Analyzing the Impact of Generational Effects on Consumer Expenditures for Meats: A Cohort Approach

J. Michael Harris and Noel Blisard

Different generations may exhibit diverse expenditure patterns that are the result of higher incomes and/or different tastes. Traditional life cycle analysis ignores these generational effects and concentrates on only those changes due to the aging effect. It is important that we look at these generational effects since succeeding cohorts are born into and socialized in a different social, technological, and economic environment (Rentz, Reynolds, and Stout, 1983). Cohort differences influence consumer consumption profiles. Both public and private policymakers are interested in these changes.

Economists have long been aware that there are life-cycle patterns in earnings and consumption. If income is examined by age group, one finds a steady increase from the early twenties through the late fifties and then a steady decline as individuals retire and live on reduced incomes. Consumption patterns can likewise exhibit variations due to changing income and age effects. What is often ignored in life-cycle studies is the generational effect on earnings and consumption. For example, if economic growth is continuous, then successive generations will be better off than older generations were at the same age. Also, different generations, or age groups, may exhibit diverse expenditure patterns that are the result of higher incomes and/or different tastes and preferences, both possibly due to higher educational attainment.

Attitudes toward diet and health can also vary across generations. Besides higher real incomes, successive generations are usually better educated, and this may lead to different tastes and preferences compared to those of preceding generations. Thus, it is possible that an older cohort may consume more red meat relative to a younger cohort who is aware of and concerned with the health risks associated with a high fat diet. Cohorts are groups of people who can be grouped according to experiences in early childhood and attitudes toward savings, a good meal, and the need for hundreds of products and services (Engel, Blackwell, and Miniard, 1995).

In order to isolate the life cycle effects (hereafter called age effects) from the generational effects (hereafter called cohort effects), one must explicitly take into account the income and consumption patterns of cohorts over time. Unfortunately, data sets, which follow a panel of households and would allow researchers to directly study life cycle and generational effects over time, are very rare. If household panels are not available, the researcher may elect to use a time series of cross-sections and follow cohorts of individuals over time.

Such cohort data have some advantages over household panel data. First, many panels suffer from attrition as households drop out and thereby run the risk of becoming unrepresentative of the population over time. This problem is avoided in cohort data since the data are constructed from a fresh sample each year. Second, cohort data can be constructed for any characteristic of the distribution that is of interest. The researcher can look at mean values, changes in equality between cohorts, or work with measures of dispersion. Third, the cohort data may be constructed from more than one data set. For example, one could use food expenditure data from one survey combined with nutrient intake from another survey (Deaton, 1997).

The research reported in this paper uses data from the Consumer Expenditure Survey (CES) to follow eight cohorts throughout a 14-year period. The cohort methodology is used to isolate the net effects of age, cohort, and time on expenditures. Deaton and Paxton (1994) have applied this methodology to look at income inequality while Attanasio (1994) has applied the methodology to an analysis of saving behavior by U.S. households. Rentz, Reynolds, and Stout (1983) also used the methodology to analyze product consumption. The researchers analyzed changing consumption patterns for soft drinks. A later work done by Rentz and Reynolds (1991) developed a methodology to forecast coffee consumption using an age, cohort, and period framework.

Hopefully, cohort analysis will provide a clearer picture of the differences in expenditure patterns by older versus younger cohorts and aging effects that may be present. This type of information
cannot be extracted by looking at a single cross-section of data or at the average consumption of different age groups over time, since the age and cohort effects will be confounded. We hope to isolate what, if any, age effects exist in meat consumption profiles for eight U.S. cohorts. In the following sections we will discuss the application of the proposed methodology, introduce the data, and present the findings.

The Cohort Concept

Historically, the term “cohort” referred to a Roman military unit. It is commonly defined as “a group of warriors or soldiers” (Glenn, 1977). In modern parlance, the idea is carried over to any subdivision of a population. Several types of cohorts can be derived from the basic idea. The most common types are age cohorts, based on age groups, and birth cohorts, based on groups born in a particular time period. But cohorts can also be based on sex and other population characteristics. Many cohort studies are based on charting such groups forward from a particular point in time. In other words, cohort studies look at the life histories of sections of populations and the individuals who comprise these sections.

