At-Home Convenience Food Consumption and BMI

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U.S. consumers spent $1,165 billion on food in 2008, an increase of 54 percent from the $740 billion spent in 1998 (USDA-ERS 2009). A changing workforce comprised of more working women and more two-income households, means that busy consumers demanded quick, easy-to-prepare convenience foods. The strong economy of the late 1990s and early 2000s has increased incomes and allows more consumers to pay for highly processed convenience foods. Consumption of value-added processing and packaging of at-home foods increased, spending at restaurants and fast-food outlets grew, and prices for marketing inputs rose. Away-from-home expenditures have increased from 47.3% of the total food expenditures in 1998 to 48.5% in 2008 (USDA-ERS 2009).

The demand for food, especially in the convenience food, mirrors the changes in social values, lifestyles, and demographic trends. Consumers' changing preferences drove changes in their food selections, which had an impact on the marketing services needed to provide these foods. The factors that influence the demand for food remain the same: quality, pleasure, health, convenience, and having more disposable income but less time to prepare food. Shortage of time and changed consumer habits form the foundation on which the steadily growing convenience food market is built. The changes in convenience food include the availability of products that are easily divided into helpings and re-sealable, self-service-packaged fresh products, and easy preparation of ready dishes inside their packaging in microwave ovens. Grocery stores offer prepared entrees and side dishes ready for the oven, microwave, or dinner plate.

Capps, Teford, and Havlicek (1985) studied the demand for convenience food using the almost ideal demand system and the 1977-78 Nationwide Food Consumption

Survey data (NFCS). In their study, Capps et al. grouped all food items into four classes according to the degree of convenience. They found that the demand for convenience food is more sensitive to changes in own-prices than non-convenience foods. In addition, they found that primary users of convenience foods are white households with household heads of less than thirty-five years of age.

Park and Capps (1997) looked at the factors affecting the demand for prepared meals which are defined as ready-to-eat or ready to cook meals. They used the Heckman two-stage model with data from the 1987-88 Nationwide Food Consumption Survey (U.S. Department of Agriculture, 1994). The authors estimated expenditure functions for ready-to-eat (RTE) meals, ready-to-cook (RTC) meals, and all prepared meals which included the first two categories. Park and Capps found that prepared meals were purchased by younger, more educated, and time constrained managers.

Richards, Gao, and Patterson (1998) studied the demand for convenience and value-added in four complex carbohydrate food items using a household production framework and data from the 1977-78 and 1987-88 NFCS. In the Richards et al. study, the retail-farm spread was used as the proxy for valued-added and the proportion of away-from-home food expenditure in total food expenditures was the proxy for convenience. The findings in the Richards et al. study suggest that consumers valued further processing of raw foods and this value was rising.

Capps and Park (2003) discussed the concept of convenience as being the basis for food demand. The concept of convenience includes preparation, delivery and service. Preparation includes the percentage of labor transferred from the consumer to marketing firms. Delivery includes the percentage of labor transferred from the consumer to

marketing firms. Service includes other characteristics and benefits received by the consumer when the item is purchased. When these three items are combined to form the concept of convenience, the four channels of distribution that are identified include complete convenience, traditional food service, consumer direct, and traditional retail.

Lin, Manchino, and Lynch (2005) developed a convenience food index based on labor required to prepare food consumed. Using the Continuing Survey of Food Intakes by Individuals data, they found that the demand for convenience foods is positively related to a respondent's income, time spent watching TV, being male, and employed; and negatively related to the respondent's age, household size, and body mass index (BMI) for non-obese respondents. In addition, Lin, Manchino, and Lynch found that blacks, whites, and Hispanics are more likely to consume convenience foods than other races.

The purposes of this study are two-fold. First, we will examine the factors that influence the use of convenience foods at-home because few studies have been undertaken and second, we will examine the relationship between body-mass-index (BMI) and the degree of convenience of at-home food preparation. In this study we assume that the demand for convenience of at-home food preparation is influenced by a set of factors and the convenience may have an impact on BMI. Formally, these relationships can be expressed as

(1) $CV_i = \alpha_1 + \beta_1' x_1$

$BMI_i = \gamma\, CV_i + \alpha_2 + \beta_2' x_2;$

where CV_i is a measure of convenience of at-home food preparation for individual *i*, x_1 and x_2 are vectors of explanatory variables, and α, β, and γ are parameters to be estimated.

