U.S. Demand for Chocolate Milk as an Alternative Energy/Sports Drinks

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ABSTRACT

Consumption of chocolate milk in the United States is growing as an alternative beverage to sports and energy drinks. Recent literature suggests that consumption of chocolate milk vis-à-vis sports and energy drinks is an effective recovery aid after prolonged workouts. In this light, knowledge of price sensitivity, substitutes/complements and demographic profiling with respect to consumption of chocolate milk is important for manufacturers, retailers and advertisers of chocolate milk from a competitive intelligence as well as from a strategic decision-making perspective. Using 62029 household level observations from Nielsen HomeScan Panel for 2011 and Tobit model, factors affecting the demand of chocolate milk was determined. Results show that, chocolate milk is substitute for energy drinks. Factors affecting the probability of purchase of chocolate milk are, price, household size, education status, race, region, the presence of children, gender of household head. The factors affecting the volume of purchase of chocolate milk are price of chocolate milk, household size, education status, race, region, the presence of children, gender of household head.

Key Words: Consumer demand, chocolate milk, energy drinks, sports drinks, Nielsen data, tobit model, censored demand

JEL Classification: D11, D12

INTRODUCTION

Energy drinks market has become a multibillion dollar business in the United States and they are referred to as an exponentially growing segment in the beverage industry, second only to bottled water. According to Beverage Marketing Corporation, Energy drinks consumption advanced by 6.4% in volume from 2013 to 2014, sports drinks increased 3% in volume, and the sports beverage segment exceeded 1 billion gallons for the first time in 2011 and topped 1.4 billion gallons in 2014. Sales of energy mixes have grown by 434% between 2011 and 2013. Sales were ticking up for the energy drink category according to data from Information Resources Inc. (IRI), Chicago, for the 52 weeks ended Dec. 28, 2014. The $10.5 billion category saw dollar sales increase 4.9% and units improved 5.4% to 4 billion.

For flavored milk market, according to NPD Group (2010) and Nielsen (2010), U.S. consumption of chocolate milk is growing and plain chocolate milk servings grew from 1.2 billion in 2009 to 1.4 billion in 2010. But after the USDA updated school meal standards, flavored milk was removed from school cafeterias in response to the concerns about childhood obesity. Because 8% of all fluid milk in the U.S. is consumed in school and 61.6% of all school milk is chocolate milk, this policy is with the result that milk consumption plummets by 35%.Furthermore, researchers have found that there's been a decade-long decline in the popularity of breakfast cereal market in the United States. According to 2011-2012 National Center for Health Statistics survey, 15% of U.S. do not eat breakfast. To a certain extent, skipping breakfast leads to a drop of chocolate milk consumption because around 20% of milk is used in the cereal. The third

disadvantage of milk market is a rising competition for chocolate milk with other beverages, such as protein shakes and soy and almond milks. As a consequence, all these factors impel chocolate milk industry to look for new target market.

More importantly, many studies have documented over the past couple of years, showing that chocolate milk was a good substitute for energy or sports drinks. Compared with energy drinks, researchers find that chocolate milk is better in reducing debilitating muscle breakdown and increasing endurance. When the runners drank fat free chocolate milk after a strenuous run, on average, they ran 23% longer and had a 38% increase in markers of muscle building compared to when they drank a carbohydrate-only sports beverage with the same amount of calories. Karp (2006) emphasized that chocolate milk contains high carbohydrate and protein content which are effective for people to recover from strenuous exercise.

In contrast, one of the most pressing issues of energy drinks is the ingredient containing many stimulants, such as the caffeine and guarana. In general, energy drinks encompass sports drinks and nutraceutical drinks but people always use the terms, energy drinks and sports drinks interchangeably. Excessive consumption of energy drinks may increase the risk for caffeine overdose and result in greater potential for acute caffeine toxicity. Initially, the primary consumers of energy drinks were athletes. However, as the energy drinks market expanded into various niche markets, the majority of energy drinks are targeted at teenagers and young adults 18 to 34 year old. Kaminer（ 2010）said that 30% of youths between ages 12 and 17 regularly consume energy

drinks. But excessive caffeine is not recommended for people under 18. Although many brands try to allay consumer's concerns about caffeine, this fact has triggered increased negative media coverage and consumers need healthier beverages.