We employ the procedure used by Deaton (1997) in which he follows cohorts, defined by date of birth (birth cohorts), of individuals over time. For example, one can look at the average consumption of 30-year-olds in one survey, contrast it with 31-year-olds in the next year’s survey, and so on. The averages relate to the same group of people and, because of this property, have many of the properties of panel data. Tracking these different cohorts through successive surveys allows us to disentangle the cohort effects from the life cycle effects from age effects in consumption profiles.

Estimating Age, Cohort, and Time Effects

Analysis of cohort data requires a method whereby the data can be decomposed into age, cohort, and time effects. The first effect gives the typical age profile (life-cycle effects); the second gives the secular trends that lead to differences in the positions of age profiles of different cohorts (generational effects); and the third gives the aggregate effects that may temporarily move all cohorts off their profiles (Deaton, 1997).

In matrix form we can define the model that we wish to estimate as:

(1) \[ y = B + A\alpha + C\gamma + T\phi + \varepsilon, \]

where \( y \) is a vector of cohort-year observations, with each row corresponding to a single observation of a cohort, \( A \) is a matrix of age dummies; \( C \) is a matrix of cohort dummies; and \( T \) is a matrix of year dummies. The equation can be given a theoretical interpretation from life cycle theory. Consumption is the product of lifetime wealth, which is modeled by a cohort element that is constant over time and an age element that is dependent upon preferences. Temporary digressions from the cohort element are captured by a time element since aggregate consumption is subject to fluctuations in the economy. Needless to say, the method is based on assumptions underlying the model and is not free of structural assumptions. For example, in the above depiction we have assumed away interaction effects between cohort, age, and time.

Age and time dummy variables are created in the usual way. Cohorts are conveniently created by choosing their age in year \( t=0 \). Thus, for a group of cohorts who are between 26 and 30 years of age in the first period of observation, each individual in the year prior to the start of the data set will be between 25 and 29 years of age, inclusive. The following year, the group will be 26 to 30 years of age and so on. Dummy variables are then created for each cohort group for each year. As usual, we must drop one column from each of the three matrices since, for the full matrices, the sum of the columns is a column of ones, which will be contained in the constant term of the above equation.

However, there is still an additional linear relationship across the three matrices. In any given year in the data set, we can determine the age of a cohort group since we know the time (year) and the cohort’s age prior to the first observation. In order to estimate the model, we need to drop one more column from any of the three matrices. Following Deaton and Paxton’s (1994) lead, one way of handling the problem is to attribute any growth or decline in income or food expenditures to age and cohort effects and to assume that the time effects capture cyclical fluctuations, which average to zero over the long run. The simplest way to proceed is to drop one dummy from the cohort group, one dummy from the age group, and the first and second year dummy variables. The remaining yearly dummies are then defined as:

(2) \[ D_t = d_l - (t - 1) d_2 - (t - 2) d_3, \]
where \( d_t \) is the usual zero or one dummy variable. This transformation makes the year effects orthogonal to a time trend and imposes the restriction that all of the year dummies sum to zero. The \( D_1 \) and \( D_2 \) coefficients can be recovered from the fact that all the year effects sum to zero.

**Data**

The Consumer Expenditure Survey (CES) was used to construct the cohort data set and to estimate the model for the years 1982 through 1995. The CES is composed of two components, each with its own questionnaire and sample. The diary survey—which includes an interview panel of 3,500–5,000 households that are surveyed every three months for a one-year period—was utilized in this study. The diary survey obtains data on small, frequently purchased items that are normally difficult to recall, such as food, beverages, tobacco, housekeeping supplies, nonprescription drugs, personal care products and services, fuels, and utilities. Two weeks of data are normally collected, although some households report only one week. Households that reported only one week of expenditures were eliminated, and the remaining household observations were averaged over the two reporting weeks. Following this procedure, the data set had 35,508 observations for the 14-year time period.

