Eating Out: An Important Source of Food for the Poor and the Food Insecure

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Abstract

Food consumption behaviors in food secure and food insecure households are compared. A two-stage budgeting and a double-hurdle model are used in the estimation. The results of the paper show that both food away from home and food at home are normal goods for both food secure and food insecure households. However, the effects of family structure on food consumption differ for the two household types. For food secure households, having one more child or one more working family member results in a larger marginal increase in foo consumption than that for food insecure households. In addition, households with married heads of household are more likely to eat out in food secure households but less likely to eat out in food insecure households compared to households with unmarried heads of household.

Introduction

One of the most dramatic changes in consumer food demand in the last 25 years is the trend towards greater consumption of food away from home (FAFH). Expenditures on FAFH represented 42% of the average household food expenditure in 1999 (BLS, 2001). During the period 1996-99, spending on FAFH increased 22.4%; spending on food at home increased 4.1%. The Consumer Expenditure Survey (CES) data also show that two-person consumer units had the greatest increase in spending on food at home, and four-person consumer units had the greatest increase in spending on FAFH. Although food-at-home (FAH) spending still accounts for the larger share of total food expenditure, the consumption of purchased meals away from home has become more and more important relative to food consumed at home. A growing economy, rising numbers of dual-income families and the wide availability of fast-food outlets have led to steady increases in spending on FAFH.

Based on the results from the CES in 1999, households with per capita before tax income of less than $5,000 spent 16% of their total expenditure on food, and 37.21% of their food expenditure on FAFH. Households with per capita before tax income between $10,000 and $29,999 spent around 15% of their total expenditure on food, but with different expenditure on FAFH: 32% for those with per capita income between $10,000 and $14,999, 34% for per capita before tax income between $15,000 and $19,999, and 38% for per capita income between $20,000 and $29,999. The share of food expenditure spent on FAFH was 50.41% for those with per capita income larger than $70,000. The numbers confirm that the share of food expenditure decreases as income increases, but the share of FAFH increases as income increases. The results imply that consumption behavior is different for the different income groups, yet FAFH is an important component for all income groups. Some authors

try to compare spending behavior differences based on income distribution. For example, Sharpe and Abdel-Ghany (1999) found significant spending differences between the poor and nonpoor for food at home, housing, health, transportation, and other expenses. However, they did not find significant differences in spending between poor and non-poor for FAFH.

Based on Bickel et al. (2000), "traditional income and poverty measures do not provide clear information about food security, even though food insecurity and hunger stem from constrained financial resources." Although being a low-income household does not mean the household is food insecure, income is one of the main factors that causes households to suffer food insecurity or even hunger. The probability of being food insecure for low-income households is larger than that for high-income households. The consumption behaviors are also likely to be different between households with food insecurity and other households. For food insecure households, people are first and foremost motivated to satisfy their basic physiological needs for food in the context of the traditional food preferences, the lowest level of the Maslow's hierarchy of needs pyramid. In contrast, people in food secure households are motivated by factors higher on the pyramid. Their attitudes towards food may be understood by considering food choices in the context of safety, belongingness, esteem, and even self-actualization and self-fulfillment needs, which are at the top of Maslow's hierarchy (see Belonax 1997 for details). The different needs between food secure families and food insecure families imply that choices between consumption at home and consumption away from home may be decided by different factors. FAFH includes meals or snacks where food preparation is performed by a commercial food facility such as restaurants, fast food outlets, cafeterias, and vending machines. Households are more likely

to chose FAFH if they are food secure, partly because expenditure on FAFH includes a service component (tip) and may involve increased commuting (travel) expenses.

Our study examines the effects of family structure on FAFH and compares the different roles of family structure, food stamp program (FSP) participation, price, and total food expenditure between food secure and food insecure households. An examination of FAFH consumption behavior is expected to provide valuable information about the underlying explanatory factors and the differences in consumption behavior between food secure and food insecure households. This focus is made possible by the recent collection of data on food security status in a large, national survey of households.

This study uses data from the April 1999 Current Population Survey Food Security supplement (CPS-FSS) to estimate demand for FAFH. The survey data make possible the estimation of disaggregate income and price elasticities for specific population groups, allow the opportunity to analyze the importance of socioeconomic and demographic factors on consumption decisions, and provide a large number of observations and thus avoid any problem of degrees of freedom. However, because price information is not collected in the survey, estimation of price parameters make use of the Consumer Price Index (CPI) for different regions based on consolidated MSA codes. An interarea price index (IRPI) developed by Kokoski, Cardiff, and Moulton (1994) is used to adjust the price difference between different regions. The CPI and IRPI for each of the above categories are matched with household observations by month and region.

Households are classified on the basis of estimated food security scales. The food security scales are based on a set of 18 survey items included in the CPS-FSS that ask respondents directly about their behavior and food choices conditioned on financial

constraints. Based on their responses, households are classified into three categories: food secure, food insecure without hunger, and food insecure with hunger (see Bickel et al., 2000 for details). We combined households in the categories of food insecurity without hunger and food insecurity with hunger as the food insecure group.

The following sections present the econometric models, describe the data source and sample, provide empirical estimation results, and summarize major findings.

Methodology

Zero problem issue in FAFH

The use of CPS data on FAFH allows examination of the effects of detailed demographic variables on consumption decisions. However, zero observations in the dependent variable present new estimation problems with the cross-section survey data. The CPS data on expenditures for FAFH only corrected the previous week's information.

There are several methods used for estimating the demand for FAFH in the presence of a large number of zero observations. These methods include the Tobit model (McCracken and Brandt, 1987), the double-hurdle model (Yen, 1993 and 1996; Jensen and Yen, 1996), Heckman's two-stage procedure (Park and Capps, 1997;), the log-linear model (Pol and Pak, 1995), and the switching regression analysis (Lee and Brown, 1986; Jensen and Manrique, 1998).

