Taste Changes in the Demand for Food by Demographic Groups in the United States: A Nonparametric Empirical Analysis

Rafael Cortez and Ben Senauer

This study uses nonparametric techniques to analyze the stability of demand for nineteen major food categories among various demographic groups in the United States. Households are divided into population groups by income, the head’s age, and the spouse’s education level. The data used are from the 1980–90 “Diary” portion of the Bureau of Labor Statistics’s annual Consumer Expenditure Survey. The programming model developed by Sakong and Hayes, with the modifications suggested by Chalfant and Zhang, is used to test for and measure taste changes. Substantial differences in preference trends between population groups are found for many of the food commodities.

Key words: demographics, food consumption, nonparametric analysis, preferences, taste changes.

Food consumption patterns in the United States have been changing dramatically. Differentiating between the impact of price and income changes on food demand and the effects of preference shifts is important. A substantial body of literature now exists which focuses on the stability of food preferences, particularly for meat and poultry. Various research studies have utilized either parametric or nonparametric techniques to test for taste changes. Virtually all the previous empirical studies have relied on aggregate time-series data, usually national per capita consumption (disappearance) series. Therefore, the empirical results relate to the average behavior of the entire population. However, a great deal remains unknown if the analyses examine only the average behavior of the entire population reflected in aggregate data. There are major differences in the food consumption patterns of different demographic groups in the United States. Moreover, the diets of various segments of the population are changing in very different ways (Senauer, Asp, and Kinsey).

This analysis applies the recent nonparametric technique developed by Sakong and Hayes to disaggregated data to detect and measure taste change for nineteen food categories by specific demographic groups. Sakong and Hayes refer to their model as a “test for preference stability.” It is related to the earlier models of Cox and Chavas (1990) and Chalfant and Alston. Sakong and Hayes’s model simultaneously solves for the taste change and expenditure elasticities that minimize the violation of stable preferences, subject to convexity, adding-up, and noninferiority constraints. A central feature of their test is its restriction of the compensated consumption bundles. The Sakong and

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A list of some of the literature in this area, which is by no means comprehensive, includes Alston and Chalfant (1991a, 1991b, and 1992); Chalfant and Alston; Chalfant and Zhang; Chavas; Choi and Sosin; Cox and Chavas (1988 and 1990); Eales; Eales and Unnevehr; Landsburg; Moschini and Meilke (1984 and 1989); and Sakong and Hayes.

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The data used in this study are from the "Diary" portion of the Bureau of Labor Statistics's Consumer Expenditure Survey (CES) and the Consumer Price Indexes (CPI). The analysis is based on the annual CES surveys for 1980–90 covering eleven years. Consumer units (households) are classified into demographic groups by income, age of the household head, and education level of the spouse. These variables were used to create segments of the population whose food consumption patterns are similar. A household's expenditures for the nineteen food categories were converted to an adult equivalent basis and matched with CPI price data by month and year to derive an implicit quantity index for each food. The household data for a specific demographic segment were then averaged together by quarter. The resulting data set used in the nonparametric analysis contained forty-four observations (eleven years with four quarters) for each demographic group.

Theoretical Background

The Sakong and Hayes model, "a test for preference stability," minimizes the degree of taste change subject to nonnegativity of expenditure elasticities, adding-up, convexity, and bounds on the elasticities. The programming model (Sakong and Hayes, p. 273) to be solved is

$$\min_{TC, \varepsilon} \mathbf{b}'TC$$

subject to

$$\sum_{i=1}^{n} p_i x_{it} - \sum_{i=1}^{n} p_i x_{is} \leq \sum_{i=1}^{n} \sum_{j=1}^{t} a_j \frac{p_i x_{ij}}{M_j} \varepsilon_{im} - \sum_{i=1}^{n} \sum_{j=2}^{t} a_j \frac{p_i x_{ij}}{M_j} \varepsilon_{im}$$

$$+ \sum_{i=1}^{n} \sum_{j=2}^{t} p_i c_{ij} - \sum_{i=1}^{n} \sum_{j=2}^{t} p_i c_{ij},$$