Real per capita meat expenditures were regressed against eight cohort groups, 14 different age dummy variables, and 14 yearly dummy variables. Cohort groups were defined over five-year intervals—starting with cohort 1, which was 26–30 years of age in 1982, and ending with cohort 8, which was 61–65 in the same year. As noted above, one cohort group, one age dummy, and two yearly dummy variables were also dropped from the regression model. Since some households reported zero expenditure for some food categories over the two-week survey period, a Tobit model was used. The results presented in the graphical presentation have been adjusted for both censored and non-censored observations.

Mean income and expenditures for beef, pork, poultry, and fish are shown in Table 1. Real per capita income rose from about $11,126 for cohort 1 to a high of $13,400 for cohort 4 before declining to approximately $9,020 for cohort 8. Expenditures on beef vary from $1.26 per capita to $1.82 per capita and then decline to $1.69 per capita for cohort 8. Pork expenditures increase almost linearly with the age of the cohort from $0.75 for cohort 1 to $1.17 for cohort 6 before declining to $1.16 for cohort 8. Poultry and fish both display similar patterns. For poultry, expenditures rise from $0.63 for cohort 1 to $0.87 for cohort 7; they then drop slightly to $0.83 for cohort 8. Fish follows a similar pattern, starting at $0.45 for cohort 1, rising to $0.70 for cohort 6, and falling slightly to $0.66 for cohort 8.

**Results**

The results of the decomposition of expenditures of the individual meats are shown in Figures 1–4. Each figure consists of four sub-graphs. The first sub-graph depicts the variable in question, adjusted for inflation, for each cohort group from 1982 through 1995. The next three sub-graphs then present the cohort, age, and time effects over the same period and are derived from the Tobit estimates. Time effects are noted but not discussed in detail since they are constrained to zero for identification purposes. However, for a variable such as income, we would expect to find major downturns in the economy captured by these estimates. For other variables, the time effect should capture major increases or decreases in spending that may be the result of economic or non-economic influences.

| Table 1. Mean Real Per Capita Income and Expenditures on Beef, Pork, Poultry, and Fish (Dollars). \(^a\) |
|---|---|---|---|---|---|---|---|
| Cohort 1 | Cohort 2 | Cohort 3 | Cohort 4 | Cohort 5 | Cohort 6 | Cohort 7 | Cohort 8 |
| 26–30\(^a\) | 31–35\(^a\) | 36–40\(^a\) | 41–45\(^a\) | 46–50\(^a\) | 51–55\(^a\) | 56–60\(^a\) | 61–65\(^a\) |
| Income | $11,126 | $12,090 | $12,441 | $13,400 | $12,865 | $11,746 | $10,270 | $9,020 |
| Beef | 1.26 | 1.38 | 1.50 | 1.71 | 1.82 | 1.74 | 1.64 | 1.69 |
| Pork | .75 | .84 | .95 | 1.06 | 1.14 | 1.17 | 1.13 | 1.16 |
| Poultry | .63 | .66 | .74 | .78 | .79 | .86 | .87 | .83 |
| Fish | .45 | .52 | .54 | .59 | .65 | .70 | .67 | .66 |

\(^a\)Age of cohorts in 1982.
Figure 1. Real Weekly Per Capita Expenditures on Beef Decomposed by Cohort, Age, and Time
Figure 2A. Real Weekly Per Capita Expenditures on Pork

Figure 2B. Cohort Effects on Per Capita

Figure 2C. Age Effects on Per Capita

Decomposed by Cohort, Age, and Time

Journal of Food Distribution Research
Impact of Generational Effects on Consumer Expenditures for Meats

Figure 3A. Age Effects on Per Capita Expenditures

Figure 3B. Cohort Effects on Per Capita Expenditures

Figure 3C. Age Effects on Per Capita Expenditures

Figure 3D. Time Effects on Real Per Capita Expenditures

Decomposed by Cohort, Age, and Time

Figure 3. Real Weekly Per Capita Expenditures on Poultry

Harris, J.M. and N. Blizard

... Impact of Generational Effects on Consumer Expenditures for Meats 69
At times, we may speak of a cohort as if s/he were one age; for instance, we may refer to cohort 4 as being 43 years of age or cohort 4 when s/he is 50 years old. When we do this, we are using the median age of the cohort age interval in 1982, plus the appropriate number of years to arrive at the age of interest.