Based on the literature, if zero observations are caused by corner solutions, the Tobit model is more suitable (Reynolds and Shonkwiler, 1991). If they are caused by either corner solutions or non-participation, then the double-hurdle model is appropriate (Yen and Huang, 1996; Yen and Jones, 1997; Jensen and Yen, 1996), and if they are caused by either corner

solutions or infrequency purchases, then the infrequency of purchase model might be employed (Su and Yen, 1996).

Because the CPS provides only information on expenditures observed for a one-week period, it is difficult to know whether they are caused by non-participation or by infrequency purchase. To select which one is more suitable, a comparison between the two non-nested models, i.e., the double-hurdle and the purchase infrequency models, is carried out. Based on Su and Yen (1996), we also use a Vuong test (Vuong, 1989) to carry out the comparison. In the present application, the results of the statistical testing indicate that zero FAFH consumption is caused by a corner solution or true non-participation. Therefore, a double-hurdle model is used in the estimation.

The double-hurdle model features two stochastic processes that determine the probability and conditional level of consumption, and it accounts for zero observations resulting from true nonconsumption determined by economic and market determinants (corner solutions) as well as other factors such as "conscientious abstention" (Pudney, 1988). In our FAFH case, the first hurdle arises from the participation in the FAFH market, and the second hurdle comes from whether the household indeed consumes the food.

Empirical specification

The demand for FAFH is analyzed in the following two steps. First, a food expenditure equation is estimated based on a linear Engel relationship, i.e.,

$$Exp_i = a + b \times INC_i,\ i = 1,2,\ldots,n \qquad (1)$$

where Exp_i and INC_i represent the ith household's food expenditures and income, respectively, and a and b are parameters. To control for differences in family structure and

other demographic information that varies across households, a number of variables specified earlier were added to the equation. The completed model to be estimated is

$$Exp_i = a_0 + \sum_k a_k s_{ki} + b \times INC_i + \varepsilon_i \qquad (2)$$

where the *s*'s are demographic and socioeconomic variables, the *a*'s and *b*'s are parameters to be estimated, and ε is the usual disturbance term (the ε's are independent $N(0,\sigma^2)$). Note that the residual ε_i may be heteroskedastic (Maddala, 1983, pp. 225-226). A weighted least squares method is used to estimate (2).

Second, we estimate the demand for FAFH based on the expected total food expenditure predicted in the first stage. Given the adding-up restriction of the LA/AIDS share equations, it is only necessary to estimate one equation of the two-equation system. The FAH equation is dropped from the estimation, with its parameters estimated from the symmetry and homogeneity conditions.

The double-hurdle model is described here. As we discussed earlier, households have a choice in how they buy food for consumption. For households that consume food away from home, there exist two hurdles: to participate in the market, and to actually consume. The first hurdle is a probit mechanism for the consumption decision and the second hurdle is a Tobit mechanism. Both hurdles are assumed to be linear in their parameters (α,β), with additive disturbance terms *u* and *v* randomly distributed with a bivariate normal distribution.

Let *X* and *Z* be the regressors that influence participation and consumption. The double hurdle model, developed by Cragg and Atkinson et al. (1984), can be represented as

$$\begin{array}{ll} y = X\beta + v & \text{if } \ Z\alpha + u > 0 \ \text{ and } \ X\beta + v > 0 \\ 0 & \text{otherwise} \end{array} \qquad (3)$$

where y is the share of food expenditure away from home. Because the LA/AIDS (Deaton and Muellbauer, 1980) can be interpreted as a first-order approximation to any demand system, its use allows tractable estimation of the second stage (i.e., within-group) allocation process without the imposition of restrictive a priori assumptions with regard to expenditure effects. Assume that the group food expenditure functions satisfy the AIDS formulation, i.e., that they can be written as

$$y_i = \alpha_i + \beta_i \log(\frac{e_t}{P_t}) + \sum_j \gamma_{ij} \log P_j$$
$$\log P_t = \alpha_{0i} + \sum_i \alpha_i \log P_i + \frac{1}{2}\sum_i \sum_j \gamma_{ijt} \log P_j \log P_i \quad (4)$$

where y_{it} is the expenditure share of the FAFH in food expenditure, e_t is total food expenditures in group t, P_{it}, P_{jt} is the price of the FAFH and FAH, respectively; and the α's, β's, and γ's are coefficients to be estimated. To measure the effects of demographic and socioeconomic information, demographic translating is used to incorporate the demographic and socioeconomic variables into the LA/AIDS model. As usual, the Stone price index is used in the estimation.

The error terms u and v are independent and are distributed as $u \sim N(0,\sigma^2)$ and $v \sim N(0,1)$. Terms v and u are assumed to be distributed as bivariate normal,

$$(u,v) \sim \begin{bmatrix} 1 & \sigma_{uv} \\ \sigma_{uv} & \sigma^2 \end{bmatrix}. \quad (5)$$