For all $t$ and $s$

$$\sum_{i=1}^{n} w_i \varepsilon_{im} = 1;$$

for all $t$

$$(3) \quad \varepsilon_{im} \geq 0;$$

for all $i$ and $t$,

$$(4) \quad \varepsilon \leq \varepsilon^U,$$

where $\mathbf{b}$ is an arbitrary vector whose elements are constant and make the problem bounded; $\varepsilon$ is a vector of expenditure elasticities; $\mathbf{TC}' = (tc_{12}, ..., tc_{n2}, ..., tc_{1n}, ..., tc_{nn})$ is a vector of taste changes, and $ic_{ij}$ denotes the taste change of good $i$ at time $j$; $p_i$ and $x_i$ are the observed price and quantity demanded of commodity $i$ at period $t$; $w_i$ and $\varepsilon_{im}$ denote the expenditure share and the food expenditure elasticity of commodity $i$ at time $t$, respectively; $M$ is total food expenditures; $a_i$ is a composite value; $\varepsilon^L$ and $\varepsilon^U$ are vectors of lower and upper bounds, respectively, of the estimated expenditure elasticities. The model solves simultaneously for the taste change and expenditure elasticities that minimize taste change subject to the convexity condition (1), adding-up (2), nonnegativity conditions (3), and the elasticity bounds (4).

Chalfant and Zhang argue that the results of this nonparametric procedure may not be invariant to the choice of price deflator and scaling of quantities. The suggested compensation measure is to include the past observed quantity (lagged $x$) rather than the current observed quantity ($x$) in the term $a_i$ of the model developed by Sakong and Hayes (Chalfant and Zhang, p. 19). The term $a_i$ is then a composite term which is equal to the change in expenditure minus the product of the lagged $x$ and the change in prices. After this modification, the nonparametric procedure would provide consistent results whether real or nominal prices are used.

In addition, the results with the Sakong and Hayes model are not invariant to the scaling of quantities. Chalfant and Zhang (pp. 29–31) suggest using a weighted version of the objective function. Specifically, they recommend employing a vector whose elements are the mean prices of the commodities rather than a vector of ones as originally used in the Sakong and Hayes model. Both modifications, the lagged $x$ in $a_i$ and a vector of mean prices in the objective function, are introduced in the model solved in this study.

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2 In Sakong and Hayes, $a = \Delta y - \sum \Delta x_i \Delta p_c$, where $y$ is income or, in our case, total food expenditure ($M$), and "$a$" represents the change in the budget constraint from $t-1$ to $t$. 
The model estimates the size of the adjustment in quantity data (either positive or negative) necessary to eliminate the Generalized Axiom of Revealed Preference (GARP) violations (i.e., rationalize the data), while satisfying the restrictions imposed on the expenditure elasticities. The adjustment in quantity data is shown by the vector \( TC' \). A positive value of \( t_{ci} \) indicates a shift of preferences in favor of the good; a negative value of \( t_{ci} \) shows a change of tastes against the good \( i \) at time \( t \).

In our analysis, food is assumed to be a weakly separable group, which is why \( M \) is total food expenditures rather than income or total consumption expenditures. This study treats the average demand of a specific demographic group as if it were generated by a representative consumer maximizing a utility function. Previous studies have made this assumption with aggregate data. Sakong and Hayes imposed a constraint on the variation of the expenditure elasticities over time in their model. This analysis does not, and, therefore, uses their model. As Sakong and Hayes (p. 274) note, the "actual" taste change could be computed if the "true" elasticities were known.

As Sakong and Hayes (p. 270) point out, the term "violation of stable preferences" is perhaps more accurate than "taste change," because one cannot be certain that the violations found are not the result of "poor data or violations of other assumptions." However, if the adjustments in commodity demand necessary to rationalize the data are relatively large, attributing the violations solely to measurement error or other factors, rather than a shift in preferences, would seem less plausible. Furthermore, with the Sakong and Hayes model, each time period is treated independently, so the emergence of a trend in tastes in favor of or away from a food indicates that the preference violations are not random, but consistent over time.

To determine the bounds for the expenditure elasticities (\( \varepsilon_i^c \) and \( \varepsilon_i^d \)), a linear approximate Almost Ideal Demand System (LA/AIDS) for the nineteen food commodities was estimated using the household-level CES data and the CPI data for prices. The linear approximate form, which substitutes Stone's price index for a more general weighted price index, does not require nonlinear estimation. Zellner's iterative seemingly unrelated regression model was utilized and the general restrictions of homogeneity and symmetry were imposed. The sample for the LA/AIDS estimation included all households in the CES with nonzero expenditures for each of the nineteen food categories. The estimation of the demand system is incidental to the nonparametric analysis. Expenditure elasticities from previous food demand studies could simply have been used to establish bounds on \( \varepsilon \). Further details on the demand estimation are provided in Cortez.