Prior to analysis, likelihood ratio tests were performed to determine whether cohort effects were statistically significant relative to one coefficient for all cohorts. Each likelihood ratio test had a chi-squared critical value of 14.07 at the 5-percent level of significance with 7 degrees of freedom. The cohort effects were found to be statistically significant, at or better than the 5-percent level for each of the four meats.

**Real Expenditures on Beef**

The analysis of real expenditures on beef is presented in Table 1. Expenditures increase by age of the cohort groups, and we find a positive and approximately linear relationship between successive cohorts and expenditures. All of these cohort effects were statistically significant. In general, older cohorts spend more on beef relative to the youngest cohort. For example, cohort 8 spends approximately $0.80 more per capita per week, on average, than cohort 1 does. One is tempted to speculate that the older generation continues to eat red meat while the younger generation may have reduced consumption of this good. In sub-graph 3, we see that, around age 47, the age effects are negative. Coefficients for the age effect variables are all significant from age 50 through age 65. The negative age effect suggests a general decrease in the consumption of beef by younger consumers as they move over the life cycle.

**Real Expenditures on Pork**

The result of the analysis on pork is depicted in Figure 2. Like beef, the second sub-graph indicates an approximately linear increasing relationship between expenditures and cohort. All the cohort effects, except for cohort 2, are statistically significant. Again, the results indicate that older cohorts spend more on pork than younger cohorts. Cohort 8 spends, on average, approximately $0.35 more per week per capita than cohort 1. Looking at age effects, only age 41 and age 44 were statistically significant. However, the overall trend of the age effects increases then falls sharply at age 65.

**Real Expenditures on Poultry**

Results for the poultry expenditure analysis are shown in Figure 3. The results are not surprising, given the increasing consumption of poultry in recent years. Cohort effects are shown in sub-graph 2. All of the cohort effects are statistically significant and indicate strong negative effects. Cohort 5 spends approximately $0.13 per week per capita more than cohort 1, while cohort 8 spends about $0.11 less. Strong age effects, depicted in sub-graph 3, increase almost linearly to age 50 and level out with increased age. All of the age effects are statistically significant. Here, age effects are clearly of greater magnitude than the cohort effects. One can clearly speculate that increasing expenditures for poultry are clearly being driven by increasing consumption by the younger generation.

**Real Expenditures on Fish**

The results for the analysis of fish expenditures are shown in Figure 4. The relationship between cohorts and expenditures on fish is depicted in sub-graph 2. There appears to be a strong increasing relationship between older cohorts and expenditures. Cohorts 4 through 8 are statistically significant, and expenditures for cohort 8 are approximately $0.18 more per week per capita than those for cohort 1. None of the age effects are statistically significant. Age is negative for ages 29 and 32, then positive for age 35 through 53, and negative for age 56 through 65, except for age 59. The results indicate that cohort effects are more important in terms of explaining expenditures on fish.

**Conclusions**

We postulate that different cohorts, or generations, may exhibit diverse expenditure patterns that are the result of increasing income levels generated by economic growth and resultant higher incomes, differing levels of concern and knowledge about health and nutrition, and/or different tastes and preferences. Our results indicate that cohort effects do exist for beef, pork, poultry, and fish. That is, statistically significant cohort effects were found for each type of meat studied.

Contrasting the cohort results by type of meat also offers some interesting results.