The major differences of this study from the Lin, Manchino, and Lynch study are (1) instead of using the ordinary least squares method, the tobit method will be used to estimate the demand for convenience in at-home food preparation and consumption parameters; and (2) the National Eating Trend (NET) data provided by the NPD Group will be used. The NET reports each end-dish consumed by survey participants. In addition, NET reports the occasion when the end-dish was consumed, the preparation method for each end-dish, and the major ingredients in the end-dish. With these pieces of information, we hope it will be easier and more accurate to code the food convenience score to be discussed in the section below.

At-Home Convenience Food Consumption

Based on the ways that foods are prepared and delivered, Lin, Manchino, and Lynch developed a four-point convenience index. This index is used in this study to measure the convenience of food consumed at home. Lin, Manchino, and Lynch assigned a zero to three score to each food according to preparation time, cooking time, cooking skills, and clean-up time:

3: no-preparation convenience food: this category includes food that is ready to eat, it can be consumed as is and takes no preparation time or cleaning time. Examples are bananas, yogurt, and hamburgers sold in fast food stores.

2: low-preparation convenience food: food that requires a minimum amount of preparation time, cooking time, cooking skills, and/or clean up time. Examples are canned soup, frozen meals, and peanut butter and jelly sandwich.

1: medium-preparation food: food that requires more preparation time, cooking time, cooking skills, and clean up time. Examples are tuna salad, cooked fresh vegetables, and bread from a bread machine.

0: high-preparation inconvenience food: food that requires lots preparation and cooking time, skills, and/or clean up time. Examples are homemade pie from scratch, chili made from dry beans, and casseroles from home recipe.

The convenience index is the average of the convenience scores of all end dishes recorded for the NET participant. The convenience index has a range of [0, 3] and the higher the convenience index, the more convenient food preparation becomes. Note that shopping time is not considered a factor in this convenience index. For each NET participant, the convenience scores of each end dish during a 14-day period were used to derive a convenience index using the scoring scheme described. The convenience index is used as the dependent variable in this study, a measure of a non-market good that was produced by the consumer using market food items.

The main reason to choose NET over other data sources such as NHANES was the additional food preparation method information provided by NET but not found in NHAHES. The food preparation information allow us to further refine the convenience scores assigned to each end dish, which will be discuss in the following section. The NET data covers the time period from February 24, 2003 through February 29, 2004. NET collected 14 consecutive days of dietary data from individuals of all ages using a

diary. There are 4,792 participants; however, there are only 806 NET participants with 14 days of food consumption records. The NET participants provided a list of end-dishes consumed as well as information on additives used in the end-dish, preparation methods, and eating occasions. NET also collected various economic, social, and demographic characteristics for the participant and his/her household.

In this study, we used the description of the end dish to assign an initial convenience-score for each of the end dishes used in NET. Based on the description of the end dish and preparation method used, the convenience-scores were revised. For example, based on the name of the end dish and how difficult to prepare the dish, we assign an initial convenience-score of zero to minestrone soup. If the form of minestrone soup is coded as ready-to-eat or from can, the score will be revised to three; however, if the form of the end dish is coded as scratch/completely homemade, then the score will not be revised.

Household production theory assumes that the household's decision making is concerned with the efficient use of market goods, time, and human capital as inputs in the production of utility yielding, non-market goods.

At the first stage the household may be characterized by cost-minimizing behavior, with food inputs assumed to be weakly separable from all other commodity groups (Deaton and Muellbauer, 1980), allowing the expenditure allocation among food groups to be in isolation from other commodities. The household's consumption choices may be written as

(2) $$\min C = \boldsymbol{p}' \boldsymbol{q} + \boldsymbol{w}'\boldsymbol{l} \quad \text{such that} \quad H(\boldsymbol{q}, \boldsymbol{l}, \boldsymbol{z}; k) = 0,$$

where H($\boldsymbol{q}$, $\boldsymbol{z}$; k) denotes the corresponding transformation function that converts food inputs (q_i), labor inputs ($\boldsymbol{l}$), and fixed capital stocks (k, capital stocks include human and physical stocks and are considered fixed for each household in the short run) into the non-market output vector $\boldsymbol{z}$; $\boldsymbol{p}$ is the price vector of market goods and $\boldsymbol{w}$ is the vector of wages. The solution to equation (1) is the household cost or expenditure function,

(3) $$m = C^0(\boldsymbol{p}, \boldsymbol{w}, \boldsymbol{z}; k),$$

indicating the minimal short-run cost of obtaining given levels of non-market goods $\boldsymbol{z}$ at given prices and wages.

