# Using Nielsen Homescan Data and Complex Survey Design Techniques To Analyze Convenience Food Expenditures

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# USING HOMESCAN DATA AND COMPLEX SURVEY DESIGN TECHNIQUES TO ESTIMATE CONVENIENCE FOOD EXPENDITURES

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A.C. Nielsen Homescan panel data has enabled researchers to conduct studies of consumer purchase behavior which utilize more detail on food products along with the ability to incorporate the price data included in the data. However, the use of Homescan data raises issues concerning complex survey design and weighting. This paper looks at the A.C. Nielsen panel data, the sampling procedure, some of the issues associated with its use. An expenditure analysis of ready foods uses complex survey estimation techniques to address these issues.

## The Proliferation of Convenience Foods

The proliferation of at-home convenience foods has been driven by the division of labor in food preparation (Cutler et. al., 2003). During the 1960's, households prepared most of their own food and consumed it at home. Manufacturers have been able to provide consumers with more foods where much of the preparation work has been done outside the home. This development has been facilitated by the use of technological innovations in preservation, packaging, freezing, artificial flavorings and ingredients, and the use of microwaves. In 1965, non-working women spent more than 2 hours per day cooking and cleaning up after meals. By 1995, this time had been reduced to less than half. The authors attribute this development to a shift in food preparation from individuals to food manufacturers. In essence, convenience has lowered the time price of food consumption and increased the quantity and variety of foods consumed.

Other factors can also be linked to this growth but still relate to time and effort of preparation and are probably causative factors that have driven the previously described phenomenon (Senauer et al., 1998; Newman et al., 2003).

- Modern American families have fewer formal eating occasions since more household members live individualistic lifestyles. All household members are increasingly cooking their own meals, especially children.
- Increasing disposable incomes has led to higher levels of expenditures on time-saving and labor-saving food products. Consumers are unwilling to spend much time on food preparation due to the increasing value placed on leisure time.
- Redefinition of gender roles in households with more women working outside the home have led to a general loss in traditional cooking skills and less time for food preparation.
- Household sizes have declined and the increasing number of 1-2 person households has led to an increase in demand for ready foods which are easy-to-serve and portion controlled.
- Younger consumers with disposable incomes are more likely to try new products (many of these are convenience products), have non-traditional eating habits, and eat out more often.

Policymakers are very interested in household food selection, purchase, and food preparation decisions since these choices are critical determinants of diet-related health outcomes for consumers as well as factors that determine the structure and composition of the food supply (ESCOP, 1990). Identifying behavioral relationships that determine food choice is critical to

understanding food demand and developing insights into future consumption patterns. These relationships are especially important since today's consumer seems to be driving the demand for prepared foods in today's market. The availability of mass produced convenience foods with a lower time cost may also be a factor in rising obesity rates due to the increased quantity and variety of these foods which are consumed by consumers.

## Foods Selected For Study

Dealing with convenience is, in general, difficult since multiple characteristics can contribute to the convenience attribute of food products. For example, preparation method, preparation time, preservation, packaging, and added culinary skills are all characteristics which contribute to the convenience attribute of food products. With the exception of packaging all of these characteristics provide direct time saving convenience. However, packaging can also be considered as a time saving characteristic, e.g. small package sizes and individual package sizing can be considered as added convenience for some consumers.

Traub and Odland (1979) identified convenience foods as those that are "fully or partially prepared foods in which a significant amount of preparation time, culinary skills, or energy inputs have been transferred from the home kitchen to the food processor and distributor." Capps et. al. (1985) followed up on the previous study and analyzed convenience foods based on the degree of processing or added features. Neither of these approaches explicitly consider preparation time and focus primarily on the degree of processing. A second set of studies take a different approach and have focused on the degree of readiness, the preparation method, or the amount of preparation that must be performed before the food can be consumed (Paulus, 1977;

Pepper, 1980; Pearson et. al., 1985). A later study perhaps incorporates the largest degree of these concepts (Park and Capps, 1997). Their approach focuses on the degree of preparedness or the relative amount of preparation done by the processor or retailer versus the remainder done by consumers.

