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Introduction

❖ Overweight and Obesity have become important public health problems in the United States (US). There is some evidence suggesting that the primary cause of the problem is increased food consumption rather than reduced exercise (Cutler, Glaeser and Shapiro, 2003; Zizza et al., 2001). Moreover, as shown in Cutler, Glaeser and Shapiro (2003), most of the increase in calories consumed by Americans during the last decades can be attributed to the increase in calories consumed during snacks (Table 1). These authors report that between 1977/78 and 1994/1996 men (women) increased the amount of calories between meal consumption by 241 (160) calories, or 90% (112%) of the increase in their overall calorie intake. These findings shed doubt on the view that fattening meals at fast food restaurants have made American obese and suggests that research analyzing the effect of food consumption on obesity should focus on household's demand and consumption of snacks at home and away from home which has been largely ignored by previous researchers.

Snack Consumption in the United States

❖ Snack foods make up a large proportion of the daily calories consumed by US households. For example, according to Piernas and Popkin (2010a) during the 2003/2006 more than 27% of children's daily calories came from snacks.

❖ Table 1 exemplifies some other long term trends in snacking behavior. For example, as shown in the table American consumers of all ages are not only snacking more frequently but in larger quantities (table 1).

Table 1: Number of snacks consumed per day and amount and energy consumed per snacking occasion by US individuals from the 1977-1978 and 2003-2006 surveys by age group

Age	Children		Adults	
	2 to 18 years	19 to 39 years	40 to 59 years	60+ years
Number of Snacks consumed per day				
1977 to 1978	1.26	1.38	1.34	0.93
2003 to 2006	2.23	2.22	2.35	2.05
Snack Size (grams)				
1977 to 1978	210	235	212	154
2003 to 2006	335	374	354	236
Total energy from snacking (kcal)				
1977 to 1978	357	403	334	278
2003 to 2006	579	679	573	404

Source: Piernas and Popkin (2010b)

Theoretical Framework

❖ Since snacks are considered a convenient food we use the theoretical context of the household production model developed by Becker (1965). The model implies that household utility function composed of commodities (snacks) is maximized subject to the household production function, and income and time constraints.

❖ By solving the utility maximization problem, the demand for snacks is a function of prices, wage rates, nonwage income and socio-demographic household characteristics. In CES surveys, price is not available; hence, the expenditure equation for snacks is specified as:

$$E_i = f(Y, L, D)$$

where E_i is expenditures on snacks category i , Y represents household's income, L represents wife's labor market participation (opportunity cost of women's time) and D represents a vector of socio-demographic household characteristics.

Objective

❖ The objective of this study is to identify how socioeconomic and demographic variables affect the demand for snacks consumed at home and away from home.

Data

❖ The data used in the estimation comes from the Consumer Expenditure Survey (CES years 2002, 2003, 2004, and 2005) administered by the US Bureau of Labor Statistics. In the diary section of the survey, each household reports their expenditures on all types of food consumed at home and away-from-home during a two week period. Snack expenditures were divided into two categories: snacks at home and snacks away from home. Expenditures of snacks at home were subsequently divided into two subcategories: 1) A "healthy snacks" category which include healthy grains based products, peanut products, 100% fruit juices and fresh fruits; and 2) The "unhealthy snacks" category includes ice cream, cookies, candy, carbonated/sugared beverages, potato chips and cakes (i.e., high fat/sugar snacks).

❖ Out of the 25,052 households in the sample, 66% reported consuming snacks away from home, 88% reported consuming unhealthy snacks, and 82% reported consuming healthy snacks.

Empirical Model and Estimation

❖ The dependent variables in our study are household two week expenditures on snacks divided into 3 categories: healthy snacks at home, unhealthy snacks at home, and snacks away from home. The explanatory variables include income, the age and education of the household head, region of residence, the year the survey was completed, race of the household, the hours worked by female members, and a dummy variable indicating household participation on the food stamp program (table 2).