In the second stage, the household chooses **z** to maximize utility, u, i.e.,

(4) $$u = u(\boldsymbol{z}) \qquad \text{such that } m = C^0(\boldsymbol{p}, \boldsymbol{w}, \boldsymbol{z}; k).$$

The solution of this second stage problem is the demand equation for $\boldsymbol{z}$

(5) $$\boldsymbol{z} = z(\boldsymbol{p}, \boldsymbol{w}, m; k).$$

An important assumption about the treatment of time should be made explicit here. Let $\boldsymbol{l}$ be the vector of labor time supplied to the market. Then $\mu + \boldsymbol{w'l} = \boldsymbol{p'q} = m$ is the market constraint where μ is non-labor income. Let $\boldsymbol{l}_0$ be the vector of labor time in household production and H($\boldsymbol{q}$, $\boldsymbol{l}_0$, $\boldsymbol{z}$; k) = 0 is the joint production function. If $\boldsymbol{T}$ is the vector of time endowments, then $\boldsymbol{T} - \boldsymbol{l}_0 - \boldsymbol{l}$ is the leisure vector and this is implicitly treated as part of the vector $\boldsymbol{z}$. One of these non-market goods produce by the household is convenience in food preparation.

As shown in equation (5), the explanatory variables of the demand for convenience include the prices of market goods (p), wage rates (w), income (m), and capital endowment in the household (k). Input prices were not recorded in the NET survey; however, since the data covered only a one year time period, we assumed that all

participants faced similar input prices, thus, input prices were not included as explanatory variables. Wage rates for the participants were not recorded; therefore, the household incomes were used as proxies for wage rates. In addition, we assumed that the wage rates for the labor that was used to prepare food were related to the household income of the participant.

Each household has its specific capital endowment. This endowment includes both the physical and human capital. There were no records about participants' kitchen facility; therefore, we assumed that all NET participants have an adequate kitchen facility. We assumed that the participants need to have knowledge about how to prepare food and this food preparation knowledge is related to participants' age, race, and ethnicity. In addition, each household has a different composition. Some household members require more care and reduce the time that food preparers can allocate for food preparation and increase the need for convenience, while other members may actually help the food preparer and reduce the need for convenience. To capture these differences among households' composition, the types of household (singles, working parent(s), traditional, seniors, and empty nesters), household size, and the presence of children of different age groups were included as explanatory variables.

Households residing in different regions of the U.S. may demonstrate different food consumption patterns. For example, people residing in the West may eat out more often than those who reside in the South. To capture these regional differences, three dummy variables were used for NET participants residing in the Northeast, Mid-West, and South (West is used as the base for comparison). Note that the regional dummies can be catch-all variables, i.e., they may also capture the impacts of price differences among

the regions. In addition to these household related variables, we assume that the more end dishes eaten, the more labor input is needed, thus the number of end dishes eaten could have an impact on the demand for convenience; therefore, the total number of end dishes eaten was included in the analysis.

Of the 4,792 NET participants, 491 had missing information; therefore, only the records of 4,301 participants were used in the analysis. Sample statistics are presented in Table 1. As shown in Table 1, breakfast occasions had the highest average convenience index, which is followed by lunch and dinner. The average convenience index for weekdays is slightly higher than that for weekends. About half of the participants were male and had children in the household. Of the 4,301 participants used in this study, 87% were white, 9% were black, and 8% were Hispanic. The average age of these participants is 38 years. The participants ate an average of 88 end dishes in two weeks or 6 end dishes per day.