The double-hurdle model specified above relies crucially on the assumption of bivariate normal errors as mentioned by Yen, Jensen, and Wang (1996). To relax the assumption of normality, they applied the inverse hyperbolic sine (IHS) transformation to the double-hurdle

model. Based on their suggestion, we also apply the IHS transformation to the dependent variable so that we can allow for nonnormal errors,

$$y(\theta) = \log[\theta y + (\theta y^2 + 1)^{0.5}]\theta^{-1} = \sinh^{-1}(\theta y)\theta^{-1} \tag{6}$$

where θ is an unknown parameter. With the transformation, the error term has a better chance of satisfying the normality and homoskedasticity assumptions. The transformation is linear when θ approaches zero and behaves logarithmically for large values of y for a wide range of values for θ; it is known to be well suited for handling extreme values (Burbidge et al., 1988). Let $\rho = \frac{\sigma 12}{\sigma}$ be based on the transformation; then the likelihood function for the IHS double-hurdle model is

$$L = \prod_{y=0}\left[1-\Phi(Z\alpha, \frac{X\beta}{\sigma}, \rho)\right] \prod_{y>0}\{(1+\theta^2 y^2)^{-0.5} \times \frac{1}{\sigma}\phi\left[\frac{y(\theta)-X\beta}{\sigma}\right]\Phi\left[\frac{Z\alpha + \rho\left(\frac{y(\theta)-X\beta}{\sigma}\right)}{(1-\rho^2)^{0.5}}\right]\} \tag{7}$$

where $\Phi(.)$ and $\phi(.)$ are the univariate standard normal distribution and density functions, respectively, and $\Phi(.,.,\rho)$ is the bivariate standard normal distribution function with correlation ρ.

In order to overcome the restriction of homogeneity, and Arabmazar and Schmidt (1981), Yen and Jensen (1996), and others, the standard deviation σ is allowed to vary across observations and is specified as a function of exogenous variables *n:*

$$\sigma = \exp(n\gamma), \tag{8}$$

where γ is a parameter vector. The parameters of the model are $(\alpha,\beta,\gamma,\rho,\theta)$.

The IHS double-hurdle model can be estimated by maximizing the logarithm of the likelihood function (7). Estimation of the model requires the specification of the participation, consumption, and heteroskedasticity equations.

The marginal effects on the probability, conditional mean, and unconditional mean are calculated based on the formula given in Yen and Jensen (1996). The effects on probability explain the binary decision on consumption, i.e., to eat out or not. The effects on the conditional level explain what makes those eating out spend either more or less. The effects on the unconditional level provide an overall assessment of the variable's contribution to the consumption level by increasing either the probability or the conditional level. The effects of the explanatory variables are evaluated at the mean of these variables. Although the IHS transformation and the heteroskedasticity specification in the IHS double-hurdle model complicate the expressions for the marginal effects of variables, the marginal effects of continuous variables can be obtained by differentiating the probability, conditional mean, and unconditional mean of consumption. Based on these marginal responses, the elasticities are straightforward. For discrete variables, the marginal effects can be computed as the finite changes in probability, conditional level, and unconditional level resulting from a change in value of these variables from zero to one.

Data and Variable Definitions

Data used in this study are compiled directly from the 1999 CPS data. Since 1995, the CPS survey has included a module to collect information on food expenditures and on food security status of households. The data include demographic and income data on the households and allow for the study of the relationship between food consumption behavior, household demographic variables, and food security status. Households are classified into

two categories: food secure and food insecure on the basis of the response to 18 questions related to food security. Households surveyed provide information on the previous week's total food expenditure, FAFH and FAH. Demographic information includes household size and composition by age and gender, region, state, county, race, income class, population class of metropolitan statistical area, and education and marital status of reference person. The total survey sample consists of 45,000 households for April 1999.

The CPS data do not provide food quantities and prices but do provide food expenditure information. We include the CPI as representative of the price for food, FAFH, and FAH. The source of price data was the Bureau of Labor Statistics' Consumer Price Indexes (CPI) for total food consumption, FAFH, and FAH (U.S. Dept. of Labor, 1999). The regional specification for the CPI includes consolidated MSA codes. Because only the CPI for urban consumers is available, we add an indicator for whether the household is living in a metro area to account for this shortcoming (the data set only provides for metro or non-metro locations). Because the expenditure data are observed across regions, an IRPI must be constructed. IRPI's exist for the year of July 1988 and June 1989, based on a special study conducted by Kokoski, Cardiff, and Moulton (1994). To convert the price index to an IRPI in 1999, each of the indices for 1988 is inflated to its 1999 value by the commodity-specific, region-specific CPI:

$$IRPI_{99} = \frac{CPI_{99}}{CPI_{88}} \times (IRPI_{88}). \tag{11}$$

At the same time, the weights developed by the Bureau of Labor Statistics are used to combine the different goods prices to the food IRPI, nonfood IRPI, FAH IRPI, and FAFH IRPI in 1999.

Income information is reported categorically, rather than by specific level. It includes money from jobs, net income from business, farm or rent, pensions, dividends, interest, social security payments, social assistance cash payments (such as TANF), and any other money income received by members of the family. Households were categorized into fourteen income ranges. In order to choose the sample of interest, it was necessary to convert the categorical income variable to a continuous measure. Because 8.04% of households did not provide income information, we first imputed income categories for those households using Rubin's methods (1987).[1] After imputation of the categories, we used the range midpoints as representative of household income.

As suggested by Andrews, Nord and Kabbani (2001), we chose households with income less than four times the poverty line as our sample for analysis. The poverty line for each household in the sample was estimated based on the number of adults and number of children in the household and the age of the household reference person (older or younger than 65). The relevant poverty line comes from the Census Bureau. The highest-income extreme values were excluded. The total sample in the analysis is 30,280 households; of these households, 10.9% were food insecure. In the sample, households can be distributed in the following income groups: income less than 100% of poverty income (29.6%); between 100% and 130% of poverty income (10.2%); between 130% and 185% of poverty income (10.3%); and between 185% and 400% of poverty income (49.8%).

