Research Service NFS Report No. 91-1 (U.S. Department of Agriculture, January 1996). See especially page 1, and abstract for dates survey was conducted.

²² The main meal planner or preparer is the person “most responsible for planning or preparing the household’s meals.” (*Ibid.*, p. 201.)

²³ *Ibid.*, p. 1.

²⁴ The second DHKS covers the period 1994–96.

²⁵ See technical note for formula.

²⁶ The CPI-U, which measures price changes in urban areas, is used. Although the Consumer Expenditure Survey data include both urban and rural consumers, most families (86 percent) in the 1980 and 1992 Diary surveys live in urban areas.

²⁷ Maureen Boyle Gray, “Consumer spending on durables and services in

the 1980's," *Monthly Labor Review*, May 1992, pp. 18–26; see especially p. 20.

²⁸ Although results from the 1980 and 1992 Diary surveys show that the average number of earners per consumer unit is 1.4 in both years, there has been a shift in the distribution of earners. Looking at single persons only, one finds that about 63 percent are earners in each year. But examining consumer units with at least two members, one readily sees that single-earner consumer units drop from 30 percent to 25 percent of these families, and two-earner consumer units increase from 44 percent to 49 percent of such families.

²⁹ Eva Jacobs, Stephanie Shipp, and Gregory Brown, "Families of working wives spending more on services and nondurables," *Monthly Labor Review*, February 1989, pp. 15–23; see p. 16.

³⁰ Putnam and Allshouse, *Food Consumption*, p. 16.

³¹ *Ibid.*, p. 37. Table 10 shows that per capita egg consumption declined at a fairly steady rate from 1980 (271 eggs) to 1987 (254 eggs), at which point it fell sharply until 1990 to a level (233 eggs) at which it stabilized.

³² Lee, "Analysis of a Food Demand System." Lee finds that poultry and seafood are substitutes (p. 275), with a cross-price elasticity of 0.36 (p. 278). In other words, for every 1-percent increase in the price of seafood, expenditures on poultry rise 0.36 percent.

³³ The BLS Division of Consumer Expenditure Surveys routinely compares results of the Diary survey with those of other surveys. Ratios of 1991 Consumer Expenditure Survey data to data from other sources are published in *Consumer Expenditure Survey, 1990–91*, Bulletin 2425 (U.S. Department of Labor, 1993), p. 11. Ratios also are found in internal reports, including Maureen Gray, *Ratios of Consumer Expenditure Diary survey to alternative sources, 1989–92*, 1994, table completed January 4. The Consumer Expenditure Survey data for fish and seafood are divided by the appropriate ratio in the table for conversion into values found by the other sources described. These values are then divided by the CPI for fish and seafood in each year, converting the values into real dollars for 1990, 1991, and 1992. The change from 1990 to 1992 can then be calculated for each source. For more information on the other sources, see Raymond Gieseman, "The Consumer Expenditure Survey: quality control by comparative analysis," *Monthly Labor Review*, March 1987, pp. 8–14.

³⁴ Steven M. Lutz, David M. Smallwood, James Blaylock, and Mary Y. Hama, *Changes in Food Consumption and Expenditures in American Households During the 1980's*, Statistical Bulletin No. 849 (U.S. Department of Agriculture, December 1992), table 2, "Household size: Average annual food use (per 21-meal equivalent person)," p. 20.

³⁵ See page 21 of the survey.

³⁶ To classify families by income group, complete income reporters are sorted by their total reported income and numbered consecutively, with the lowest income reported receiving a value of 1. The values are then all divided by the value associated with the family with the highest income, so that the family with the lowest income has a rank close to 0 and the rank of the family with the highest income is exactly 1. Families whose rank is less than one-third are counted in the lowest group. Those whose value is between one-third and two-thirds are placed in the middle group. The remaining families are placed in the highest group.

³⁷ In 1980, about 27 percent of low-income families had a reference person with at least some college education, compared with 54 percent of high-income families. In 1992, approximately 30 percent of low-income families had a reference person with at least some college education, compared with 66 percent of high-income families. Differences in level of education are controlled for in the logistic regressions.

³⁸ See p. 24 of the survey.

³⁹ See p. 127 of the survey.

⁴⁰ See p. 21 of the survey.