A two-limit tobit model (Maddala 1983) was considered for this study, because the dependent variable, convenience index, which has a minimum of zero, a maximum value of three, and values in between. Formally, the model can be written as

(6) $$y_i^* = \boldsymbol{\beta}'\mathbf{x}_i + \varepsilon_i;$$

where y_i^* is the latent variable (i.e., convenience index) for individual *i*, $\mathbf{x}_i$ is a vector of explanatory variables, $\boldsymbol{\beta}$ is a vector of the parameters to be estimated, and ε_i is the disturbance term which is distributed $N(0, \sigma^2)$. If one denotes y_i the observed dependent variable, then

(7) $$y_i = L_i \text{ if } y_i \leq L_{1i}$$
$$= y_i^* \text{ if } L_{1i} < y_i < L_{2i}$$

$= y_i^*$ if $L_{2i} < y_i$

where L_{1i} is the lower limit, i.e., zero in this study; and L_{2i} is the upper limit or a value of three in this study. The likelihood function is

(8) $L(\beta,\sigma \mid y_i, x_i, L_i) =$

$$\prod_{y_i=L_{1i}} \Phi\left(\frac{L_{1i}-\beta' x_i}{\sigma}\right) \prod_{y_i=y_i^*} (1/\sigma)\Phi\left(\frac{y_i-\beta' x_i}{\sigma}\right) \prod_{y_i=L_{2i}} (1-\Phi)\left(\frac{L_{2i}-\beta' x_i}{\sigma}\right)$$

where Φ is the standard normal distribution function. Nelson showed that the log-likelihood function is concave; hence (8) can be estimated using the Newton-Raphson method. Note that the estimates of β are inconsistent when heteroscedasticity occurs. One of the approaches proposed by Peterson and Waldman is to replace σ with σ_i in the log-likelihood function. In this study, the variance is assumed to be of the form $\sigma_i^2 = \exp(\alpha' w_i)$, where w_i is x_i without the intercept. A test of the homoskedastic null hypothesis that $\alpha = 0$ can be based on the likelihood ratio statistic (Green 1990, p. 733).

Of the 14 reporting days, only about 65% of the participants reported at-home food consumption , 60% of the participants reported at-home breakfast consumption, a little less than 50% reported at-home lunch consumption, a little over 50% reported at-home dinner consumption, and less than 40% reported to have at-home food consumption for all three meals in any given day during the reporting period. Due to the incomplete information we found in NET, three models were estimated, i.e., the convenience indices for breakfast, lunch, and dinner were analyzed. The models were estimated using LIMDEP (Greene, 1998).

Homoskedastic hypothesis tests are presented in Table 2. The test statistics are between 662 and 819 with a χ^2 distribution of 23 degrees of freedom. These test statistics

exceed the critical value ($\chi^2_{(.005,23)}$ = 44.1813); therefore, the results from the heteroskedastic models will be used in the following discussion. Parameter estimates are presented in Table 2.

Let $\Phi_{1i} = \Phi[(L_{1i} - \beta' x_i)/\sigma_i]$ and $\Phi_{2i} = \Phi[(L_{2i} - \beta' x_i)/\sigma_i]$ be the cumulative probability density function and the corresponding probability density functions φ_{1i} and φ_{2i}, one has the expression for $E(y_i)$ as (Maddala, p. 161)

(9) $$E(y_i | L_i < y_i < L_{2i}) = \beta' x_i + E(u_i \mid L_{1i} - \beta' x_i < u_i < L_{2i} - \beta' x_i)$$
$$= \beta' x_i + \sigma(\varphi_{1i} - \varphi_{2i})/(\Phi_{2i} - \Phi_{1i});$$

and the unconditional expectation of y_i is

(10) $$E(y_i) = \Phi_{1i} L_{1i} + \beta' x_i (\Phi_{2i} - \Phi_{1i}) + \sigma(\varphi_{1i} - \varphi_{2i}) + (1 - \Phi_{2i})L_{2i}.$$

Equations (9) and (10) can be used to obtain the appropriate conditional and unconditional predictions of y_i (the convenience index) with given x_i and to calculate the conditional and unconditional marginal effects of the explanatory variables on the dependent variable

(11) $$\partial E(y_i | L_{1i} < y_i < L_{2i})/\partial x_{ij} = \beta_j, \text{ and}$$

(12) $$\partial E(y_i)/\partial x_{ij} = \beta_j (\Phi_{2i} - \Phi_{1i}).$$

Note that in equations (11) and (12), the marginal effects of the explanatory variables is proportional to the parameter estimate, β_j. Therefore, the sign of the parameter estimate indicates the direction of the impact of the explanatory variable on the convenience index and the magnitude of the parameter estimate represents the relative importance of the explanatory variable to the convenience index.