This paper takes the approach of Newman et.al. (2001) who analyzed a group of convenience food products they call "ready meals." Ready meals can be defined as meals that include meat, poultry, fish, seafood, pasta and vegetable dishes and can be classified as traditional, continental, ethnic, vegetarian, and low calorie. These are also products that have had culinary or recipe "skills" added to them by manufacturers that result in a high degree of readiness, completion, and convenience. These types of products can be divided into five different categories: canned, ambient[1], frozen, chilled, and dry.

Ready meals comprise a subset of the complex convenience category developed by Capps, et.al. (1985) and similar to the prepared meals category specified by Park and Capps (1997). Some products that could be classified as meal components (entrees and pot pies) have been included. Entrees were included since many consumers often eat entrees as a whole meal. Pot pies were included since most are family sized whole meals instead of the smaller, individual pies. The list of "selected meals." is shown in table 1. These meals are expected to represent the highest level of at-home ready-to-cook or ready-to-prepare convenience foods.

[1] Actually the correct phrase is ambient temperature foods which consist of foods that can be stored at the temperature of their surroundings. Some examples include shelf stable entrees, jars of coffee, etc.

Further assumptions also have to be made regarding the selections used here. Ready foods are assumed to be produced by processors or retailers with marketing inputs. Convenience foods produced in the household are not considered nor are foods consumed away-from-home. Also,

Table 1. Selected ready meals used in the analysis.

| |
|---|
| **Frozen dinners** |
| **Pizza** |
| Fresh |
| Frozen |
| **Dry Pasta dinners** |
| **Canned/dry/kit dinners** |
| Rice |
| Remaining |
| Canned Mexican dinners |
| Dry/kit Mexican dinners |
| Dried instant meals |
| **Pot pies** |
| **Frozen entrees** |
| One food – meat |
| One food – poultry |
| One food – seafood |
| One food – ethnic |
| One food - remaining |
| Two food – meat |
| Two food – poultry |
| Two food – seafood |
| Two food – ethnic |
| Two food – remaining |
| Multi-pack |
| **Shelf stable entrees** |

the Homescan data does not provide information on foods produced at-home or food-away-from-home. Therefore, this study only looks at convenience in terms of food products purchased for at-home use.

## Sampling and Weighting Procedures

AC Nielsen has a 15 year history of collecting Homescan data. The Nielsen Homescan panel began in 1989 and the sample size has been steadily increasing. In 1989, Nielsen was collecting data from 15,000 households in over 30 markets. Sample size will rise to over 100,000 households in late 2005 or in 2006. For the 1999 panel used here, 55,000 households in 52 markets are included.

AC Nielsen uses probability sampling to produce the Homescan panel using the sample frame of US households, Nielsen household population lists provided by an outside contractor and Nielsen media are used to select sample households. The sample frame is based on households in the contiguous 48 states. Selected households are sent a letter or e-mail (80 percent by internet) asking them if they would like to participate. If they respond yes, they are mailed a demographic questionnaire and a detailed summary of participation requirements.

### Stratification

The Homescan data result from a stratified probability sample based on demographic and geographic targets. A major function of the complex survey design is to allow description of households in major markets which are made up of urban/suburban areas. Table 2 shows the demographic strata for the 1999 data. There are six cities and urban/metro areas that are demographic strata. The remaining strata are census regions. If a household is not in one of city or urban/suburban markets, it is part of one of the Census regions.

Table 2. Geographic strata used in the 1999 panel.

| Strata | Description |
|---|---|
| 1 | Chicago |
| 2 | Los Angeles |
| 3 | New York City |
| 4 | Atlanta |
| 5 | Baltimore-Washington |
| 6 | San Antonio |
| 7 | East |
| 8 | Central |
| 9 | South |
| 10 | West |

**Demographic Targets**

There are 28 demographic targets and each are shown in table 3. Several levels are used for each of the targets except for the Hispanic target which is Hispanic or non-hispanic.