Due to the ingredient advantage of chocolate milk and weakened outlook of milk market, it is a unique opportunity for chocolate milk processors and retailers to enter the fastest growing beverage market as recovery drinks. This could provide an additional occasion for consumers to buy chocolate milk and drive incremental sales. In fact, dairy industry has been repositioning chocolate milk as a contender in the fast-growing market for protein bars, shakes and energy beverages. Since 2012, Milk Processor Education Program (MilkPEP), the group responsible for the "Got Milk?" campaign, has invested $15 million a year into chocolate-milk campaign to strengthen the role of chocolate milk as a new-age sports/energy drink. Also, MilkPEP treated their next 20 year campaign as 'propelling milk back into a position of power'. In 2012, Milkpep launched "My after" campaign to strengthen the consciousness that consuming low-fat chocolate milk is better for athletes. Additionally, chocolate milk, like sports or energy drinks, is aligning with professional athletes and celebrities, incorporating sports games and music to advertise their products. Recently, NBA stars, professional football players, swimmers and running groups have been gradually taking chocolate milk as their recovery drink. Chocolate milk has become the official refuel beverage of many prominent sports organizations and teams, like IRONMAN® triathlon series, Rock' n Roll Marathon series, and Challenged Athletes Foundation.

While the literature linking chocolate milk benefits with emphasis on the healthy ingredient and performance edge are abundant, when it comes to the demand analysis for chocolate milk and sports/ energy drinks, the literature is scarce. Dharmasena and Capps (2009) used Heckman correction to estimate the demand model for chocolate milk, for calendar year 2008 in the Nielsen Homescan panels. They found that the own-price elasticity of demand for chocolate milk was estimated to be -0.04. Factors affecting the probability of purchase of chocolate milk are price of chocolate milk, household income, age of household head, education status of household head. Maynard estimated the flavored milk's own price elasticity which fell within a range from -1.4 to -1.47 by using weekly scanner data for the period 1996 through 1998. But they just used this result to testify whether the price elastic demand for dairy products was increasing. Capps and Hanselman employed the Barten synthetic demand system to estimate own price, cross-price, and expenditure elasticities for major energy drink brands by using weekly survey data from October 2007 to October 2010.

Therefore, a thorough and a complete analysis of demand for chocolate milk and energy drinks are important due to the lack of demand and price information in the literature. And the price sensitivity, substitutes or complements and demographic profiling with respect to consumption of chocolate milk and energy drinks is important for manufacturers, retailers and advertisers of chocolate milk. In this paper, we will pay more attention to: (1) determine the factors affecting the purchase of chocolate milk, and energy or sports drinks (2) estimate the own-price elasticity, cross-rice elasticities and

income elasticity of chocolate milk and energy/sports drinks (3) once the decision to purchase chocolate milk is made, to determine the drivers of purchase volume.

DATA AND METHODOLOGY

The data we used is based on 2011 Nielsen Homescan panel data which provides detailed beverage-purchase information from 62029 households, including expenditures, quantities, and socioeconomic demographic characteristic. The table 1 is the summary statistics for all variables included in the model. We standardized the quantity data as liquid ounces and the expenditures are express in dollars. Therefore we generated the price for three beverages in dollars per gallon. Fraction of households did not buy chocolate milk or energy/sports drinks during the sampling period. In this case, the amount a household spends on recovery drinks would be zero. If the fraction of the observations on the dependent variables takes a limit value, the dependent variable is censored. This kind of consuming behavior leads to corner solutions for some nontrivial fraction of the population. Application of ordinary least squares to estimate this kind of regression gives rise to biased estimates even asymptotically (Kennedy 2003). So Tobit model is indispensable to explicitly model the corner solution dependent variables. Tobit model is applied to outcome variables that are roughly continuous over positive values but have a positive probability of equaling zero (Tobin (1958) and Heckman (1979)). For this data, we do not observe the price of households with zero purchases. Therefore we used an auxiliary regression to forecast the unavailable price. The price for each beverage is regressed on household income, household size, and the region. The parameters estimated from the auxiliary regression are then used to impute prices for the zero-expenditure observations. It is effective method to address endogenous issue. In our Tobit model, the independent variables included imputed prices, observed prices,

household income, presence of children in the household, region, race, employment status, level of education, gender of household head. Table 2 is the summary statistics for observed prices and imputed price for each beverage. We found that the observed prices are consistent with the imputed price. Table 3 is correlation test for three beverages' price.