Household income is found to be positively associated with the convenience indices for breakfast and lunch but not for dinner, an indication that high-income

households demand more convenience than low-income households for breakfast and lunch occasions but not the dinner occasion. This result suggests that, in general, as household income increases, the consumption of convenience would increase.

The results for the type of household variables show that single-member (working) households demand more (less) convenience than empty nesters (the base for comparison) for the dinner occasion, but there is no difference from the base for breakfast or lunch. Senior (traditional) participants had less (more) demand for convenience than empty nesters for breakfast; however, for dinner occasions the senior and traditional (one parent worked and the other stayed home) households both demand less convenience than empty nesters.

The coefficient estimates show that male participants consumed less convenience food than female participants (the base of comparison) for breakfast and lunch; however, there was no difference at dinner. The coefficient estimates for household size indicate that the addition of a member in the household would decrease (not affect) the demand for convenience food for breakfast and dinner (lunch), but at a decreasing rate for dinner (a positive coefficient for $(\text{HH SIZE})^2$). This result suggests that when household size increases for dinner, there are more mouths to feed and the need for convenience food decreases; however, as the household size grows, it places pressure on the household to look for convenience in food consumption.

The presence of children in a household could mean more available labor input, but it can also mean more mouths to feed and a higher demand for parents' time to prepare food for the children and feed them. The coefficient estimates for the presence of children of various age groups show that the presence of children in the household

increases the demand for convenience in food consumption for dinner and the coefficient estimates are larger than the ones for other explanatory variables. For breakfast, the presence of children of all age groups had no impact on the demand for convenience; however, there is an increased demand for convenience for lunch if there is a presence in the household of children 12 years of age and under.

The coefficient estimates for region dummies show that the demand for convenience for the respondents who resided in the Northeast, Mid West, and South regions are different from those respondents who resided in the West (the base of comparison). For dinner, residents in the Mid West and the South demand more convenience and those in the Northeast demand less convenience than the residents in the West. For breakfast the residents in the Northeast and Mid West demand more convenience than those in the West whereas for lunch, the residents in the Mid West and the South demand less convenience than those in the West. This result indicates that there is a difference in the demand for convenience among regions.

Race and ethnicity influence the demand for convenience food. Specifically, the results show that Hispanics and Blacks demand less convenience food in breakfast and dinner occasions than the base group (Asians and other) and Hispanics demand more convenience for lunch. On the other hand, white respondents do not differ from the base group. These results are consistent with the findings in the Capps et al. study, i.e., Black or Nonwhite households allot a smaller share of the food dollar to convenience foods than their corresponding counterparts.

The coefficient estimates for the age of respondent is negative for breakfast, lunch, and dinner, indicating that as a respondent gets older, their demand for

convenience food decreases for all three meal occasions at a decreasing rate because the age squared term is positive. The coefficient estimates for the number of end dishes consumed per day show that as the number of end dishes increase, the demand for convenience food increases for breakfast and dinner but not lunch.

At-Home Convenience Food Consumption and BMI

Weight gains likely develop due to a combination of factors. Previous research suggests that the individual's body weight is influenced by several major categories of variables, including genetic (Cardon 1995; Barsh et al. 2000) and physiological factors; demographic factors; physical activity patterns; and dietary factors (Lahti-Koski et al. 2000; Ritchie et al. 2001; Wang and Beydoun 2007).

Demographic factors such as gender, income, family types, and education provide useful indicators of environmental and household influences potentially related to body weight. Nayga (1999) reported that individuals with a lower education level are more likely to be obese than others. Kuchler and Lin (2002) found an inverse relationship between education level and weight status among adults regardless of gender. Kuchler and Lin (2002) suggested that at the low end of the income distribution, additional income primarily supports additional food consumption and raises BMI, while additional income primarily helps satisfy the demand for thinness at the upper end of income distribution. More females in the United States seem to fall in the portion of the income distribution where food needs are met. Paeratakul et al. (2002) found that the nature of obesity-related health risks is similar in all populations, the specific level of risk associated with a given level of obesity may be different depending on gender, race and socioeconomic condition

Nayga (2000) reported that household size correlates positively and significantly with weight status and the probability of being obese. Acculturation may also influence the relationship between body weight and socio-demographic factors. The risk of obesity has been reported to be 3.5- to 4-fold greater between U.S.-born versus foreign-born Asian American adults. The highest levels of overweight were found among black non-Hispanic females and Hispanic males, but Asian Americans who were neither Chinese nor Filipino were also more likely to be overweight. Among Asian Americans and Hispanics, there were also significant differences by gender and for post-migration generations (Popkin and Udry, 1998; Pan et al. 1999).