[1]Income categories were assumed to relate to age, square of age, gender, race, Hispanic, marriage status and education attainment of households, household size, metro or nonmetro, and living regions such as midwest, Northeast, West and South. We imputed the income five times and the results presented in the paper are the average results calculated based on the formula provided by Rubin (Rubin, 1987; Pan, Jensen, and Fuller, 2000).

The dependent variable of the analysis is the share of FAFH in the total food expenditure, which is calculated from the data. FAFH expenditures include expenditures for meals or snacks where food preparation is performed by a commercial food facility. Examples of commercial food facilities are restaurants, fast food outlets, cafeterias, and vending machines. A comparisons of food expenditures between food secure households and food insecure households is presented in Table 1. The mean of weekly total food expenditure per person in the sample is $42.17; FAFH accounts for 25% of food expenditures. Nearly 70% of the households in the sample ate out sometime during the survey week. The mean of total food expenditure per person for food secure households was $43.06; these households spent more than 25% of their food dollar on FAFH and had a 70.72% participation rate for FAFH spending. Households experiencing food insecurity spent on average $34.94 for total food; they spent 15% of their food expenditures on FAFH and 55.24% had FAFH expenditures. Based on Table 1, food insecure households had relatively lower income, lower food expenditure, and lower FAFH participation rates than did households with food security. Those food secure households participating in the FSP had lower income, higher FAH expenditure, less FAFH expenditure and lower FAFH participation rates than did food secure households that did not participate in the FSP. Food insecure households with FSP recipients had lower income, and lower food expenditure (especially lower FAFH expenditure) than did food insecure households that did not participate in the FSP.

To estimate the food expenditure equation and FAFH expenditure equations, we include explanatory variables for price (IRPI) for nonfood, food, FAFH and FAH; number of children less than age 6, between ages 6 and 13, male and female children older than 13, male and female adults between ages 19 and 64, and older than 64; the ratio of food

expenditure with the Stone price index; age of household; an indicator of household education; Hispanic; food stamp receipt; metro or non-metro; and region (Northeast, Midwest, South, or West).

Empirical Findings

Food Expenditure

Table 2 presents the estimated weighted least squares (WLS) results of total food expenditure and associated standard errors for all households, for food secure households and for food insecure households. All of the variables are significant in the equation of food secure households; however, only family structure, an indicator of living in a metro and West area, and income variables are significant at the 10% level for the food insecure equation. The food IRPI and nonfood IRPI are significant in the food secure equation but not in the food insecure equation, although the signs are in the same direction for both groups. One of the interesting results is that the FSP participation indicator is significant and negative in the food secure equation but it is not significant in the food insecure equation, although, again, it is of the same sign. Food secure FSP recipients spend $4.68 less on food than do food secure non-FSP recipients.

Given the other factors, food secure households who are Hispanic spend $3.61 less on food than those who are not Hispanic. A food secure household whose head has a high school degree and is married spends about $7.50 more than those households whose head does not have a high school degree and is not married. The results also show that food secure white households spend $5.64 more than the non-white. Among the four regions, food secure households living in the West spend more on food than those living in the Northeast, South or Midwest; also those who live a metro area spend $10.28 more than those who live in a

non-metro area. Most of these variables in the food insecure equation are not statistically significant, although in general they are of the same sign. The only significant variables are those that indicate for living in metro and West. The results indicate that for food insecure households, those living in a metro area spend $4.21 more on food than those living in a non-metro area; and those who live in the West spend $6.25 than Midwest. These results may relate to family size and living style.

Based on the results, having one additional male child between ages 14 and 18 in the household increases food expenditure by $25.47 and $21.27 per week for food secure and food insecure households, respectively. Having one additional female child between ages 14 and 18 increases food expenditure by $18.92 and $22.21 for food secure and food insecure households, respectively. Children between ages 14 and 18 have the largest marginal effects on food expenditure among family structure variables, especially for the food insecure households. Having one additional working male-adult also increases household food expenditure by $19.18 and $15.50 for food secure and food insecure households, respectively. The marginal effect of having a working female adult is $8.28 and $9.39 for food secure and food insecure households, respectively. The major difference in marginal effects between food secure households and food insecure households is for non-working adults. Having one additional non-working male adult increases food expenditure by $12.71 and having one non-working female adult increases food expenditure by $8.05 for food secure households. The marginal effects of non-working adults on food insecure households are not statistically significant. The results indicate that for food insecure households, household food expenditures are not likely to increase for additional non-working adults. The

smaller effects of variables for food insecure households suggest the households face more constraints on overall household resource.

Elasticities

To further measure the effects of economic situation on food consumption, we present the elasticities of food consumption with respect to the age of the reference person, food prices and total income in Table 3. With a significant and positive effect on the level of food expenditure, the age variable suggests that food secure households with older household heads spend more on food than do other age groups. The effect also is positive but insignificant in the food insecure households. The effects of income are similar and positive for all households. The income elasticity is 0.16 for food secure households and 0.14 for food insecure households. This result implies that a 10% increase in income increases food consumption 1.61% for food secure households and 1.43% for food insecure households. The CPIs for food and nonfood are statistically significant in the food secure equation but not in the food insecure equation. The results imply that a 10% increase in food price decreases food expenditure by 0.79% and a ten% increase in nonfood price increases food expenditure by 0.94% in the food secure households. It also implies that food and nonfood are substitutes for food secure households; the similar signs suggest this also is true for food insecure households.