The Tobit model is most easily defined as a latent variable model:

(1) $Yi = Xi\beta + \mu i, \quad Xi\beta + \mu i > 0 \quad \mu i \sim Normal(0, \sigma^2)$

$Yi = 0 \quad Xi\beta + \mu i \leq 0$

Where i = 1,2,3,……n is the number of observations, Yi is the censored dependent variable, Xi is the vector explanatory variables, β is the vector of unknown parameters to be estimated. And μi has a normal distribution. For Tobit model, there are two expectations of dependent variables. If Yi >0, it is called the "conditional expectation", otherwise, called "unconditional expectation".

(2) Conditional expectation: $E(Y|Y > 0, X) = X\beta + \sigma(\frac{f(z)}{F(z)})$

(3) Unconditional expectation: $E(Y|X) = E(Y|Y > 0) * P(Y > 0|X)$

$$= X\beta F(z) + \sigma(f(z))$$

Where $Z = X\beta/\sigma, \lambda = \frac{f(z)}{F(z)}$ which is called inverse mills ratio, is the ratio between the standard normal PDF and standard normal CDF. In Tobit model, the coefficients with each explanatory variable must be transformed into meaningful marginal effects. There are two types of meaningful marginal effects. The first one is conditional marginal effects which reflect the marginal effects on consumption that contains the households actually bought the beverage. The other is unconditional marginal effects for

consumption of beverage which include all the households whether or not buy the beverage.

If Xi is a continuous variable, the conditional marginal effect of Xi on $E(Y|Y>0,X)$is represented by

(4) $$\partial E(Y|Y>0)/\partial X = \beta(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})$$

The unconditional marginal effect of Xi on $E(Y|X)$ is shown by

(5) $$\partial E(Y)/\partial X = \beta F(z)$$

Therefore,

(6) $$\partial E(Y|X)/\partial X = F(z)\frac{\partial E(Y|Y>0)}{\partial X} + E(Y|Y>0)\frac{\partial F(Z)}{\partial X}$$

So total change in the unconditional expected value of dependent variable Y is represented by the sum of (i), the change in the expected value of y being above the limit weighted by the probability of being above the limit and (ii) the change in the probability of being above the limit weighted by the expected value of y being above the limit (McDonald & Moffitt's (1980)). We tried several functional forms, including linear, quadratic, and semi-log Tobit model. We found that semi-log model outperformed other functional forms, except the independent variable-price of chocolate milk used in linear term for energy drink Tobit model, considering model fit, significance of the variables (the level of significance used is P-value of 0.05), and Akaike information criterion. Therefore, we used the semi-log functional form to calculate the conditional and unconditional marginal effects associated with each explanatory variable and linear functional form for price of chocolate milk in energy drink demand.

Conditional marginal effect for semi-log price variable:

(7) $$\partial E(Y|Y>0)/\partial p = \beta/\, p^c(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})$$

Unconditional marginal effect for semi-log price variable:

(8) $$\partial E(Y)/\partial p = \beta/\, p^u F(z)$$

Where $p^c$the average price is in the censored sample, p^u is the average of the unconditional price.

Therefore

Conditional elasticities:

Own-Price: $\varepsilon_{ii}^C = \beta/\, p_i^C(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})\frac{p_i^C}{Q_i^C}$

Cross-Price: $\varepsilon_{ij}^C = \beta/\, p_j^C(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})\frac{p_j^C}{Q_i^C}$

Income: $\varepsilon_I^C = \beta/\, I_i^C(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})\frac{I_i^C}{Q_i^C}$

For the linear price, conditional cross-price elasticity is

$$\varepsilon_{ij}^C = \beta(1 - z\frac{f(z)}{F(z)} - \frac{f(z)^2}{F(z)^2})\frac{p_j^C}{Q_i^C}$$

Unconditional elasticities:

Own-Price: $\varepsilon_{ii}^u = \beta/\, p_i^u F(z)\,\frac{p_i^u}{Q_i^u}$

Cross-Price: $\varepsilon_{ij}^u = \beta/\, p_j^u F(z)\,\frac{p_j^u}{Q_i^u}$

Income: $\varepsilon_I^u = \beta/\, I_i^u F(z)\,\frac{I_i^u}{Q_i^u}$

For the linear price, unconditional cross-price elasticity is

$$\varepsilon_{ij}^u = \beta \mathrm{F}(z)\frac{p_j^u}{Q_i^u}$$

Where I^c is conditional mean income and I^u is unconditional mean income, Q_i^C is the conditional mean of quantity, Q_i^u is the unconditional mean of quantity. From equation 6, we could obtain the changes in the probability of being above the limit for

consumption of each beverage category in response to a change in an explanatory variable.