⁴¹ See p. 22 of the survey.

⁴² See p. 125 of the survey.

⁴³ See p. 124 of the survey.

⁴⁴ See pp. 38–39 of the survey.

⁴⁵ See pp. 48–49 of the survey.

⁴⁶ See pp. 44–45 of the survey.

⁴⁷ See pp. 22–23 of the survey.

⁴⁸ Peter Kennedy, *A Guide to Econometrics*, 3rd ed. (Cambridge, MA, MIT Press, 1992), Chapter 15; see especially pp. 228–30, 241–42.

⁴⁹ In this article, children are defined as persons less than 18 years old. Hence, in considering the addition of an adult to the husband-wife family with one child, the interpretation is that the spouses have two offspring living at home, one who is at least age 18 and the other under age 18. Otherwise, it is necessary to include the parameter estimate for "other family" in the probability equation, which complicates the comparison. Furthermore, the percent change from adding one child older than age 18 can be compared with the percent change from adding one child under age 18 to see whether the age of the older child affects the probability of purchasing a particular item of food, thus adding more flexibility to the analysis without further complicating the model.

⁵⁰ According to Jean A. T. Pennington and Helen Nichols Church, *Food Values of Portions Commonly Used*, 14th ed. (New York, Harper & Row Publishers, Inc., 1985), a large boiled egg contains 274 milligrams of cholesterol (p. 52). This compares with 3½-ounce servings of canned oysters (230 milligrams; p. 68), lobster (200 milligrams; p. 67), and shrimp (150 milligrams; p. 70).

⁵¹ *Nutritional Attitudes*, pp. 21–23.

⁵² Although the decrease in the family's probability of purchasing cereal and bakery products over the period (0.3 percent) is statistically significant for this food group, it is not economically significant.

⁵³ *Nutritional Attitudes*, pp. 21–22.

⁵⁴ *Ibid.*, pp. 78–80.

⁵⁵ Although the parameter estimates for the older-than-65 and 1992 interaction terms are not statistically significant for any food group, the dummy variable for 1992 is statistically significant for all but two (poultry, and fats and oils) of the foods just mentioned. Therefore, one can conclude that the control group experienced a decrease in the probability of purchasing these foods in 1992 and those older than 65 had no significant difference in the probability of purchasing the foods in the 2 years the survey was conducted.

⁵⁶ *Nutritional Attitudes*, pp. 124–26.

⁵⁷ *Ibid.*, pp. 21–23.

⁵⁸ *Ibid.*, p. 25.

⁵⁹ *Ibid.*, pp. 38–43.

⁶⁰ *Ibid.*, pp. 32–33.

⁶¹ *Ibid.*, pp. 44–45.

⁶² *Ibid.*, pp. 21, 23.

⁶³ *Ibid.*, p. 124.

⁶⁴ *Ibid.*, p. 126.

⁶⁵ For those with some college, the decline also appears to be sharp (about 8 percentage points), although the parameter estimate just misses statistical significance at the 90-percent level.

⁶⁶ *Nutritional Attitudes*, pp. 21–22.

⁶⁷ *Ibid.*, p. 124.

⁶⁸ Although the CPI is sometimes used as a proxy for price levels (see, for example, Lee, "Analysis of a Food Demand System"), there is insufficient variation in price levels in the 2 years investigated in this study to warrant the attempt.

⁶⁹ James J. Heckman, "Sample Selection Bias as a Specification Error," *Econometrica*, January 1979, pp. 153–61.

⁷⁰ John F. McDonald and Robert A. Moffitt, "The Uses of Tobit Analysis," *Review of Economics and Statistics*, vol. 62, no. 2, 1980, pp. 318–21.

⁷¹ G. E. P. Box and D. R. Cox, "An Analysis of Transformations," *Journal of the Royal Statistical Society, Series B*, 1964, pp. 211–43.

⁷² *Ibid.*, p. 214.

⁷³ Stuart Scott and Daniel J. Rope, "Distributions and Transformations

for Family Expenditures,” *1993 Proceedings of the Section on Social Statistics* (Alexandria, VA, American Statistical Association), pp. 741–46.

⁷⁴ Had incomplete reporters been included in the probit sample, the parameters from the logit and probit regressions would presumably predict identical probabilities (or extremely similar ones) for each demographic group.