The lower and upper bounds for the elasticities are shown in table 1. These elasticities are with respect to total food expenditures and, therefore, larger than income elasticities. The lower and upper bounds were set equal to 0.5 and 1.5 times the mean value of the expenditure elasticity of the commodity \( i \) rounded off to the nearest five-hundredths (0.05). These bounds on the expenditure elasticities are expected to reduce the errors from potential model misspecification. The bounds appear reasonable since they contain the confidence intervals at the 95% level of all the expenditure elasticities computed by earlier studies that used similar CES data but different models and estimation procedures (Kokoski; Falconi; Smallwood and Blaylock; Young). Since the expenditure elasticities can be expected to vary across demographic groups, the wide bounds were used to avoid inappropriately constraining the taste change solutions.

### Table 1. Lower and Upper Bounds for Food Expenditure Elasticities

<table>
<thead>
<tr>
<th>Food Commodity</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>0.30</td>
<td>0.90</td>
</tr>
<tr>
<td>Bakery products</td>
<td>0.30</td>
<td>1.00</td>
</tr>
<tr>
<td>Beef</td>
<td>0.65</td>
<td>1.80</td>
</tr>
<tr>
<td>Pork</td>
<td>0.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Other meats</td>
<td>0.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Poultry</td>
<td>0.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Fish and seafood</td>
<td>0.60</td>
<td>1.60</td>
</tr>
<tr>
<td>Eggs</td>
<td>0.30</td>
<td>0.75</td>
</tr>
<tr>
<td>Fresh milk</td>
<td>0.30</td>
<td>0.75</td>
</tr>
<tr>
<td>Dairy products</td>
<td>0.40</td>
<td>1.20</td>
</tr>
<tr>
<td>Fresh fruits</td>
<td>0.40</td>
<td>1.20</td>
</tr>
<tr>
<td>Fresh vegetables</td>
<td>0.50</td>
<td>1.10</td>
</tr>
<tr>
<td>Processed fruits</td>
<td>0.50</td>
<td>1.10</td>
</tr>
<tr>
<td>Processed vegetables</td>
<td>0.50</td>
<td>1.20</td>
</tr>
<tr>
<td>Sugar and sweets</td>
<td>0.40</td>
<td>1.10</td>
</tr>
<tr>
<td>Non alcoholic beverages</td>
<td>0.40</td>
<td>1.00</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>0.50</td>
<td>1.00</td>
</tr>
<tr>
<td>Miscellaneous foods</td>
<td>0.50</td>
<td>1.20</td>
</tr>
<tr>
<td>FAFH</td>
<td>1.20</td>
<td>2.40</td>
</tr>
</tbody>
</table>

3 Households (consumer units) with zero expenditures were included in the nonparametric analysis.
Data

The annual Consumer Expenditure Surveys provide a continuous flow of data on the purchases of American consumer units, which in most cases are households. The “Diary” survey covers small frequently purchased items, including detailed food expenditures. Expenditures are collected for two one-week periods and the data collection is spread over twelve months. The weighing procedure recommended by the BLS was used which translates the sample consumer units (CUs) into the universe of CUs in the U.S. population. Weights are assigned to each CU by the BLS. The weight given to a CU is basically the inverse of its probability of selection into the sample (U.S. Dept. of Labor 1991).

The CES expenditure data were adjusted for differences in household size and composition (i.e., the number, and age and gender of household members) using adult equivalent scales. The adult equivalent scales derived by Tedford, Capps, and Havlicek were used to convert household expenditures to a per capita adult equivalent basis.