- Beef, pork, and fish display strong positive cohort effects, while poultry displays strong negative cohort effects. One is compelled to speculate that older cohorts prefer red meat, pork, and fish to poultry. At a minimum, one may say that the younger cohorts spend more per capita on poultry than the older cohorts do.
Cohort effects dominate age effects for red meat, pork, and fish; however, age effects dominate cohort effects for poultry. Per capita expenditures for poultry are primarily driven by age since the relative magnitude is greater than it is for the cohort effects. In fact, as the age of cohort groups increase, they spend less on chicken. However, younger cohorts spend more as incomes rise and they move through the life cycle.

Strong cohort effects for younger consumers' of poultry and strong age effects suggest that younger cohorts will consume more poultry relative to preceding older cohorts, and the cohort will be complemented by the age effect as well. Aging younger cohorts, whose incomes tend to rise with age, will consume more poultry.

These results are not inconsistent with recent trends in per capita consumption and retail price trends over the past 10 years (Clauson, 1994). Per capita poultry consumption has continued to increase over the period; pork has maintained a steady consumption level; and beef consumption has declined. Moreover, beef, pork, and poultry prices have declined noticeably. Despite falling prices, per capita beef consumption has declined. Income and prices obviously do not fully explain this phenomenon, but some insight can be provided by changes in tastes and preferences, which in turn are a function of education and knowledge and are different in succeeding cohorts or generations. We contend that cohort succession and differences between these cohorts (generations) may play a role in this phenomenon.