Relationships have been found between eating patterns and overweight. Reported associations of food groups with overweight include low intake of fruit and vegetables (Kennedy and Powell 1997; Muller et al. 1999; Howarth et al. 2001), high intake of fast foods and sweets (Munoz et al. 1997; Muller et al. 1999); and high intake of sugar-sweetened beverages such as soft drinks (Ludwig et al. 2001). Based on the weight of epidemiologic and experimental evidence Malik et al. (2006) concluded that a greater consumption of sugar-sweetened beverages is associated with weight gain and obesity. Wang and Beydoun (2009) found positive associations between meat consumption and BMI.

Away-from-home food expenditure has increased from 33% of total food expenditures in 1970 to 49% in 2007 (USDA 2008). Consumption of foods at fast food and other restaurants has been associated with a diet high in fat and low in nutrient density (Dausch et al. 1995; Cusatis and Shannon 1996; Zoumas-Morse et al. 2001). Eating restaurant foods or fast foods has also been associated with high weight and

energy intake among women (McCrory et al. 1999; Binkley et al. 2000). Bowman and Vinyard (2004) found that adults who reported eating fast food on at least one survey day had higher mean body mass index values than those who did not eat fast food on both survey days. Jeffery et al. (2006) found that eating at "fast food" restaurants was positively associated with having children, a high fat diet and BMI; it was negatively associated with vegetable consumption and physical activity (Jakicic et al. 2002; Tate et al. 2007).

As discussed in previous sections, the demand for convenience for at-home food consumption is influenced by household income and the presence of children in the household. Does the increase in convenience for at-home foods consumption contribute to increased body weight like away-from-home food consumption does?

The explanatory variables include socio-demographic variables, such as if female head had college education, household income, household size, race, age, gender, and the census region where the participant resided. Two life-style related variables, i.e., exercise frequency and the average number of end-dishes for away-from-home meals per day (AFH meals). In addition, we included the types of food the NET participants ate and convenience indices. The types of food are measured in average number of end-dishes eaten per reporting day, because there was no serving size information available. Seven food items were included in the analysis: soft drinks, fruits, vegetables, cereals, dairy products, meats, and legumes. Three equations were estimated using the convenience indices for three different eating occasions, respectively. In the regression analysis, convenience indices are endogenous; therefore, the predicted values for

convenience indices from the tobit analyses presented in Table 3 were used in the regression. Results are shown in Table 4.

Results show that BMI is negatively related to the college education of female heads (FH College), when the female head had a college education, the NET participant's BMI would be 0.3046 lower than those whose female heads had no college education (Table 4). BMI is also negative related to household income. For every $1,000 increase in household income, the NET participant's BMI would decrease by 0.0155. The coefficient estimates show that BMI is not influenced by household size. Additionally, there was no significant difference in BMIs between Hispanics, Black, White and other race.

As expected, participants who exercised weight less than those who did not exercise. The estimates for the exercise variable show that for each day that the NET participant exercised, his/her BMI would decrease by 0.20. The coefficient estimates for the age variables show that BMI is positively related to the age of the participant. The older the participant is, the higher his/her BMI becomes. The estimates for the two age variables, age and age squared, show that the increase in BMI with respect to age is increasing at a decreasing rate with the influence of age on BMI peaking at about 54 years and then decreasing. Male participants had higher BMIs than female participants; however, this relationship was insignificant, an indication that the result is not robust. Results also show that there are regional differences in BMI. NET participants from the Northeast and Mid-West regions had lower BMI than those from the West (base for comparison).

With respect to dietary intakes frequencies or the number of end-dishes consumed, results show that the number of end-dishes consumed away-from-home (AFH) is positively and significantly associated with BMI. Every AFH end-dish consumed increased BMI by 0.14. This finding is in agreement with previous studies that suggest a positive association between BMI and eating out (Binkley et al. 2000; Lin et al. 1999; McCory et al. 1999). Results also show that the number of fruit (except by day of the week) and legume end-dishes consumed is negatively related to BMI and the number of meat end-dishes consumed is positively related to BMI. The coefficient estimates for convenience indices are either positive or negative, but all of the estimates are statistically not different from zero, an indication that the convenience of at-home food preparation has no impact on BMI.