⁷⁵ It may be of interest to note that the coefficient for the inverse of Mill’s ratio is statistically significant only three times. The first is for cereal and bakery products in 1992; the coefficient (8.293) is significant at the 90-percent confidence level. The second is for fruits and vegetables; the 1980 coefficient (6.552) is statistically significant at the 90-percent confidence level, and the 1992 coefficient (–3.098) is not statistically significant, indicating that the 1980 estimate holds for both periods. The third time is for dairy products. As with fruits and vegetables, only the 1980 coefficient (10.292) is statistically significant, but this time at the 99-percent confidence level; the 1992 coefficient (–3.858) is not statistically significant.

⁷⁶ The regression model presented in the equation that follows is greatly simplified. Let *a* stand for all parameter estimates and independent variables not associated with income. Let *I* stand for the income of the group under study; *b* is the parameter estimate related to income for the group. Note that in the Heckman procedure, it is necessary to include the inverse of Mill’s ratio and its coefficient when taking the derivative $\partial Y/\partial I$. However, recall that the first stage of the model which uses the Heckman procedure includes no continuous income variables—only categorical variables defin-

ing the income class (low, high, or incomplete reporter). Therefore, the inverse of Mill’s ratio can be treated the same way as all the other variables included in *a*; that is, the partial derivative of the inverse of Mill’s ratio equals zero. (For more on calculating this derivative, see Atanu Saha, Oral Capps, and Patrick J. Byrne, “Calculating marginal effects in dichotomous-continuous models,” *Applied Economics Letters*, vol. 4, 1997, pp. 181–85.)

⁷⁷ In other words, if the parameter estimate for 1980 is statistically significant, it is interpreted in the usual way. If the parameter estimate for 1992 is statistically significant for a particular characteristic, then the effect of this characteristic in 1992 is different from the effect it had in 1980, and this difference is statistically significant. As explained later in the text, the two parameters can be added, and the resulting sum can be tested with an *F*-test. The purpose of the *F*-test is to determine whether there is a statistically significant relationship between the characteristic in question and a particular food expenditure in 1992. (Consider a case where a 1980 parameter is, say, 5.0, and the 1992 counterpart is –5.0. Each value may be statistically significant according to a *t*-test: the effect in 1980 is 5 points, whatever that means in this case, and in 1992 it is 5 points less than in 1980. Combining the two yields a parameter estimate of zero, suggesting that there is no statistically significant relationship between the characteristic and expenditures in 1992. The absence of such a relationship is confirmed with the *F*-test.)

⁷⁸ The change in elasticity for poultry for single men just barely fails the test for statistical significance at the 90-percent confidence level: the calculated *F*-test value is 2.69; the critical value is 2.71.

APPENDIX 1: Food groups and Consumer Price Index categories

The following is a detailed list of food items contained in each food group.

Cereal and bakery products:

Cereal and cereal products

Flour; prepared flour mixes; ready-to-eat and cooked cereals; rice; pasta, cornmeal, and other cereal products.

Bakery products

White bread; bread other than white; cookies; crackers; frozen and refrigerated bakery products; biscuits and rolls; cakes and cupcakes; bread and cracker products; sweet rolls, coffee cakes, and doughnuts; pies, tarts, and turnovers.

Meat, poultry, fish, and eggs:

Beef

Ground beef; chuck roast; round roast; other roast; round steak; sirloin steak; other steak; other beef.

Pork

Bacon; pork chops; ham, not canned; canned ham; sausage; other pork.

Other meats

Frankfurters; bologna, liverwurst, and salami; other lunch meats; lamb and organ meats; mutton, goat, and game.

Poultry

Fresh whole chicken; fresh and frozen chicken parts; other poultry, including whole frozen chicken.

Fish and seafood

Canned fish and seafood; fresh and frozen shellfish; fresh and frozen finfish.

Eggs

Dairy products:

Fresh milk and cream

Whole milk; other milk and cream.

Other dairy products

Butter; cheese; ice cream and related products; miscellaneous dairy products.

Fruits and vegetables:

Fresh fruits

Apples; bananas; oranges; other fresh fruits.

Fresh vegetables

Potatoes; lettuce; tomatoes; other fresh vegetables.