Food Away from Home

The IHS double-hurdle model for FAFH was estimated by maximizing the logarithm of the likelihood function (Equation (7)). Estimation of the model requires the specification of the participation, consumption, and heteroskedasticity equations. Excluding some variables from the equations is important in an estimation of the double-hurdle model because of the

linear combination of variables $Z\alpha-(\rho/\sigma)X\beta$ (Jones, 1992; Yen, Jensen and Wang, 1996). As in Yen, Jensen and Wang (1996), we excluded some insignificant variables from the participation equation based on preliminary analysis. At the same time, we did not include the logarithm of the ratio of food expenditure with the Stone price index and price variables in the participation equation in order to simplify the calculation of elasticities, though the logarithm of the ratio is statistically significant in the equation. To test whether there is heteroskedasticity or whether an IHS transformation was needed, we used likelihood ratio tests. The results rejected the restricted model of homoskedasticity in favor of the alternative variance specification in the whole sample and food security cases while it accept homoskedasticity in the food insecurity sample. Likelihood ratio tests also unanimously rejected the normality restriction in favor of the IHS specification. As we discussed earlier, Vuong's (1989) non-nested test for model specification identifies the double-hurdle model as the appropriate choice for FAFH. It implies that zero expenditures are better explained by non-participation than by non-purchase.

Marginal effects

Tables 4, 5, and 6 present the marginal effects of probability, conditional level, and unconditional level with respect to different demographic variables evaluated at the sample means. The effects of each discrete variable were calculated for the finite changes in these components of consumption as the value of the variable changed from zero to one, *ceteris paribus.*

The marginal effects indicate that having one additional working female adult or working male adult for food insecure households increases the probability of eating out by about 5.7% and 6.9%, respectively. For food secure households, the numbers are smaller: 0.85% for

working males and 0.83% for working females. The results also show that these two age categories have the relatively largest effects on the probability of eating out among the different family member age groups for both food insecure and food secure households, and that increasing the number of working adults in the family has a greater effect for food insecure households than for food secure households. One of the reasons may be that as incomes (both wages and salaries) increase, the opportunity cost of time increases. The rising value of time has driven households away from home-cooked meals and toward greater demand for convenience. With a significant and negative effect on the probability of eating out, the age variable suggests that older household heads are less likely to consume FAFH than are other age groups. For food insecure households, relative to other households in the group, household heads with a high school degree are 5.8% more likely, those who are white are 0.33% more likely to consume FAFH than are others. Households participating in the FSP are 7% less likely and those who are Hispanic are 11% less likely to eat out than are others. For food secure households, those participating in the FSP are 4.3% less likely to eat out than those not participating in the FSP. The effects of other variables can be interpreted in the same manner. Among all the discrete variables, being Hispanic, participating in the FSP, and living in the Northeast have the largest different effects on eating out. One interesting result here is that food secure households with married household heads in the food secure sample are 0.58% more likely to eat out than are households with household head who are single. However, food insecure households with married household heads are 2.9% less likely to eat out than are those with household heads who are single.

The marginal effects of unconditional consumption show that having one additional working female adult or working male adult increases the share of FAFH 38% and 32% in

food insecure households while it increases 11% and 12% in food secure households. Those who participate in the FSP have a smaller of food expenditure on FAFH: 35% smaller for food secure households and 46% smaller for food insecure households, compared to those not participating in the FSP. Having a high school degree and being white are also associated with a higher share of FAFH; the relative magnitude of the effect of education for food insecure households is higher than for other households. Food secure Hispanic cases and food insecure Hispanic cases have smaller share of FAFH than do non-Hispanic cases.

Elasticities

Table 7 provides the elasticities of the conditional level with respect to the price index; food expenditure and income were also evaluated at the sample means. As shown in the table, the conditional FAFH expenditure elasticity with respect to the level of food expenditure for food insecure households is larger than that for food secure households. The result implies that when food insecure households do eat out, they are relatively more responsive to changes in total food expenditures in spending on FAFH than are food secure households. Both the FAFH IRPI and the FAH IRPI have small but significant effects on the probability of eating out.

The own-price elasticities are negative. The food secure group was more responsive to changes in the price of FAFH, and the food insecure group was more responsive to changes in the FAH price. Both FAFH and FAH price elasticities are significant in the two groups. The elasticities of unconditional mean of food expenditure show that FAFH is a luxury good (with elasticity greater than unity) compared to FAH. The overall effect of food expenditure is driven by both the positive effect on the probability of consumption and by the positive effect on the conditional level of consumption. The income elasticities were almost the same

for food secure and food insecure households. The sign and magnitude of the income elasticities show that FAFH is normal and a necessary good for households.

Summary

In this paper we use an IHS double-hurdle model to estimate consumer demand systems with zero expenditures. The effects of family structure and demographic variables on FAFH consumption vary, to some degree, by different food security status. The results suggest that interaction between the participation and consumption decisions is important in modeling consumption of FAFH and that the specification of a more flexible error distribution is justified. The double-hurdle estimation shows that family structure and demographic variables play significant roles in the decisions about whether to eat out and how much to spend. Being food insecure limits consumers' participation and consumption decisions.

The study has several implications for government and for the FAFH industry. FAFH is important in food expenditures for both food secure and food insecure households. Demographic factors influence eating out: food secure households with married heads of households and food insecure households with single parents are more likely to eat out. Nonwhites, Hispanics, and household heads without a high school degree and living in nonmetro areas are less likely to eat out than are other households. On the whole, the economic and demographic effects on total food expenditure are different for food secure and food insecure households but the share of FAFH response to economic and demographic variables is similar for the two groups. The slight differences are in the age, marital status and gender effects, suggesting important differences in the role of household composition and food purchases.