(9) $$\partial F(z)/\partial X = \frac{1}{E(Y|Y>0)}\left(\frac{\partial E(Y)}{\partial X} - F(z)\frac{\partial E(Y|Y>0)}{\partial X}\right)$$

EMPIRICAL ESTIMATION

Table 4 is the summary statistics for price, quantity, expenditure and market penetration for three beverages. From that form, we know that 26.1% households purchase chocolate milk. Compared with energy drink (7.23% price penetration), 35.7% household would choose sports drink. Table 5 presents the Tobit regressions results. The significant economic determinants for chocolate milk are price of chocolate milk, energy drink, sports drink. The household income did not have a significant effect on the demand of chocolate milk. In addition, significant demographic independent of demand of chocolate milk includes household size, education, race, Hispanic origin, region, the presence of children in a household and gender of the household head.

For energy drink demand, statistically significant determinants are the price of energy drink, chocolate milk, and sports drink; household size, age, employment status, education, race, Hispanic origin, region, the presence of children in a household, and household gender. The household income did not have a significant effect on the demand of energy drink.

Regarding demand of sports drink, price of chocolate milk, energy drink, and sports drink significantly affect it. Significant demographic determinants comprise household size, age, education, race, region, the presence of children in a household, gender of the household head. Household income is nonsignificant variable for the demand of sports drink.

Although Tobit model is a regression model, the interpretation of coefficients of Tobit model is more complicated than OLS regression. Tobit coefficients represent the

effect of an independent variable on the latent dependent variable of the Tobit model. Therefore, we transform the coefficients into marginal effects. There are two types of meaningful marginal effects, conditional marginal effects in equation 4, unconditional marginal effects in equation5. Conditional marginal effects on the demand of beverage consider the household who actually bought the beverage into account. On the contrary, unconditional marginal effects take into account all the households no matter whether they bought the beverage. The sign of marginal effects are the same as the sign of coefficients in Tobit model. In order to reduce the influences by outliers and skewed data, we use the median values to analyze. Table 6 reports the median unconditional marginal effects. The results of median conditional marginal effects are shown in Table 7. For brevity, we pay more attention to the results of conditional marginal effects. The difference between conditional and unconditional marginal effects is unconditional marginal effects are larger than conditional marginal effects. Table 8 presents the results of median change in probability of consumption.

For chocolate milk, the average change in probability of consumption for household size is 0.022, which means if increase one household family number, the household is 2.2% more likely to consume chocolate milk. A household head had post college education is less likely to consume chocolate milk compared with the base case of less than high school education. Compared with white household head, other race is 9.8%~2.2% less likely to consume chocolate milk. Non-Hispanic household head consume 18.8 more ounces with 2.2% greater probability than Hispanic household head. For regions, the median changes in probability of consumption when the household head

located in Middle Atlantic is 0.049. Thus, the household head is 4.9% more likely to consume chocolate milk than the base case –Pacific. From the table 7, the household head living in Middle Atlantic consume 42.8 ounces more chocolate milk per year. Other regions, including East North Central, West north Central, South Atlantic, East south Central, West south Central, and Mountain, have the same trend like Middle Atlantic. The presence of children in a household increases the probability of chocolate milk consumption relative to household without children. Male household heads purchase about 27 ounces less chocolate milk per year relative to the base case of households headed by a male and a female.

For energy drink, the household heads with age above 35 years old are 5.6%~15.7% less likely to purchase energy drink. They consume about 83.5~231.6 ounces less energy drinks than the base case of household heads with age less than 25 years. The households who are in full time jobs are 0.8% more likely to buy energy drink. Education degree significantly affects the consumption of energy drinks. People with higher education are about 2.1%~6.6% less likely to buy energy drink per year compared with the base case of households who has less than high school degree. Household heads who classified as Hispanic are 1.2% more likely to purchase energy drink. Oriental household heads are 3% less likely to consume energy drink. The regions, except the mountain part, are all less likely to consume energy drink than the base case of Pacific part. The presence of children in a household whose age is between 13~17 increases the probability of energy drink. Male household heads are 3.33% more likely

to purchase energy drink. They purchase 49.3 ounces more energy drink relative to the base case of households headed by a male and female.