Processed fruits

Frozen orange juice; other frozen fruits and juices; canned and dried fruits; fresh, canned, or bottled fruit juices.

Processed vegetables

Frozen vegetables; canned beans; canned corn; other canned and dried vegetables and juices.

Other food at home:

Sugar and other sweets

Candy and chewing gum; sugar; artificial sweeteners; jams, preserves, and other sweets.

Fats and oils

Margarine; other fats, oils, and salad dressing; nondairy cream and imitation milk; peanut butter.

Miscellaneous foods

Frozen meals; other frozen prepared foods; canned and packaged soups; potato chips and other snacks; nuts; salt, spices, and other seasonings; olives, pickles, and relishes; sauces and gravies; baking needs and miscellaneous products; salads and desserts; baby food; miscellaneous prepared foods.

Nonalcoholic beverages
 Cola; other carbonated drinks; roasted coffee; instant and freeze-dried coffee; noncarbonated fruit-flavored drinks; tea; other nonalcoholic beverages.

The following data show the levels of the CPI for detailed expenditure items. These are used to obtain real expenditures for the income elasticity estimates presented in the text.

<i>CPI category</i>	<i>CPI deflator</i>	
	1980	1992
Cereal and bakery products:		
Flour and prepared flour mixes	0.917	1.326
Cereal .....	.763	1.754
Rice, pasta, and cornmeal ...	.909	1.283
White bread .....	.859	1.462
Other breads .....	.859	1.483
Fresh biscuits, rolls, and muffins .....	.841	1.445
Fresh cakes and cupcakes ...	.822	1.484
Cookies .....	.808	1.563
Crackers; bread and cracker products .....	.829	1.749
Fresh sweet rolls, coffee cakes, and doughnuts .....	.835	1.449
Frozen and refrigerated bakery products, pies, tarts, and turnovers .....	.820	1.491
Meats, poultry, fish, and eggs:		
Ground beef other than canned	1.046	1.189
Chuck roast .....	.998	1.371
Round roast	1.013	1.259
Round steak .....	.989	1.299
Sirloin steak .....	.962	1.324
Other beef and veal ¹ .....	.932	1.461
Bacon .....	.735	1.046
Pork chops .....	.829	1.389
Ham ² .....	.855	1.356
Other pork .....	.838	1.295
Pork sausage .....	.822	1.236
Frankfurters .....	.925	1.313
Bologna, liverwurst, and salami .....	.905	1.353
Other lunch meats .....	.903	1.269
Lamb and organ meats ³	1.025	1.314
Fresh whole chicken ⁴ .....	.944	1.319
Fresh and frozen chicken parts .....	.917	1.344
Other poultry .....	.950	1.269
Canned fish and seafood ...	.937	1.187
Fresh and frozen fish and seafood ⁵ .....	.841	1.687
Eggs .....	.886	1.083

<i>CPI category</i>	<i>CPI deflator</i>	
	1980	1992
Dairy products:		
Fresh whole milk	0.935	1.264
Other fresh milk and cream	.923	1.278
Cheese .....	.887	1.355
Ice cream and related products .....	.864	1.309
Butter .....	.894	.924
Other dairy products .....	.875	1.384
Fruits and vegetables:		
Apples .....	.921	1.795
Bananas .....	.915	1.399
Oranges, including tangerines	.726	1.762
Other fresh fruits .....	.862	2.007
Potatoes .....	.810	1.415
Lettuce .....	.778	1.557
Tomatoes .....	.819	1.718
Other fresh vegetables .....	.778	1.616
Frozen fruit and fruit juices ⁶	.793	1.327
Other fruit juices ⁷ .....	.822	1.411
Canned and dried fruits .....	.844	1.310
Frozen vegetables .....	.776	1.309
Cut corn, canned beans excluding lima beans ⁸ .....	.825	1.317
Other processed vegetables ⁹	.865	1.269
Other food at home:		
Sugar and artificial sweeteners	1.073	1.204
Candy and chewing gum ....	.846	1.375
Other sweets ¹⁰ .....	.822	1.404
Margarine .....	.928	1.320
Other fats, oils, and salad dressing .....	.913	1.233
Nondairy substitutes and peanut butter ¹¹ .....	.804	1.375
Carbonated drinks ¹² .....	.866	1.149
Roasted coffee	1.169	1.087
Instant and freeze-dried coffee	1.065	1.146
Other noncarbonated drinks ¹³ .....	.859	1.313
Canned and packaged soup	.866	1.537
Frozen prepared food ¹⁴ .....	.857	1.375
Snacks ¹⁵ .....	.808	1.331
Seasonings, condiments, sauces, and spices ¹⁶ .....	.823	1.430
Seasonings, olives, pickles, and relish .....	.804	1.439
Other condiments ¹⁷ .....	.835	1.381
Miscellaneous prepared food, including baby food .....	.840	1.503
Other canned and packaged prepared foods ¹⁸ .....	.848	1.278
Income before taxes ¹⁹ .....	.824	1.403