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Table 1 Comparison between food secure, food insecure, and Food Stamp Program receipts (standard errors in parentheses)

			Food Secure Households:			Food Insecure Households	
	Total	Subtotal	With FSP	Without FSP	Subtotal	With FSP	Without FSP
N	30,280	26,978	1,155	25,823	3,302	904	2398
Weekly total income per household	540.78	565.17	216.33	580.77***(b)	341.54***(a)	190.21	398.57***(c)
($ income)	(2.16)	(2.30)	(5.38)	(2.35)	(4.83)	(5.04)	(5.97)
Weekly total food expenditure per	98.01	99.50	91.84	99.84***	85.82***	81.52	87.44***
Household ($ exp)	(0.41)	(0.44)	(2.33)	(0.45)	(1.12)	(2.17)	(1.31)
Food expenditure per person ($)	42.17	43.06	31.52	43.58***	34.94***	30.54	36.60***
	(0.18)	(0.19)	(0.69)	(0.20)	(0.47)	(0.81)	(0.57)
Average FAH expenditure ($)	73.79	74.11	80.99	73.80***	71.17***	73.30	70.36
	(0.33)	(0.35)	(2.14)	(0.35)	(0.99)	(2.08)	(1.12)
Average FAH expenditure per	30.99	31.30	22.47	31.44***	28.47***	27.47	28.85
person ($)	(0.13)	(0.14)	(1.51)	(0.14)	(0.40)	(0.79)	(0.46)
Average FAH expenditure for	77.08	77.43	83.30	77.16***	74.23***	76.08	73.52
those with FAH ($)	(0.33)	(0.35)	(2.16)	(0.36)	(1.00)	(2.10)	(1.13)
% with FAH	95.73	95.71	97.23	95.64***	95.88	96.34	95.70
	(0.11)	(0.12)	(0.48)	(0.13)	(0.34)	(0.62)	(0.41)
Average FAFH expenditure ($)	24.22	25.39	10.86	26.04***	14.66***	8.22	17.08***
	(0.20)	(0.22)	(0.80)	(0.23)	(0.41)	(0.46)	(0.53)
Average FAFH expenditure per	11.19	11.76	3.54	12.13***	6.46***	3.07	7.75***
person ($)	(0.11)	(0.12)	(0.23)	(0.12)	(0.22)	(0.23)	(0.28)
Average FAFH expenditure for	35.08	35.90	22.47	36.30***	26.53***	18.90	28.85***
those with FAFH ($)	(0.26)	(0.28)	(1.51)	(0.29)	(0.62)	(0.79)	(0.46)
% with FAFH	69.03	70.72	48.31	71.72***	55.24***	43.47	59.67***
	(0.27)	(0.28)	(1.47)	(0.28)	(0.87)	(1.65)	(1.00)

Note: ***(i) difference between food secure and food insecure households, between food secure FSP recipients and not FSP recipients; between food insecure FSP recipients and not FSP receipts is significant at the 1% level, *i=a,b,c.*

Table 2 Weighted least square results of food expenditure equation (independent variable: household food expenditure)

	Total Sample		Food Secure Households		Food Insecure Households	
Variable	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Constant	22.64***	(3.33)	19.78***	(3.63)	49.49***	(8.48)
Education	7.31***	(0.77)	7.50***	(0.82)	2.26	(2.15)
Metro	9.59***	(0.81)	10.28***	(0.86)	4.21*	(2.49)
Northeast	6.57***	(1.07)	6.64***	(1.14)	4.06	(3.17)
West	11.70***	(1.15)	12.62***	(1.23)	6.25**	(3.15)
South	3.63***	(0.91)	4.11***	(0.97)	-0.39	(2.69)
White	5.27***	(1.10)	5.64***	(1.24)	0.67	(2.46)
Hispanic	-4.53***	(1.45)	-3.61***	(1.65)	-2.14	(3.05)
Married	8.42***	(0.94)	8.92***	(1.01)	1.40	(2.70)
FSP participation	1.55	(1.58)	-4.68**	(2.18)	-2.16	(2.37)
Age	0.47***	(0.12)	0.57***	(0.13)	-0.23	(0.34)
Age square	-0.83e-02***	(0.11e-2)	-0.92e-02***	(0.12e-02)	-0.19e-02	(0.35e-02)
Number of children:						
Under 6	8.40***	(0.85)	9.24***	(0.96)	5.01***	(1.74)
Age 6-13	16.06***	(0.68)	16.54***	(0.75)	14.64***	(1.56)
M age 14-18	24.49***	(1.40)	25.47***	(1.54)	21.27***	(3.28)
F Age 14-18	19.21***	(1.44)	18.92***	(1.58)	22.21***	(3.37)
Number of the older adults:						
M-older	6.94***	(2.40)	7.32***	(2.54)	2.30	(7.89)
F-older	4.97**	(2.35)	18.92*	(2.48)	5.94	(7.90)
Number of working-age adults:						
M-w 19-64	18.82***	(0.92)	19.18***	(1.01)	15.50***	(2.19)
M-nw 19-64	10.08***	(2.23)	12.71***	(2.62)	3.48	(4.00)
F-w 19-64	8.49***	(0.83)	8.28***	(0.90)	9.39***	(2.25)
F-nw 19-64	7.02***	(2.60)	8.05***	(3.13)	5.92	(4.54)
Food IRPI	-0.88e-01***	(0.21e-01)	-0.98e-01***	(0.19e-03)	-0.11e-01	(0.55e-01)
Non-food IRPI	0.12***	(0.28e-01)	0.14***	(0.30e-01)	0.19e-01	(0.73e-01)
Income	0.30e-01***	(0.14e-02)	0.28e-01***	(0.15e-02)	0.36e-01***	(0.55e-02)
Adjusted R-square	0.26		0.26		0.24	
N	30280		26978		3302	

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 3 Elasticities of food expenditure for some of the continuous variables in the food expenditure equation