Appendix Table 1. Tobit Regression Results for Beef, Pork, Poultry, and Fish.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beef</th>
<th>Pork</th>
<th>Poultry</th>
<th>Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.704***</td>
<td>0.011</td>
<td>-0.245**</td>
<td>-0.504***</td>
</tr>
<tr>
<td>Cohort 2</td>
<td>0.137***</td>
<td>0.065</td>
<td>-0.116***</td>
<td>0.040</td>
</tr>
<tr>
<td>Cohort 3</td>
<td>0.374***</td>
<td>0.171***</td>
<td>-0.161***</td>
<td>0.089</td>
</tr>
<tr>
<td>Cohort 4</td>
<td>0.666***</td>
<td>0.345***</td>
<td>-0.203***</td>
<td>0.142**</td>
</tr>
<tr>
<td>Cohort 5</td>
<td>1.001***</td>
<td>0.410***</td>
<td>-0.249***</td>
<td>0.267***</td>
</tr>
<tr>
<td>Cohort 6</td>
<td>1.267***</td>
<td>0.497***</td>
<td>-0.140*</td>
<td>0.294***</td>
</tr>
<tr>
<td>Cohort 7</td>
<td>1.330***</td>
<td>0.572***</td>
<td>-0.212***</td>
<td>0.286**</td>
</tr>
<tr>
<td>Cohort 8</td>
<td>1.557***</td>
<td>0.675***</td>
<td>-0.229***</td>
<td>0.359***</td>
</tr>
<tr>
<td>Age 29–31</td>
<td>0.006</td>
<td>-0.002</td>
<td>0.13328</td>
<td>-0.088</td>
</tr>
<tr>
<td>Age 32–34</td>
<td>-0.104</td>
<td>0.069</td>
<td>0.232**</td>
<td>-0.030</td>
</tr>
<tr>
<td>Age 35–37</td>
<td>-0.022</td>
<td>0.081</td>
<td>0.318***</td>
<td>0.051</td>
</tr>
<tr>
<td>Age 38–40</td>
<td>0.013</td>
<td>0.195</td>
<td>0.418***</td>
<td>0.075</td>
</tr>
<tr>
<td>Age 41–43</td>
<td>-0.020</td>
<td>0.222</td>
<td>0.497***</td>
<td>0.055</td>
</tr>
<tr>
<td>Age 44–46</td>
<td>-0.002</td>
<td>0.270**</td>
<td>0.593***</td>
<td>0.061</td>
</tr>
<tr>
<td>Age 47–49</td>
<td>-0.158</td>
<td>0.192</td>
<td>0.634***</td>
<td>0.053</td>
</tr>
<tr>
<td>Age 50–52</td>
<td>-0.328*</td>
<td>0.211</td>
<td>0.771***</td>
<td>0.040</td>
</tr>
<tr>
<td>Age 53–55</td>
<td>-0.360**</td>
<td>0.226</td>
<td>0.694***</td>
<td>0.108</td>
</tr>
<tr>
<td>Age 56–58</td>
<td>-0.601***</td>
<td>0.153</td>
<td>0.725***</td>
<td>-0.044</td>
</tr>
<tr>
<td>Age 59–61</td>
<td>-0.681**</td>
<td>0.198</td>
<td>0.784***</td>
<td>0.026</td>
</tr>
<tr>
<td>Age 62–64</td>
<td>-0.861***</td>
<td>0.130</td>
<td>0.698***</td>
<td>-0.014</td>
</tr>
<tr>
<td>Age 65+</td>
<td>1.251***</td>
<td>-0.058</td>
<td>0.722***</td>
<td>-0.111</td>
</tr>
<tr>
<td>1984</td>
<td>-0.065</td>
<td>-0.017</td>
<td>0.057*</td>
<td>-0.045</td>
</tr>
<tr>
<td>1985</td>
<td>-0.099**</td>
<td>0.061*</td>
<td>-0.027</td>
<td>-0.055</td>
</tr>
<tr>
<td>1986</td>
<td>-0.036</td>
<td>0.002</td>
<td>-0.009</td>
<td>0.020</td>
</tr>
<tr>
<td>1987</td>
<td>-0.114***</td>
<td>-0.096*</td>
<td>-0.100***</td>
<td>0.043</td>
</tr>
<tr>
<td>1988</td>
<td>-0.169***</td>
<td>-0.161***</td>
<td>-0.108***</td>
<td>-0.039</td>
</tr>
<tr>
<td>1989</td>
<td>-0.044</td>
<td>-0.089**</td>
<td>-0.020</td>
<td>0.010</td>
</tr>
<tr>
<td>1990</td>
<td>-0.031</td>
<td>-0.097***</td>
<td>-0.023</td>
<td>0.118**</td>
</tr>
<tr>
<td>1991</td>
<td>0.096**</td>
<td>0.032</td>
<td>0.075**</td>
<td>0.041</td>
</tr>
<tr>
<td>1992</td>
<td>0.017</td>
<td>0.152***</td>
<td>0.072**</td>
<td>-0.069**</td>
</tr>
<tr>
<td>1993</td>
<td>0.071</td>
<td>0.054</td>
<td>0.012</td>
<td>-0.083**</td>
</tr>
<tr>
<td>1994</td>
<td>-0.054</td>
<td>0.029</td>
<td>-0.017**</td>
<td>-0.043</td>
</tr>
<tr>
<td>1995</td>
<td>0.104</td>
<td>-0.001</td>
<td>0.012</td>
<td>0.045</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-66,522.89</td>
<td>-56,817.99</td>
<td>-49,914.54</td>
<td>-46,742.46</td>
</tr>
<tr>
<td>Probability</td>
<td>0.528</td>
<td>0.512</td>
<td>0.505</td>
<td>0.490</td>
</tr>
</tbody>
</table>

* *** = p < .01; ** = p < .05; * = p < .10.
Appendix Table 2. Birth Years Included in Cohorts (1982=base year).

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Birth Years</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1952-56</td>
<td>26-30</td>
</tr>
<tr>
<td>2</td>
<td>1947-51</td>
<td>31-35</td>
</tr>
<tr>
<td>3</td>
<td>1942-46</td>
<td>36-40</td>
</tr>
<tr>
<td>4</td>
<td>1937-41</td>
<td>41-45</td>
</tr>
<tr>
<td>5</td>
<td>1932-36</td>
<td>46-50</td>
</tr>
<tr>
<td>6</td>
<td>1927-31</td>
<td>51-55</td>
</tr>
<tr>
<td>7</td>
<td>1922-26</td>
<td>56-60</td>
</tr>
<tr>
<td>8</td>
<td>1917-21</td>
<td>61-65</td>
</tr>
</tbody>
</table>

References