Footnotes to appendix 1

¹ Used to deflate other roast; other steak; other beef.

² Used to deflate ham, not canned; canned ham.

³ Also used to deflate mutton, goat, and game.

⁴ Used to deflate fresh and frozen whole chicken.

⁵ Used to deflate fresh and frozen shellfish; fresh and frozen finfish.

⁶ Used to deflate frozen orange juice; other frozen fruits and juices.

⁷ Used to deflate canned or bottled fruit juices.

⁸ Used to deflate canned beans; canned corn.

⁹ Used to deflate other canned and dried vegetables and juices.

¹⁰ Used to deflate jams, preserves, and other sweets.

¹¹ Used to deflate nondairy cream and imitation milk; peanut butter.

¹² Used to deflate cola; other carbonated beverages.

¹³ Used to deflate noncarbonated fruit-flavored drinks; tea; other nonalcoholic beverages.

¹⁴ Used to deflate frozen meals; other frozen prepared foods.

¹⁵ Used to deflate potato chips and other snacks; nuts.

¹⁶ Used to deflate salt, spices, and other seasonings; sauces and gravies.

¹⁷ Used to deflate baking needs and miscellaneous products.

¹⁸ Used to deflate salads and desserts.

¹⁹ Deflator is CPI for all items.

APPENDIX 2: The *t*-test

In comparing the means of two samples, a *t*-test is frequently used to see whether observed differences are statistically significant. For large samples, the formula for the standard *t*-test is

$$t = (M_1 - M_2)/SE_p,$$

where

M_1 is the mean of the first sample,

M_2 is the mean of the second sample, and

SE_p is the pooled standard error of the samples.

The pooled standard error is calculated by squaring the standard errors of the first and second samples, adding the squares together, and taking the square root of the summed squares. If the value of *t* is greater than 1.96, the difference is said to be statistically significant at the 95-percent confidence level.

However, the above equation is not appropriate for testing differences in shares, because, as defined in the text, shares are calculated by dividing an average by an average. For example, if the average family in, say, group 1 spends \$2 on beef and \$50 on total food at home, its share S_{b1} is 0.04. If the average family in group 2 spends \$3 on beef and \$25 on total food at home, its share S_{b2} is 0.12. Both the

mean expenditure for beef and the mean expenditure for total food at home have their own associated standard errors, which most likely differ for groups 1 and 2. These facts must be taken into account before a *t*-test can be computed.

Fortunately, a formula is available for the comparison of shares. (See Geoffrey Paulin, "Consumer expenditures on travel, 1980-87," *Monthly Labor Review*, June 1990, p. 60.) This formula uses the relative standard error of the mean (RSE) for each element of the share (beef and total food), where the RSE is defined as the standard error of the expenditure, divided by the mean expenditure. (That is, SE_{b1}/M_{b1} equals RSE_{b1} , in which $b1$ indicates group 1's expenditures for beef.) To calculate the pooled standard error for use in the shares test, the following formula is employed:

$$(SE_{pb})^2 = S_{b1}^2[RSE_{b1}^2 + RSE_{f1}^2 - 2S_{b1}RSE_{b1}^2] + S_{b2}^2[RSE_{b2}^2 + RSE_{f2}^2 - 2S_{b2}RSE_{b2}^2].$$

Here, the subscripts 1, 2, and *f* indicate 1980, 1992, and total food at home, respectively. To test whether the change in a group of consumers' share of beef from 1980 to 1992 is statistically significant, the following formula is used:

$$t_b = (S_{b1} - S_{b2})/SE_{pb}.$$