❖ Given the fact that some of the households do not spend any money on some of the snacks categories, econometric estimation requires a censored system estimator. Hence, we used Shonkwiler and Yen (1999) two-step censored system of equations. The procedure is as follows: (1) In the first step, estimate a probit model which explains the participation decision (to buy or not buy the snack category). (2) Use the estimates of from the probit model to estimate the system of expenditure equations accounting for the sample selection problem. Standard errors were estimated using bootstrapping to account for the use of imputed regressors and heteroskedasticity.

Table 2: Participation (Probit Model) Parameter Estimates and Marginal Effects of Variables with respect to Unconditional Expenditures

Variable	Snacks Away from home		Unhealthy Snacks		Healthy Snacks	
	Participation	Marginal Effects	Participation	Marginal Effects	Participation	Marginal Effects
Age	-0.0070**	-0.0594**	0.0068**	0.1069**	0.0129**	0.1242**
High School graduate	-0.2804**	-1.3782**	-0.0289	0.6661*	-0.1966**	-4.5065**
Bachelor's degree	-0.0807**	-0.0314	-0.0191	1.2485**	-0.1269**	-2.7177**
Married	0.0932**	-0.0966	0.2869**	6.3720**	0.4104**	4.9974**
White	-0.2397**	-2.4145**	-0.0143	-0.7775**	0.0555	-0.4374
Black	-0.3334**	-4.6772**	-0.1677	-6.6140**	0.0368	-1.8341
Asian and Pacific Islander	-0.3324**	-3.2241**	-0.2439**	-5.6538**	0.1510	0.9427*
Northeast	-0.0454*	0.1046	-0.1241**	0.0326	-0.0259	-0.0916
Midwest	0.0406	-0.1715	0.0005	0.5527**	-0.0764**	-1.8002**
South	-0.0812**	-1.1672**	-0.0617**	-1.0211*	-0.1764**	-2.6567**
Income (\$1000)	0.0021**	0.0377**	0.0025**	0.0684**	0.0023**	0.0403**
Children less than 18	0.1974**	2.6407**	0.4354**	11.0113**	0.3805**	4.7257**
Hours of work female	0.0013**	0.0325**	0.0005	0.0217**	-0.0019**	-0.0235**
Food Stamp Participation	-0.1658**	-2.1489**	0.3499**	4.0619**	0.1919**	1.2336**
Household head is employed	0.3056**	2.2957**	0.1186**	2.2977**	0.1389**	1.4673**

Note: Significance levels of 0.05 and 0.10 are indicated by ** and *, respectively.

Results

❖ On average, household expenditures on snacks away from home, unhealthy snacks and healthy snacks during the 2 week period are \$9.85, \$22.51 and \$12.53, respectively.

❖ The sign of the parameter estimates for the participation equations indicates if the variable increases (positive sign) or decreases (negative sign) the likelihood of buying the snack category. For example, a household's likelihood of non-zero snack consumption at home and away from home increases with income, presence of children in the household, and household head participation in the work force. Households participation in the Food Stamp Program have a negative and significant effect on a household's probability of eating snacks away from home and a positive and statistically significant effect on a household's probability of eating snacks at home.

❖ The "marginal effects" column shows the marginal effects with respect to observed expenditures (both zero and higher than zero expenditures). Marginal effects of the dummy variables are the effects in relation to an individual with characteristics of the dummy variables not included in the model (household whose household head has Master/Doctorate degree, without children and not participating in the Food Stamp Program). For example, relative to this type of household, households who participates in the food stamp program spends \$2.14 less on snack away from home while they spend \$4.06 and \$1.23 more on unhealthy and healthy snacks at home, respectively.

❖ The marginal effects of income translated to elasticities indicate that a 1% increase in income increases expenditures on snacks away from home by 0.2%, and in unhealthy and healthy snacks at home by 0.16% and 0.17%, respectively.

Conclusions

❖ This study has identified how key economic and demographic variables affect household's expenditures on snacks.

❖ Results of this study could be used to project how economic and demographic changes in the US population are affecting the demand for snacks at home and away from home and/or target nutrition education programs aimed to fight overweight and obesity.

❖ A limitation of this study is the use of expenditure data which does not allow to tease out quantity and quality effects.

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