The CES does not provide quantities or prices. The source of price data was the BLS’s CPI for the selected food categories (U.S. Dept. of Labor 1992). The expenditure and price series are compatible because the CPI series are constructed on the basis of expenditure weights from the CES. The CPI and a detailed list of food prices during the base period were used to derive monthly composite prices for each of the nineteen food categories. The seasonally unadjusted U.S. average Consumer Price Indexes for all urban consumers with a 1982-84 base were used. For this reason, only urban households were extracted from the CES to match with the CPI. This analysis, therefore, relates to the 85% of the U.S. population which is urban. The CES records each household for a particular month of the year. It was assumed that all households in a particular month face the same prices. An estimated quantity for each food category was obtained by dividing current expenditures by the corresponding composite price developed.

Using the share proportion \((w_j)\) and prices \((p_i)\) at base period zero (1982–84) for good \(j\) in each category \(i\), \((P_i^0)\) the composite price for category \(i\) at the base period was computed as follows:

\[
P^0_i = \sum_{j=1}^{n} w_j P^0_j.
\]

Since \(CPI^i_t = (P^i_t / P^0_i) \times 100\), solving for the composite price for category \(i\) at time \(t\), we obtained

\[
P^i_t = P^0_i \left(\frac{CPI^i_t}{100}\right).
\]

The estimated quantity \((Q^i_t)\) for category \(i\) at time \(t\) was estimated as

\[
Q^i_t = \frac{E^i_t}{P^i_t}
\]

where \(E^i_t\) is the expenditure on category \(i\) at period \(t\).

The constructed composite price series reflect a rescaled index of the Consumer Price Index data. In the case of most food aggregates, such as cereals, meats, dairy products, and fresh fruits and vegetables, an extensive list of prices per pound for specific food items in the base period was used to construct their respective composite prices. Therefore, the quantity index can be viewed as a reasonable approximation of the quantity measured in pounds.

However, the BLS does not provide a list of prices for items within miscellaneous foods and food away from home. In these cases, the price indices were simply rescaled with a base of 1.00, rather than 100. Similarly, the available list of prices for items within processed fruits and vegetables is quite limited. For all of these food categories it is clear that the composite price indices are not a close estimate of average prices, and therefore the constructed quantities should only be interpreted as implicit quantity indices.

The variables used to create the demographic groups from the CES household data were income, age of the household reference person, and education level of the spouse. The reference person is the person considered by other members of the CU to be the household head (usually the husband, if present). These variables were chosen because they have been shown in previous studies to have an important effect on food consumption (Smallwood;
Smallwood, Blaylock, and Blisard; Senauer, Asp, and Kinsey). Each of these variables was divided into two categories. Households were classified into two income groups by a multiple of the poverty level. The first group contained households with incomes less than or equal to twice the poverty level related to that size household. The second group had incomes above that level.

The two age-related categories were households whose reference person (head) was younger than forty-five years old, and those whose reference person was forty-five years old or older. Education of the spouse (of the reference person if no spouse was present) was used to classify households into those with spouses that had a high school education or less, and those with more than a high school education. When combined, these three variables create eight demographic groups. For example, one group is all households with income more than twice the poverty level, heads age forty-five and over, and spouses with more than a high school education.

Once they were classified into the selected demographic groups, the household observations were aggregated by quarter. The resulting data set used in the nonparametric analysis had forty-four observations (four quarters for eleven years) for the nineteen food categories for each demographic group. The data cover a period from the first quarter of 1980 to the fourth quarter of 1990. The quarterly data represent the averages for a population group within each period and can be viewed as reflecting the behavior of a "representative consumer" within a particular demographic segment of the population. The CES is not a panel data set composed of the same sample of households over time. This analysis traces the

taste changes over time of households defined by a particular set of demographic characteristics. Households in the population shift between groups as their income, the head's age, or the spouse's education change. The nonparametric analysis was conducted independently for each partitioned demographic group.

The application of the Sakong and Hayes model with the Chalfant and Zhang modifications created an optimization problem involving a very large number of constraints; 2,527 restrictions were imposed for a solution. The most recent version of the GAMS computer software, GAMS 386 version 2.25, was used to solve this large linear programming problem.

**Empirical Results**

Table 2 shows the cumulative taste changes for the period 1980–90 covered by this analysis. For most of the commodities in table 2, the implicit quantity index can reasonably be interpreted as pounds per adult equivalent per week. Food away from home (FAFH) and the others discussed earlier are exceptions. The population groups (1–8) are based on a three-way cross-classification using household income, the head’s age, and the spouse’s education. Each group is fully described in the notes for table 2.