Table 3. Demographic targets used in the 1999 panel.

| Target | Number of levels |
|---|---|
| | |
| Household size | 4 levels |
| Household income | 4 levels |
| Age of female head | 4 levels |
| Household race | 3 levels |
| Male head education | 4 levels |
| Female head education | 4 levels |
| Household occupation | 3 levels |
| Hispanic | Yes/no |

**Participation Incentives**

Nielsen offers what they call "unbiased" incentives to participate in the Homescan panel. Offering incentives that are not associated with industry firms or products prevents potential bias. Therefore there are no coupons, discounts, and other incentives provided by manufacturers, specific retailers, restaurants, etc. Table 4 shows the different types of incentives offered to participants.

Table 4. Types of participation incentives.

| Frequency | Type |
|---|---|
| Weekly | Sweepstakes |
| Monthly | Sweepstakes |
| Quarterly | Sweepstakes |
| Quarterly | Participation every week in quarter |
| Annual | Participation every week for a year |

**Attrition**

Along with advantages, panel data may have a number of specific problems. One of the most serious is attrition. That is, the entry/exit of panel members. Over sampling by Nielsen is used for replenishment of the panel and is done weekly to maintain the panel size (sample size). Replenishment mainly happens when households' dropout, they violate the programs used to evaluate cooperation status, or where households are asked off the panel for no/low participation or failing to meet a predetermined number of static periods. However, reported data is based on households that participate ten out of twelve months. Because of sample attrition and the ten out of twelve month requirement, the size of the panel decreases over the course of a calendar year. Table 5 shows the effect of attrition for 2003 data.

Table 5. Panel retention rates for the 2003 panel.

| Calendar year 2003 | Number of households |
|---|---|
| | |
| End of first 13 weeks | 50,396 |
| End of first 26 weeks | 46,043 |
| End of calendar year | 42,987 |

**Data Verification**

Panelist weekly transmissions are monitored and panelists who are inactive for 2 consecutive weeks are consulted and motivated to either resume active participation or are dropped from the panel. New panelist's transmissions are monitored for a length of time to assure regularity and stabilization before they are included in reported panel data. Uploaded data from households are also subjected to internal Nielsen checks for consistency with other households and also to detect households which may be "under-scanning" their purchases.

**Sample Weights**

Household universe weights are available at the county level for all demographic targets. These numbers are kept updated at the beginning of each year and population growth is forecasted each month to allow for population growth. Projection factors for the data are basically computed using these numbers. The projection factors reflect the sample design and each factor reflects the representation of each household in the U.S. population,

Projection factor = universe of households / sample households.

The projection factor produces demographic weighting as well as household population projection. The projection system also takes into account the correlation between household demographics and item purchases. Additional weighting is also included in the case of lower income households because of slight under-sampling due to the difficulty of recruiting households in this group. The values of the weights range from small to large and reflect the differential probabilities of household selection.

**The Fresh Food Panel**

For size and cost reasons, a subset of the full panel is used to give information on both random weight items which have no UPC codes and UPC-coded products. Unfortunately, not all panelists in the Homescan panel provide purchase information on both types of items. Currently, 22,500 households are in the "fresh foods" panel. In 1999, there were only 12,500 households. The sub-sample chosen only contains household panelists that were in the panel 10 out of 12 months. This is what Nielsen considers as the panel and the data reflect this group. The actual number of panelist for 1999 is slightly more that 7,000 panelists. The 7,000 plus households are U.S. representative when weighted with their projection factors.