Concluding Remarks

A variation of the household production theory was used to select relevant explanatory variables for the demand for convenience foods. The analysis of the demand for convenience in at-home food preparation and consumption demonstrates that the demand for convenience differs in meal occasions; and the presence of children plays an important role in the demand for convenience. Results show that the presence of children in a household increases the demand for convenience in dinner occasions, especially in those households that have children of different age groups. In addition, the number of end dishes eaten is positively related to the demand for convenience foods. This finding seems to support what the household production theory suggests, i.e., one has limited time or labor supply, when one allocates time to take care of children, s/he would have less time to prepare meals, as a result, the demand for convenience increases.

With regard to demographics, results show that primary users of convenience foods are white, single, and higher income respondents. These findings are consistent to those found in the Capps, Tedford, and Havlicek and the Lin, Mancino, and Lynch studies.

Results show that the consumption of convenience foods had no impact on BMI, an indication that the use and consumption of convenience food at home may save food preparation time; however, they do not contribute to body weight. Convenience saves food preparation time, but it does not mean the foods are convenient to eat – they still need to be prepared. Results also show that the number of away-from-home end dishes and meat end dishes had a positive relationship to BMI; the number of fruit and legume dishes eaten had a negative relationship with BMI. The lack of influence of at-home convenience food consumption and the significant relationship found between BMI and a selected group of food end dishes, including the number of end dishes eaten away-from-home, suggest that the consumption of certain groups of food had more influence on BMI than if the end dishes were convenient to prepare. In other words, convenience in at-home food preparation does not mean high calories in food.

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Table 1. Sample statistics – NET

Variable Definition	Variable Name	Mean	Standard Deviation
Convenience Index			
All Meals		2.0585	0.3289
Breakfast		2.5350	0.4532
Lunch		1.9166	0.5095
Dinner		1.5598	0.4360
Weekdays		2.0715	0.3396
Weekends		2.0712	0.4002
Income ($1,000)	Income	51.8343	36.2598
Household Size (Persons)	HH Size	3.2431	1.4619
Male (Proportion)	Male	0.4748	0.4994
Type of Household (Proportion)			
Singles	Singles	0.1076	0.3100
Traditional Household	Traditional	0.3317	0.4709
Working Parent(s)	Working	0.1930	0.3947
Senior	Senior	0.0705	0.2560
Empty Nester	(Base)	0.2971	0.4570
Census Region (Proportion)			
Northeast	Northeast	0.1839	0.3874
Mid-West	Mid-West	0.2670	0.4424
South	South	0.3577	0.4793
West	(Base)	0.1914	0.3934
Presence of Children (Proportion)			
Age < 6	C < 6	0.1334	0.3400
Age 6-12 only	C 6-12 only	0.0995	0.2994
Age 13-17 only	C 13-17 only	0.0863	0.2808
Age < 6 & 6-12	C < 6 & 6-12	0.0963	0.2950
Age <6 & 13-17	C <6 & 13-17	0.0100	0.0994
Age 6-12 & 13-17	C 6-12 & 13-17	0.0810	0.2728
All 3 Age Groups	C all 3 groups	0.0204	0.1414
Ethnicity and Race (Proportion)			
Hispanic	HISP	0.0793	0.2703
White	WHITE	0.8720	0.3342
Black	BLACK	0.0863	0.2808
Other Race	(Base)	0.0418	0.2000
Age (Years)	AGE	38.29	22.67
Number of End Dishes/meal	No. of End Dishes		
All Meals*		2.06	0.33
Breakfast		2.53	2.30
Lunch		1.92	2.17
Dinner		1.56	2.03
Weekdays*		2.07	0.34
Weekends*		2.07	0.40

*Include snacks.

Table 2. Test statistics for heteroskedastic two-limit model

	Log-likelihood function		Test-statistic
	Regular	Heteroskedastic	
All Meals	-1,194.58	-863.81	661.53
Breakfast	-3,442.24	-3,032.53	819.42
Lunch	-2,824.69	-2,435.20	778.99
Dinner	-1,911.51	-1,570.32	682.38

The table critical value is $\chi^2_{(.005,23)} = 44.1813$.