There were no violations of stable preferences by several demographic groups for cereals and also bakery products. Among those groups for which taste changes occurred, all showed a positive shift in preferences for both categories. The largest was for group 7, households with higher incomes, older heads, and less-educated spouses in both cases.

The taste changes are negative for every group for beef: preferences shifted away from beef. However, there are some very large differences in behavior among demographic segments. The shift for group 1, households with lower incomes, younger heads, and less educated spouses, was only -0.425, whereas it was -1.769 for group 8—households with higher incomes, older heads, and more educated spouses—over a four-fold difference. The three population segments (groups 5, 7, and 8) with preference shifts away from beef of over one pound per adult equivalent all contained higher-income households. The four segments (groups 1–4) with the smallest taste changes were all lower-income groups.

The preference changes for pork were much smaller than for beef. For groups 1–3, all
Table 2. Cumulative Taste Changes by Commodity for Selected Population Groups: 1980–90 (Quantity Index, i.e., Pounds per Adult Equivalent per Week)

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Cereals Products</th>
<th>Bakery Products</th>
<th>Beef</th>
<th>Pork</th>
<th>Other Meats</th>
<th>Poultry</th>
<th>Fish &amp; Seafood</th>
<th>Eggs</th>
<th>Fresh Milk</th>
<th>Dairy Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.021</td>
<td>0</td>
<td>-0.425</td>
<td>0.118</td>
<td>0</td>
<td>-0.084</td>
<td>0.026</td>
<td>0.188</td>
<td>0.171</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>-0.697</td>
<td>0.138</td>
<td>-0.081</td>
<td>0.123</td>
<td>0.122</td>
<td>0.039</td>
<td>0.133</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>-0.798</td>
<td>0.099</td>
<td>-0.417</td>
<td>-0.213</td>
<td>0.029</td>
<td>0.020</td>
<td>0.030</td>
<td>-0.246</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>-0.665</td>
<td>-0.417</td>
<td>-0.421</td>
<td>-0.875</td>
<td>-0.171</td>
<td>0.090</td>
<td>-0.074</td>
<td>-0.425</td>
</tr>
<tr>
<td>5</td>
<td>0.049</td>
<td>0</td>
<td>-1.418</td>
<td>-0.110</td>
<td>0.038</td>
<td>-0.143</td>
<td>0.068</td>
<td>0.014</td>
<td>-0.033</td>
<td>0.053</td>
</tr>
<tr>
<td>6</td>
<td>0.044</td>
<td>0.017</td>
<td>-0.853</td>
<td>-0.116</td>
<td>-0.154</td>
<td>-0.138</td>
<td>0.012</td>
<td>-0.164</td>
<td>0.030</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0.182</td>
<td>0.117</td>
<td>-1.360</td>
<td>-0.050</td>
<td>-0.267</td>
<td>0.084</td>
<td>-0.012</td>
<td>-0.114</td>
<td>-0.343</td>
<td>0.010</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
<td>-1.769</td>
<td>-0.036</td>
<td>-0.005</td>
<td>0.093</td>
<td>0.097</td>
<td>-0.669</td>
<td>-0.019</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Fresh Fruits</th>
<th>Fresh Vegetables</th>
<th>Processed Fruits</th>
<th>Processed Vegetables</th>
<th>Sugar &amp; Sweets</th>
<th>Beverages</th>
<th>Fats &amp; Oils</th>
<th>Misc. Foods</th>
<th>FAFH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.026</td>
<td>-0.084</td>
<td>0.133</td>
<td>0</td>
<td>-0.142</td>
<td>-0.049</td>
<td>-0.042</td>
<td>0</td>
<td>-0.044</td>
</tr>
<tr>
<td>2</td>
<td>-0.442</td>
<td>-0.257</td>
<td>-0.081</td>
<td>0.112</td>
<td>0.312</td>
<td>0.090</td>
<td>-0.154</td>
<td>0.024</td>
<td>-0.063</td>
</tr>
<tr>
<td>3</td>
<td>-0.354</td>
<td>0.063</td>
<td>-0.041</td>
<td>0.493</td>
<td>0.050</td>
<td>-0.203</td>
<td>-0.119</td>
<td>0.021</td>
<td>-0.017</td>
</tr>
<tr>
<td>4</td>
<td>-0.367</td>
<td>0.617</td>
<td>-0.053</td>
<td>-0.704</td>
<td>0.178</td>
<td>-0.629</td>
<td>0.067</td>
<td>-0.364</td>
<td>-0.050</td>
</tr>
<tr>
<td>5</td>
<td>0.418</td>
<td>0.412</td>
<td>0.023</td>
<td>-0.053</td>
<td>0</td>
<td>0</td>
<td>-0.285</td>
<td>0.054</td>
<td>-0.033</td>
</tr>
<tr>
<td>6</td>
<td>0.358</td>
<td>0.475</td>
<td>0.205</td>
<td>0.035</td>
<td>0.148</td>
<td>-0.223</td>
<td>-0.070</td>
<td>0.340</td>
<td>-0.049</td>
</tr>
<tr>
<td>7</td>
<td>0.402</td>
<td>0.012</td>
<td>0.097</td>
<td>0.233</td>
<td>-0.195</td>
<td>0.224</td>
<td>-0.129</td>
<td>0</td>
<td>-0.033</td>
</tr>
<tr>
<td>8</td>
<td>-0.777</td>
<td>0.688</td>
<td>-0.215</td>
<td>0.792</td>
<td>0.355</td>
<td>-0.278</td>
<td>-0.124</td>
<td>0</td>
<td>-0.063</td>
</tr>
</tbody>
</table>