## Analytical Framework

The ready foods market is most appropriately analyzed using the household production model (Becker, 1965: Lancaster, 1971). Studies that have employed the model have stressed the impotance of accounting for time constraints in the household decision framework. Nayga (1998) provides an excellent description of the framework. This theory is especially relevant here since it takes into account that household decision making is based on efficient use of market goods, time, and human capital as inputs into production of utility-yielding non-market goods. Households are considered to be both production and consumption entities. The household utility function (U) can be expressed as:

$$(1) \qquad U = U(c_1, c_2, \ldots, c_n)$$

where the c are amounts of commodities produced within the household, e.g. a nutritious meal. The household utility function is constrained by the household production function, time

constraints, and full income constraints. For the full mathematical description of the model see Nayga (1998).

The model leads to household-derived market-good demand equations that are analogous to derived demand equations for factor inputs in traditional production theory (Becker, 1965):

$$(2) \quad X = X_i(P_j, Y_j, W_j, E_j)$$

Where $X_{ij}$ is the jth household's consumption of the ith market good, $P_j$ is a vector of market prices faced by the jth household, $Y_j$ is the jth household's income , $W_j$ is the value of time for the jth household , and $E_j$ is a vector of variables reflecting the environment. These environmental factors can be household characteristics or socioeconomic factors (McCracken and Brandt, 1987).

Equation 2 implies that household purchase behavior varies across consuming household units due to prices, income, time, and socio-demographic factors. Here, the household production model attempts to account for the environmental factors explicitly. For example, household size, education, age, etc. In other words, food spending by U.S. households depends on income and demographic characteristics as well as prices (Stewart and Harris, 2005).

Wage rates are not provided in the Nielsen Homescan data. The number of wage earners and income are used as a proxy for the value or opportunity cost of time. This variable is expected to have a positive effect on household expenditures for ready foods. Income is also hypothesized to have a positive relationship with expenditures on prepared foods. Higher income households have been found to spend more (expenditures) on food than lower income households.

The socioeconomic variables include: region, age, race, marital status, education, and presence of children. Regional differences in expenditures have been found in previous food studies mainly due to price variation. Age is a variable used to reflect the position of the household in the life cycle. The younger households are expected to have higher expenditures on ready foods than others. Whites and higher educated households have also been found to consume more food away-from-home (convenience) than do others (Nayga and Capps, 1992).

According to household production theory, the present of children should be positively related to expenditures of time-saving foods such as ready foods (Nayga, 1998). The list of variables can be found in table 6.

## Complex Survey Design

An ideal method for conducting a household survey would be to have an up to date list of households in the population (sample frame), a design that gives equal probability to individual households selected, and all selected households participate in the survey. These conditions meet the criteria for a simple random sample (SRS). In reality, most surveys are much more complex, Deaton (1997).

Table 6--Dependent and independent variables in the expenditure equation.

| | |
|---|---|
| Expenditure | Annual household expenditure (dependent variable) |
| Income | Household income[1] |
| Priceadj | Quality adjusted price of ready meals[2] |
| Othpriceadj | Quality adjusted price of all other at-home foods[2] |
| Hhsize | Number of persons in household |
| East | Household located in the Eastern U.S. |
| South | Household located in the Southern U.S. |
| Central | Household located in the Central U.S. |
| West | Household located in the Western U.S.[3] |
| Age | Age of household head[4] |
| Metro | Households in urban/suburban areas |
| Rural | Households in rural areas[3] |
| White | Household race is white |
| Black | Household race is black |
| Other races | Household race is other than white or black[3] |
| Hispanic | Household is Hispanic |
| Non-hispanic | Household is non-hispanic[3] |
| Single | Household marital status[3] |
| Married | Household marital status |
| High school | Household head has a high school education or less[3] |
| College | Household head has a college education |
| Post graduate | Household head has a post graduate education |
| Children | Household contains children |
| Childless | Household contains no children[3] |
| Wage earners | Number of wage earners in the household |

[1]Income is recorded as interval data and the midpoint was used to represent household income. Income is assumed to be a continuous variable based on a further assumption that mid income values are randomly and normally distributed within the interval (Byrne, 1994).