Table 3. Tobit estimates by meal occasion

	Breakfast		Lunch		Dinner	
	Est.	SE	Est.	SE	Est.	SE
Constant	2.6155*	0.0643	1.7966*	0.0639	1.4863*	0.0501
Household Income	0.0006*	0.0002	0.0012*	0.0002	0.0001	0.0002
Type of Household						
Single	-0.0320	0.0266	0.0333	0.0299	0.0841*	0.0229
Senior	-0.0739*	0.0239	0.0090	0.0250	-0.0424*	0.0204
Traditional	0.0923	0.2157	-0.0408	0.0742	-0.2319*	0.0930
Working	0.1094	0.2162	-0.0458	0.0749	-0.2359*	0.0931
MALE	-0.0426*	0.0133	-0.0254*	0.0129	0.0017	0.0099
HH SIZE	-0.0445*	0.0254	-0.0114	0.0264	-0.0774*	0.0194
$(\text{HH SIZE})^2$	0.0021	0.0033	-0.0039	0.0033	0.0061*	0.0025
Presence of Children						
C < 6	-0.1026	0.2170	0.0591	0.0762	0.3049*	0.0935
C 6-12 only	-0.0262	0.2176	0.0723	0.0742	0.2710*	0.0945
C 13-17 only	-0.0674	0.2168	0.0499	0.0750	0.2513*	0.0930
C < 6 & 6-12	-0.0835	0.2185	0.1493*	0.0786	0.2704*	0.0960
C <6 & 13-17	-0.0345	0.2290	0.0936	0.1065	0.2125*	0.1110
C 6-12 & 13-17	-0.0801	0.2170	0.0631	0.0777	0.2643*	0.0944
C all 3 groups	0.0369	0.2251	0.1334**	0.1011	0.2479*	0.0981
Census Region						
Northeast	0.0921*	0.0201	-0.0049	0.0212	-0.0429*	0.0173
Mid West	0.1106*	0.0202	-0.0311**	0.0207	0.0472*	0.0168
South	0.0234	0.0184	-0.0256**	0.0194	0.0290*	0.0161
Ethnicity/Race						
HISP	-0.0430*	0.0241	0.0660*	0.0246	-0.0361*	0.0213
BLACK	-0.2607*	0.0414	0.0383	0.0397	-0.0985*	0.0306
WHITE	0.0157	0.0321	0.0261	0.0291	0.0229	0.0259
AGE	-0.0019*	0.0010	-0.0040*	0.0010	-0.0042*	0.0009
$(\text{AGE})^2$	0.0000	0.0000	0.0000	0.0000	0.0000*	0.0000
No. of End Dishes	0.0210*	0.0024	0.0770	0.0021	0.0817*	0.0012
σ	0.6728*	0.0918	0.7905*	0.0792	0.6855*	0.0618
Mean of Dep. Var.	2.5350	0.4532	1.9166	0.5095	1.9987	0.2883
N	4,216		4,034		4,220	

*Statistically different from zero at α = 0.05 level.
**Statistically different from zero at α = 0.10 level.

Table 4. Convenience and BMI

Variable	Estimate	SE
Constant	15.9409*	4.6619
FH College	-0.3046**	0.2363
HH Income	-0.0155*	0.0036
HH Size	0.2388	0.3468
$(\text{HH Size})^2$	-0.0371	0.0448
Hispanic	0.2434	0.4220
White	0.0070	0.5399
Black	-0.1668	0.7679
Exercise Freq	-0.2054*	0.0439
Age	0.5139*	0.0187
Age^2	-0.0047*	0.0002
Male	0.2848	0.2307
N East	-0.5950**	0.3840
Mid West	-0.5943*	0.3533
South	-0.3793	0.3158
Food Intake Frequency		
Soft Drinks	0.0499	0.2487
Fruit	-0.3935*	0.1722
Vegetables	-0.2778	0.2493
Cereals	-0.0583	0.1948
Dairy Products	0.1521	0.1712
Meats	1.1943*	0.1875
Legumes	-0.8846*	0.4871
AFH Meals	0.1437*	0.0456
Instrumental Variable (convenience Index)		
Breakfast	-1.3971	1.6235
Lunch	0.3345	0.7879
Dinner	0.9251	0.8177

*Statistically different from zero at $\alpha = 0.05$ level.
**Statistically different from zero at $\alpha = 0.10$ level.