1 The population groups are as follows:
Group 1 = Households with lower incomes, younger household heads, and less-educated spouses.
Group 2 = Households with lower incomes, younger household heads, and more-educated spouses.
Group 3 = Households with lower incomes, older household heads, and less-educated spouses.
Group 4 = Households with lower incomes, older household heads, and more-educated spouses.
Group 5 = Households with higher incomes, younger household heads, and less-educated spouses.
Group 6 = Households with higher incomes, younger household heads, and more-educated spouses.
Group 7 = Households with higher incomes, older household heads, and less-educated spouses.
Group 8 = Households with higher incomes, older household heads, and more-educated spouses.

lower-income households, the shift was in favor of pork. However, households with lower incomes, older heads, and more educated spouses (group 4) showed the largest shift away from pork. Only households with higher incomes, younger heads, and less-educated spouses (group 5) had a small positive taste change for other meats. All the other groups had negative changes in preferences. The largest were by lower-income households with older heads (groups 3 and 4). The model for the period 1980–90 detected a negative taste change for poultry for five of the eight demographic groups. The actual consumption of poultry increased between 1980 and 1990. This means that factors such as price and income effects had a positive impact on demand and more than offset the negative taste change. Households with lower incomes, older heads, and more educated spouses (group 4) had the largest negative shift of -0.875. The other taste changes were much smaller. The only negative shifts for fish and seafood were by groups 4 and 7. Although most were small, groups 1–4 with incomes less than twice the poverty level all had taste changes toward eggs, as did group 5. The largest shift away from eggs was by households with higher incomes, older heads, and better-educated spouses (group 8).

Four of the taste shifts for fresh milk were positive and four were negative. The largest taste changes in favor of milk were by lower-income households with younger heads (groups 1 and 2). The largest shift away from milk was by group 7, households with higher incomes, older heads, and less-educated spouses. For other dairy products, no violation of stable preferences was detected for four of the population groups. Households with lower incomes and older heads (groups 3 and 4) had negative shifts in preferences, whereas households with higher incomes and less-educated spouses (groups 5 and 7) had small positive shifts.

The preferences of all the groups with lower-
income households shifted against fresh fruits, as did those of households with higher incomes, older heads, and more educated spouses (group 8). On the other hand, the other three groups with higher-income households showed preference shifts toward fresh fruits. Only households with lower incomes and younger heads (groups 1 and 2) shifted away from fresh vegetables. The preferences of the other six groups shifted in favor of fresh vegetables. The largest positive taste changes were by households with older heads and more educated spouses (groups 4 and 8).

Four of the groups had positive taste changes for processed fruits and four had negative changes. For processed vegetables, the largest negative change was −0.704 by households with lower incomes, older heads, and more educated spouses (group 4). The largest positive change was 0.792 by households with higher incomes, older heads, and more-educated spouses (group 8).