**[2]**Quality adjusted using a technique suggested by (Cox and Wohlgenant, 1986).

**[3]** Base, omitted dummy variable.

**[4]**Same technique as described in footnote 1.

Typical household surveys collect data on population households randomly selected from the national "frame" of households. More often, households are selected from a two-stage design where selection of individual households are selected based on prior knowledge and have an equal chance of selection in the sample. Commonly, surveys generate population statistics based on subgroups defined by geographical areas such as geographic area, ethnic affiliation, or standards of living.

The use of complex surveys over simple random samples can be justified based on the idea that prior knowledge about the population can enhance the precision of population estimates by using an appropriate survey design. In essence, the efficiency of statistical inference can be enhanced using an appropriate design. Most designs use stratification and/or clustering.

Stratification usually will enhance the precision of sample estimates and is considered a good reason for departing from simple random sampling. Stratification produces a sample not of one population but several population subgroups and guarantees that there will be sufficient observations to produce estimates for each strata. Stratification takes advantage of prior knowledge about the population and the use of this information can improve the efficiency of statistical inference. Deaton (1997) provides a good example based on incomes in rural versus urban incomes. For the population as a whole, income is calculated using a weighted mean based on the proportion of the population in each group. Precision of the estimate is based on the inverse of the variance derived from replications of the survey. Since the two groups are considered independent, the variance of the overall mean is the sum of the two variances from each group. Therefore, variance is based on variance within each group and not between groups. With simple random sampling, the variance of overall mean would have been composed of variation within each group and between groups. If the groups are truly different, between group variation will contribute to the variability of the estimated overall mean. The general rule is that stratification will have the largest influence in reducing variance when the stratum means differ and variation within strata are small. However, the concept is different for clustering.

If clustering is used or exists, it generally reduces variance since households within clusters are more similar to each other compared to households in other clusters. Generally, the precision of estimates rests on the correlation within the cluster for the variable measured.

The effect of sample design on precision can be assessed by using a concept called "deff" (design effect) developed by Kish (1965). The design effect measure (deff) is expressed as the ratio of the variance of the estimate to the variance that would have been produced by simple random sampling. Stratification tends to reduce the measure to values below one while clustering effects tend to raise values to over one. Groves (1989) found that estimates of means produced by most complex survey designs produced "deff" values greater than one.

Unequal selection probabilities for households should also be taken into consideration. Complex surveys can be conducted where all households in the population have an equal probability of section. However, in reality, probabilities may differ for reasons such as refusal to participate or cost of surveying some households over others. With differing probabilities of selection, selected households are, in essence, representative of differing numbers of households in the population. According to Deaton (1997), sample means will not be unbiased estimates of population means and to obtain unbiased estimates, household data must be weighted by the reciprocals of the sampling probabilities. These factors are often called "inflation" or "projection" factors. Data sets usually contain these factors along with other data and are used to inflate household data, then summed to produce an estimate of the population total. Differences in weights can be caused by different probabilities caused by the sample design or simply by non-response. The later are usually taken care of by adjusting sample weights.

Complex survey design techniques are used to estimate the regression model in this analysis. This procedure is used because of three data characteristics: sampling weights; clustering; and stratification (Stata, 2003). These characteristics arise from the design of the data collection procedure. Sampling weights result from designs where observations are selected using a random process but different observations may have different probabilities of selection. Post-sampling adjustments may also be performed on the weights as well, and in fact, some extra weighting is done to the Nielsen Homescan. Using sampling weights in the analysis provides estimators that are approximately unbiased for statistics and coefficients that are estimated for the population and also produces unbiased standard errors.

Clustering can result when household observations are not sampled independently. However, there is no intentional clustering in the data according to A.C. Nielsen. Due to the sample design, some observations in a cluster, if they occur, are not independent. If estimates are based on independence, standard errors may be smaller than actual. Accounting for clustering is necessary to produce "honest" estimates of standard errors, p-values, and confidence intervals.