	Total		Food Secure Households		Food Insecure Households	
Variable	Point Estimate	Std Error	Point Estimate	Std Error	Point Estimate	Std Error
Age	0.22***	(0.12)	0.27***	(0.64e-01)	0.11	(0.17)
Nonfood IRPI	0.86e-01***	(0.20e-01)	0.94e-01***	(0.20e-01)	0.15e-01	(0.57e-01)
Food IRPI	-0.73e-01***	(0.18e-01)	-0.79e-01***	(0.19e-01)	-0.12e-01	(0.58e-01)
Income	0.17***	(0.79e-02)	0.16***	(0.85e-02)	0.14***	(0.22e-01)

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4 Marginal effects of probability for FAFH with respect to the demographic variables

	Whole Sample		Food Secure Households		Food Insecure Households	
Variable	Point Estimate	Std Error	Point Estimate	Std Error	Point Estimate	Std Error
Number of children:						
Under 6	-0.50e-2***	(0.64e-03)	-0.95e-02***	(0.14e-02)	-0.13e-02***	(0.50e-03)
Age 6-13	0.11e-01***	(0.24e-02)	0.15e-02	(0.11e-02)	0.18e-01***	(0.60e-02)
M age 14-18	0.13e-01***	(0.47e-02)	0.49e-02***	(0.17e-02)	0.24e-01*	(0.13e-01)
F age 14-18	0.11e-01**	(0.48e-02)	0.27e-02	(0.17e-02)	0.37e-01***	(0.14e-01)
Number of the older adults:						
M-older	-0.27e-01***	(0.10e-01)	-0.13e-01**	(0.51e-02)	-0.59e-01	(0.40e-01)
F-older	-0.10e-01	(0.10e-01)	-0.15e-02	(0.50e-02)	-0.29e-01	(0.39e-01)
Number of working-age adults:						
M-w 19-64	0.32e-01***	(0.35e-02)	0.85e-02***	(0.13e-02)	0.57e-01***	(0.10e-02)
M-nw 19-64	-0.29e-01***	(0.93e-02)	-0.12e-01***	(0.44e-02)	-0.50e-01**	(0.23e-1)
F-w 19-64	0.46e-01***	(0.40e-02)	0.83e-02***	(0.83e-02)	0.69e-01***	(0.10e-02)
F-nw 19-64	0.17e-02	(0.96e-02)	-0.10e-02	(0.46e-02)	-0.25e-01	(0.21e-01)
Age	-0.96e-04***	(0.14e-04)	-0.53e-03***	(0.52e-04)	-0.64e-04***	(0.24e-04)
Education	0.70e-01***	(0.51e-02)	0.23e-01***	(0.15e-02)	0.58e-01***	(0.12e-01)
Metro	0.17e-01***	(0.36e-02)	0.49e-02***	(0.17e-02)	0.64e-02	(0.64e-01)
Northeast	-0.79e-01***	(0.61e-02)	-0.31e-01***	(0.23e-02)	-0.73e-01***	(0.16e-01)
West	-0.32e-01***	(0.49e-02)	-0.14e-01***	(0.20e-02)	-0.21e-01	(0.15e-01)
South	-0.21e-01***	(0.44e-02)	-0.46e-02**	(0.19e-02)	-0.45e-01***	(0.15e-01)
White	0.66e-01***	(0.57e-02)	0.19e-01***	(0.21e-02)	0.33e-02***	(0.12e-01)
Hispanic	-0.94e-01***	(0.73e-02)	-0.24e-01***	(0.30e-02)	-0.11***	(0.14e-01)
Married	0.13e-01***	(0.36e-02)	0.58e-02***	(0.17e-02)	-0.29e-01**	(0.12e-01)
FSP participation	-0.97e-01***	(0.79e-02)	-0.43e-01***	(0.39e-02)	-0.70e-01***	(0.13e-01)

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 5 Marginal effects of conditional consumption for FAFH with respect to continuous variables(Independent variable: share of FAFH on food expenditure)

	Whole Sample		Food Security		Food Insecurity	
Variable	Point Estimate	Std Error	Point Estimate	Std Error	Point Estimate	Std Error
Number of children:						
Under 6	0.88e-03	(0.89e-03)	0.27e-02**	(0.12e-02)	0.10e-2	(0.37e-02)
Age 6-13	0.21e-01***	(0.30e-02)	0.71e-02**	(0.31e-02)	0.19e-01*	(0.10e-01)
M age 14-18	0.21e-01***	(0.60e-02)	0.38e-02*	(0.23e-02)	0.26e-01	(0.17e-01)
F age 14-18	0.18e-01***	(0.61e-02)	0.41e-02*	(0.23e-02)	0.38e-01*	(0.22e-01)
Number of older adults:						
M-older	-0.33e-01**	(0.13e-01)	-0.60e-02	(0.40e-02)	-0.52e-01	(0.45e-01)
F-older	0.14e-01	(0.13e-01)	-0.50e-02	(0.50e-02)	-0.33e-01	(0.41e-01)
Number of working-age adults:						
M-w 19-64	0.40e-01***	(0.41e-02)	0.86e-02**	(0.38e-02)	0.57e-01**	(0.28e-01)
M-nw 19-64	-0.32e-01***	(0.12e-02)	-0.49e-02	(0.38e-02)	0.48e-01	(0.31e-01)
F-w 19-64	0.61e-01***	(0.12e-01)	0.10e-01**	(0.45e-02)	0.67e-01**	(0.33e-01)
F-nw 19-64	0.71e-02	(0.12e-01)	0.86e-02*	(0.53e-02)	-0.24e-01	(0.23e-01)
Age	0.38e-04***	(0.60e-05)	0.52e-04**	(0.24e-04)	0.47e-04***	(0.18e-04)
Education	0.86e-01***	(0.55e-02)	0.29e-01***	(0.95e-02)	0.57e-01*	(0.27e-01)
Metro	0.24e-01***	(0.47e-02)	0.23e-01***	(0.83e-02)	0.12e-01	(0.13e-01)
Northeast	-0.97e-01***	(0.93e-02)	-0.96e-01***	(0.26e-01)	-0.71e-01	(0.45e-01)
West	-0.37e-01***	(0.63e-02)	-0.12e-01**	(0.60e-02)	-0.20e-01	(0.18e-01)
South	-0.28e-01***	(0.56e-02)	-0.25e-02	(0.20e-02)	-0.44e-01*	(0.26e-01)
White	0.83e-01***	(0.81e-02)	0.44e-01***	(0.16e-01)	0.32e-01*	(0.20e-01)
Hispanic	-0.12***	(0.12e-02)	-0.17***	(0.43e-01)	-0.11	(0.75e-01)
Married	0.18e-01***	(0.44e-02)	-0.19e-02	(0.16e-02)	-0.32*	(0.20e-01)
FSP participation	-0.11***	(0.14e-02)	-0.18***	(0.60e-01)	-0.65***	(0.45e-01)