Only two groups showed negative taste shifts for sugar and sweets. The others were all positive. The only sizable positive preference shift for nonalcoholic beverages was by group 7, households with higher incomes, older heads, and less-educated spouses. For fats and oils, all the shifts were negative (perhaps reflecting health-related concerns), except for one group. Three groups showed no change for miscellaneous foods. The preference shifts varied from −0.364 for lower-income households with older heads and more-educated spouses (group 4) to 0.340 for higher-income households with younger heads and more-educated spouses (group 6). This latter shift may relate particularly to prepared meals and reflect the time pressures these households face when frequently both spouses are employed.

All the taste changes for food away from home (FAFH), surprisingly, are negative—albeit very small. FAFH expenditures have increased, which means that these negative preference shifts were offset by other factors. The most likely explanation may be the high income elasticity of food away from home and the rise in household incomes during the 1980s.

In a number of cases, the preference shifts are larger than the actual changes in consumption between 1980 and 1990. In some, the directions are even different. For example, the taste change of −1.769 for beef by group 8 was more than the actual decrease in consumption between 1980 and 1990 of −0.454 for that group. Changes in prices and income offset much of the negative shift in preferences. Fish is another commodity for which the taste changes, which were positive for six of the eight demographic segments, were offset by other factors. Fish consumption actually declined by 0.0014 pounds per adult equivalent per week between 1980 and 1990 for all groups combined. In particular, fish prices rose substantially over this period, which more than offset the positive taste changes.

If there is a case to be made that the implicit quantity index numbers can reasonably be interpreted as measuring pounds per adult equivalent per week, one should be able to relate them to other food consumption data. Analyzing the beef quantity figure for 1980 for the average of the eight population groups yields 48.3 pounds per adult equivalent per year. Beef consumption in 1980 was 76.4 pounds per capita according to USDA's time-series food disappearance data, measured as a retail cut equivalent (Putnam and Allshouse, p. 32). The USDA figures are derived on an estimated supply and utilization basis.

The USDA number includes beef going into both the at-home and away-from-home markets, whereas our figure derived from the CES data reflects only beef purchased for consumption at home. Food-away-from-home expenditures in 1980 accounted for 32.3% of total spending for food, and food-at-home expenditures accounted for 67.7% (Putnam and Allshouse, p. 138). If this at-home proportion is applied to the USDA beef figure, the 1980 at-home market estimate is 51.7 pounds. This USDA-based figure and our CES estimate of 48.3 pounds are reassuringly close. There are many factors that might explain the small difference. Recall that our quantity is per adult equivalent and USDA's is per capita; USDA's estimate of total pounds is simply divided by the U.S. population.

Figures 1–3 dramatically show the substantial differences in cumulative taste changes for several food categories between two of the demographic groups. The first is group 1 (lower-income households with younger heads and less-educated spouses) and the second is group 8 (higher-income households with older heads and more-educated spouses), which represent the two most dissimilar segments. The taste shift away from beef was far stronger for the second group in figure 1 than for the first. Moreover, the preferences of the first population group shifted toward pork and away from poultry, whereas the reverse was the case for the second group.

In figure 2, lower-income households with
Figure 1. Cumulative taste changes by two demographic groups, 1980–90

Figure 2. Cumulative taste changes by two demographic groups, 1980–90
younger heads and less-educated spouses had positive changes in preferences for eggs and milk. Those in higher-income households with older heads and more-educated spouses showed a strong shift in tastes away from eggs and fresh fruits, but toward fresh vegetables. The most striking difference in figure 3 is for processed vegetables. In addition, the preferences of the two groups shifted in opposite directions for processed fruits and sweets.

Conclusions

This study has shown that the magnitude, and even direction in many cases, of taste changes for several major food categories vary substantially among demographic groups in the U.S. population. This information has considerable practical significance for the food industry. It is important for policy and marketing purposes to know whether an observed change in food consumption is being affected by economic factors, price and income changes, or by preference shifts. As seen in this study, they may be working in opposite directions and partially offsetting one another.

A knowledge of preference trends for various population groups is particularly valuable because of the increasing emphasis on market segmentation and targeted marketing. Many food products are developed for, and marketed to, particular market niches or segments, defined by demographic characteristics. Mass marketing is being supplanted by targeted marketing. Food producers, processors, and marketers need to know not just the preference trends of the aggregate population but how tastes and preferences are changing among demographic groups.

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