Stratification can also affect standard errors. In the survey design, different groups (strata) clusters may be sampled separately and sampling is done independently across strata. Strata are assumed to be independent and are analyzed as such. However, some cases, if the strata are not independent, this can reduce the size of standard errors.

A.C. Nielson indicated that clustering should not be a problem in their sample. The strongest argument for using complex survey design techniques was to weight the data to generate population estimates based on appropriate standard errors.

## Empirical Results

### Population Estimates Of Household Statistics

Estimates for the means and standard errors for the households that purchased ready meals are shown in table 7. These numbers are produced using complex survey design techniques and constitute a demographic profile of households who purchase ready meals. The average household expenditure was $118.55 and average annual income is $42,600.60--average age is slightly over 47. The average quality adjusted price is also shown for both ready meals and all other at-home foods--$2.84 and $0.83 per pound, respectively. The average number of full time wage earners was also found to be 1.02.

The remaining variables provide a demographic picture of households which consume these convenience foods. Here, the means are proportions (dummy variable means) which have been expressed as percentages. The largest number of households are located in the south (36 percent) followed by households in the central region (24 percent). For all regions, 78 percent were located in metropolitan areas and 75 percent had incomes more than 200 percent of the U.S.

poverty level. Most of the household heads were white, married, and had a high school education or less. However, 48 percent of the households were single. Only 34 percent of the households had children.

Table 7—Survey mean estimation (svymean)

| **Variable** | **Units** | **Estimate** | **Standard error** | **Deff**[1] |
|---|---|---|---|---|
| Expenditure | Dollars | 118.55 | 2.47 | 3.08 |
| Income | Dollars | 42600.60 | 584.73 | 3.64 |
| Adj. own price | Dollars/pound | 2.84 | 0.02 | 3.24 |
| Adj. other prices | Dollars/pound | 0.83 | 0.005 | 3.29 |
| East | Proportion | 0.19 | 0.005 | 1.21 |
| West | Proportion | 0.21 | 0.005 | 1.21 |
| South | Proportion | 0.36 | 0.01 | 2.46 |
| Central | Proportion | 0.24 | 0.01 | 1.38 |
| Age | Years | 47.41 | 0.30 | 4.24 |
| Household size | Number | 2.59 | 0.03 | 4.08 |
| Metro | Proportion | 0.78 | 0.01 | 3.55 |
| Rural | Proportion | 0.22 | 0.01 | 3.55 |
| Poverty | Proportion | 0.25 | 0.01 | 6.03 |
| Non-poverty | Proportion | 0.75 | 0.01 | 5.19 |
| White | Proportion | 0.85 | 0.01 | 4.64 |
| Black | Proportion | 0.11 | 0.01 | 5.40 |
| Other race | Proportion | 0.04 | 0.003 | 2.08 |
| Hispanic | Proportion | 0.09 | 0.01 | 4.48 |
| Non-hispanic | Proportion | 0.91 | 0.009 | 4.44 |
| Single | Proportion | 0.48 | 0.01 | 3.81 |
| Married | Proportion | 0.52 | 0.01 | 3.81 |
| High school or less | Proportion | 0.74 | 0.01 | 2.81 |
| College | Proportion | 0.19 | 0.01 | 2.68 |
| Postgraduate | Proportion | 0.07 | 0.005 | 2.27 |
| Child | Proportion | 0.34 | 0.01 | 4.00 |
| No children | Proportion | 66.01 | 0.01 | 4.00 |
| Wage earners | Number | 1.02 | 0.02 | 3.73 |

| | | | |
|---|---|---|---|
| Number of observations | 7195 | Population size | 1.033e+08 |
| Number of strata | 10 | Subpopulation observations | 7,043 |
| Number of PSU's[2] | 7195 | Subpopulation size | 1.008e+08 |

[1] The deff ratio is used to compare the variance obtained from complex survey design estimation with the variance that would have been obtained using random weight sampling (Kish, 1965).