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 6 Marginal effects of unconditional mean for FAFH with respect to continuous variables(Independent variable: share of FAFH on food expenditure)

	Whole Sample		Food Secure Households		Food Insecure Households	
Variable	Point Estimate	Std Error	Point Estimate	Std Error	Point Estimate	Std Error
Number of children:						
Under 6	-0.24e-02	(0.25e-02)	0.29e-01***	(0.59e-02)	-0.15e-03	(0.17-02)
Age 6-13	0.64e-01***	(0.10e-01)	0.80e-01***	(0.18e-01)	0.10**	(0.42-02)
M age 14-18	0.71e-01***	(0.21e-01)	0.45e-01**	(0.21e-01)	0.14**	(0.79-01)
F age 14-18	0.60e-01***	(0.21e-01)	0.49e-01**	(0.21e-01)	0.21**	(0.99e-01)
Number of older adults:						
M-older	-0.12**	(0.46e-01)	-0.74e-01*	(0.40e-01)	-0.31	(0.25)
F-older	0.48e-01	(0.45e-01)	-0.61e-01*	(0.39e-01)	-0.17	(0.22)
Number of working-age adults:						
M-w 19-64	0.14***	(0.14e-01)	0.11***	(0.22e-01)	0.32**	(0.11)
M-nw 19-64	-0.11***	(0.41e-01)	-0.61e-01	(39e-01)	-0.27*	(0.15)
F-w 19-64	0.21***	(0.16e-01)	0.12***	(0.27-01)	0.38***	(0.13)
F-nw 19-64	0.21e-01	(0.42e-01)	0.10**	(0.50-01)	-0.14	(0.12)
Age	0.12e-05	(0.13e-04)	0.58e-03***	(0.13e-03)	-0.70e-05	(0.77e-04)
Education	0.30***	(0.20e-01)	0.13***	(0.29e-01)	0.30***	(0.10)
Metro	0.78e-01***	(0.16e-01)	0.42e-01**	(0.17e-01)	0.36e-01	(0.66e-01)
Northeast	-0.38***	(0.32e-01)	-0.32***	(0.67e-01)	-0.47***	(0.18)
West	-0.13***	(0.23e-01)	-0.55e-01**	(0.24e-01)	-0.12	(0.92e-01)
South	-0.10e-01***	(0.20e-02)	-0.13e-01***	(0.96e-02)	-0.26**	(0.12)
White	0.32***	(0.29e-01)	0.23***	(0.58e-01)	0.19**	(0.90e-01)
Hispanic	-0.50***	(0.46e-01)	-0.48***	(0.92e-01)	-0.84***	(0.26)
Married	0.64e-01***	(0.15e-01)	0.76e-02	(0.51e-02)	-0.17*	(0.90e-01)
FSP participation	-0.47***	(0.50e-01)	-0.35***	(0.11)	-0.46***	(0.16)

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 7 Elasticities of participation, conditional mean and unconditional mean for FAFH with respect to continuous variables

	Whole Sample		Food Secure Households		Food Insecure Households	
Variable	Point Estimate	Std Error	Point Estimate	Std Error	Point Estimate	Std Error
Probability:						
FAH IRPI	0.22e-02***	(0.38e-03)	0.55e-02***	(0.12e-02)	0.16e-02*	(0.97e-03)
FAFH IRPI	-0.15e-02***	(0.40e-03)	-0.70e-02***	(0.11e-02)	-0.29e-02***	(0.11e-02)
Food expenditure	0.87***	(0.78e-01)	0.87***	(0.38e-01)	0.87***	(0.11)
Conditional mean:						
FAH IRPI	0.16***	(0.40e-01)	0.35***	(0.12)	0.29***	(0.89e-01)
FAFH IRPI	-0.22***	(0.38e-01)	-0.44***	(0.14)	-0.17*	(0.82e-01)
Food expenditure	0.87***	(0.25)	0.72***	(0.25)	0.87***	(0.33)
Unconditional mean:						
FAH IRPI	0.18***	(0.40e-01)	0.36***	(0.12)	0.29***	(0.90e-01)
FAFH IRPI	-0.24***	(0.25)	-0.45***	(0.14)	-0.17***	(0.82e-01)
Food expenditure	1.74***	(0.32)	1.59***	(0.29)	1.74***	(0.44)
Income	0.30***	(0.25e-01)	0.25***	(0.25e-01)	0.24***	(0.97e-02)

Note: *** significant at the 1% level; ** at the 5% level; * at the 10% level.