[2] PSU refers to primary sampling units (households).

**Regression Results**

The effects of the economic and socioeconomic variables on expenditures are shown in table 8. The table shows whether each variable is statistically significant and its impact on expenditures (either positive or negative). Table 8 shows pseudo maximum likelihood estimates for the expenditure equation.

Table 8—Regression estimates for ready meals with correction for complex survey design.

| Variable | Coefficient | Standard error |
|---|---|---|
| | | |
| Income | 0.0004** | 0.0001 |
| Adjusted price | 16.70* | 2.58 |
| Other prices | 7.00 | 10.54 |
| Household size | 14.94* | 3.15 |
| East | -18.79* | 5.40 |
| West | 15.26** | 6.28 |
| South | -7.16 | 6.03 |
| Age | -0.52** | 0.24 |
| Metro | 14.13* | 5.25 |
| Poverty | -15.08** | 7.35 |
| White | 21.91** | 8.89 |
| Black | -21.57** | 10.43 |
| Hispanic | -32.17* | 8.27 |
| Married | -17.59** | 6.93 |
| College | -13.47** | 5.88 |
| Postgraduate | -14.24*** | 8.08 |
| Child | 17.60** | 7.75 |
| Wage | 4.78 | 3.61 |
| Constant | 17.72 | 19.75 |

F (18,7168)=17.36 R-squared=0.11

* Significant at the .01 level.
** Significant at the .05 level
*** Significant at the .10 level.

The expenditure equation was estimated using regression techniques which take into account complex survey design since nearly all of the households bought these products. Regression was used since only 130 out of 7,195 households did not purchase ready meals.

Results are shown for both the continuous variables along with the discrete effects for the categorical variables. The marginal effects of income and prices and their mean values are used to calculate elasticities for the continuous variables in the model. The statistical significance of computed elasticities are based on the significance of the marginal effects and evaluated at their respective means.

As expected, income and own-price have a positive and significant effect on expenditures for ready meals. This result indicates that, as household income increases, so do the expenditures on ready meals. The income elasticity with respect to expenditure, computed at the mean, is 0.15. That is, for a 1 percent increase in household income, ready meal expenditures will increase by 0.15 percent. This result is consistent with the elasticity found by Park and Capps (1997) for at-home ready-to-cook meals (0.13). Like income, the quality-adjusted price also had a positive and significant effect on expenditures. As expected, as price increases, expenditures increase. The computed price elasticity is -0.41. This result is consistent with food products where the product is price inelastic and the percentage change in price dominates the quantity change. Therefore, an increase in price will increase total expenditure and, conversely, a decrease in price will decrease total expenditure. The quality adjusted price of other food products was insignificant. The estimated price elasticities are similar to those found by Park and Capps (1997).

Household size and some regional effects are significant as well. The household size variable was positive and significant and for each extra person in the household, nearly $15 was spent. This result indicates that larger families consume more ready meals. Regional expenditures are measured relative to the central region of the U.S. Only two regional variables were significant. Households in the West spent over $15 dollars more for ready meals in 1999 compared to $18 less for households in the East. Expenditures in the Central and Southern regions are not significantly different from each other.

The effect of age of the household head on expenditures is negative and significant. This result suggests that expenditure on ready meals declines with age of the household head. This implies that younger heads of households are more likely to purchase ready meals. That is, the younger the household head, on average, more is spent on ready meals This result is also consistent with another factor identified in the introduction and suggests that younger households have a preference for a more convenient lifestyle and compared to older households, purchase more ready meals.

The urban/suburban variable is positive and significant. The coefficient indicates that these households spend nearly $14 more per year on ready meals than rural households. This significant difference is probably due to the different lifestyles lived by the two different groups. Urban/suburban households face greater time constraints due to commuting and/or traffic congestion to and from work. Another possible explanation may be the greater availability and variety of foods in urban/suburban markets compared to rural markets and may be more likely to purchase ready meals and spend more for these products.

The poverty variable is negative and significant. Households that have incomes less that 200 percent of the poverty threshold spend over $15 a year less on ready meals. This finding is consistent with previous studies conducted at the Economic Research Service which indicate that higher income households spend more for prepared foods than low income households.

The race variable measures ready meal expenditure differences relative to non-white or non-black households. In other words, households that are of another race other that black or white. Both the white and black variables were found to be significant. However, the white variable was positive and indicates that white households spent over $21 per year more on ready meals than the other races category. For blacks, the coefficient is negative and indicates that blacks spent over $21 less per year on ready meal products.

The Hispanic variable measures expenditure differences relative to non-Hispanic households. The coefficient is negative and significant. Hispanic households spent over $32 less per year than non-Hispanic households. One possible reason might be that, in 1999, the range of ready meals might not have had a significant variety of ethnic Hispanic meals.

For marital status, married households were compared to single households. The coefficient is negative and significant. Married households spent over $17 less per year on ready meals than single households. Married households may stay in more and prepare more meals at-home, especially if there are children in the household.

Educational attainment of the household head is measured relative to heads with a high school education or less. Both the college and postgraduate variables are negative and significant. Households with heads holding a college degree spent over $13 less on ready meals relative to those heads with a high school degree. Post graduates spent slightly over $14 less on ready meals.

It has been suggested that more educated households are more health conscious than other households and therefore might consider ready meals less healthy. This could be one explanation. Another might be that these two groups might eat out more and consume fewer meals at-home. Unfortunately, the Nielsen data does not contain data on expenditures on food-away-from-home. Including food-away expenditures would shed additional light on this finding.

The variable that indicates the presence of children in the household was positive and significant. Households with children spent over $17 more per year on ready meals. This finding is consistent with the notion mentioned in the introduction (factors driving ready meals growth) that increasingly consumers are adopting more individualistic lifestyles. The implication is that the importance of formal family eating occasions is declining and family members, including children, are independently preparing and consuming their own meals (Newman *et.al.*, 2001). Senauer *et.al.* (1998) reported that two-thirds of U.S. children prepared at least one meal a week without adult supervision in 1990. Another implication of the finding in this study is that households with children are probably more likely to purchase ready meals which are much easier for children to prepare.

Contrary to expectation, the variable which measures the effect of the number of wage earners on expenditures was insignificant. However, the coefficient is positive and, if significant, would suggest that expenditures on ready meals would increase with more adult wage earners in the household. This result is somewhat surprising since one would expect households where more members were working would have a higher opportunity cost of time, and in households where all adults work, there would not be adult household members to engage in household tasks such as cooking. An interaction term combining the poverty level and number of wage earners was used in an alternative specification and was found to be insignificant as well.

The finding regarding the number of wage earners does not support the notion mentioned in the introduction. That is, the redefinition of gender roles in households and the number of two wage households has led to a general loss in traditional cooking skills and less time for food preparation. However, this finding could also suggest that all-working households could be eating out more and substituting food-away for home cooked meals, even ready meals.

## Summary and Conclusions

This work focuses on ready food products and looks at the impact of economic and socioeconomic factors on purchases of selected convenience foods. Techniques which allow for correcting estimates for complex survey design were used in order to produce estimates which reflect population behavior. That is, the impact for all U.S. households, not just sample households. This technique is employed to provide the necessary weights to the sample strata contained in the sample and to provide “honest” estimates of standard errors for population coefficients.

When using data where household selection probabilities are non-uniform, the researcher has several options. One can assume that the probabilities of household selection are uniform and produce estimates from analysis of the sample data. However, to produce population totals or means, one must use the projection weights. Another choice is to use weighted regression. This technique takes care of weighting but disregards the complex survey design of the sample data. Only complex survey design techniques account for both weighting and the survey design. However, some econometric procedures may not be available in complex survey procedures.

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