For sports drink, the median changes in probability of consumption when the household from 55 years to 64 years of age is -0.13. The median changes in probability of consumption when the household is 64 years or older is -0.18. Thus a household headed by someone elderly is from13% to 18% less likely to consume sports drink. From the conditional marginal effect, the household heads who are 55~64 years old consume 174.8 ounces less sports drinks per year. The household heads that are older than 64 years consume 249.7 ounces less sports drink compared with the base case of household heads are less than 25 years old. In addition, the education of household head significantly affects the demand of sports drink. According to the conditional marginal effects, households with post -college 51.5 ounces less sports drink per year and they have a 3.7% lower probability of purchasing sports drink than household with less than a high school education. Oriental purchase 56.8 ounces less sports drinks per year. Oriental household heads have a 4.1% less likely to purchase sports drink than the base case of white household heads. The presence of children in a household whose age is under 6 years is 4% less likely to purchase sports drink. Regionally, the households living in South Atlantic are 4.2% more likely to purchase sports drink than the Pacific part. Female household heads are 5.8% less likely to buy sports drink. The female household heads purchase 80.9 ounces less sports drinks per year.

Based on the coefficient estimates, we calculated the conditional and unconditional own-price, cross-price elasticities and income elasticities for all beverages.

Table 9 represents the mean value of conditional and unconditional elasticities. The unconditional elasticities estimates are consistently larger than the conditional elasticities.

For chocolate milk, the conditional own-price elasticity is -0.624, which means that consumers are insensitive to own price changes. The conditional cross-price elasticities of energy drink and sports drink are -0.091, -0.099, which implies energy drink and sports drink are complementary beverages for chocolate milk. The conditional income elasticity of chocolate milk is -0.011 but the income elasticity is not statistically significant.

For energy drink, the own-price elasticity is -0.599, indicating that energy drink is less elastic than chocolate milk. The cross-elasticity of chocolate milk and sports drink are 0.047, -0.072. Therefore, chocolate milk is substitute for energy drink but sports drink is complementary beverage for energy drink. The income elasticity is 0.004 which is statistically nonsignificant.

For sports drink, the own-price elasticity is -0.718, indicating that energy drink is less elastic than energy drink. The cross-elasticity of chocolate milk and sports drink are -0.038, -0.147. Therefore, chocolate milk and energy drink are complementary for sports drink. The income elasticity is 0.012 which is not statistically significant.

CONCLUSIONS

Using household-level purchase data for chocolate milk, energy drink, and sports drink with related demographic characteristics from the 2011 Nielsen Homescan data, we estimated three beverage demand models to show that chocolate milk is used as a substitute for energy drink. In addition, we find that the demographic characteristics of households have some impact on demand for chocolate milk, energy drink, and sports drink. The household size, age, education, race, region, the presence of children, gender of household head are significant determinants of demand for chocolate milk. Energy drink and sports drink are complementary for chocolate milk. For energy drink demand model, household size, age, employment status, education, race, region, the presence of children in a household, gender of household head significantly affect the demand of energy drink. From estimating the elasticities, we find chocolate milk is a substitute for energy drink but sports drink is complementary for energy drink. Finally, we estimate the sports drink demand model. For sports drink, significant demographic variable includes household size, age, education, race, region, the presence of children, gender of household head. Chocolate milk and energy drink are complements for sports drink. The income elasticity of demand demonstrates that energy drink and sports drink are normal good, however they are not statistically significant.

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Drinks

Table1 Summary Statistics of the Variables in the Model

Variable	Mean	Standard Deviation
Price of chocolate milk	0.049	0.024
Price of energy drinks	0.129	0.056
Price of sports drinks	0.052	0.149
Household size	2.36	1.290
Household income	58.32	31.93
Age of household head 25-29	0.018	0.042
Age of household head 30-34	0.038	0.191
Age of household head 35-44	0.147	0.354
Age of household head 45-54	0.276	0.447
Age of household head 55-64	0.297	0.457
Age of household head 65 or older	0.222	0.415
Employment status part-time	0.178	0.383
Employment status full-time	0.390	0.488
Education high school	0.237	0.425
Education undergraduate	0.618	0.485
Education post-college	0.12	0.325
Black	0.094	0.292
Oriental	0.029	0.166
Other	0.040	0.196
Hispanic	0.051	0.220
New England	0.045	0.208
Middle atlantic	0.131	0.337
East north central	0.181	0.385
West north central	0.086	0.281
South atlantic	0.198	0.398
East south central	0.06	0.237
West south central	0.102	0.303
Mountain	0.073	0.260
Children less than 6 hears	0.028	0.164
Children 6-12 years	0.052	0.223
Children 13-17 years	0.067	0.249
Children under 6 and 6-12 years	0.024	0.154
Children under 6 and 13-17 years	0.004	0.064
Children 6-12 and 13-17 years	0.033	0.179
Children under 6, 6-12, and 13-17	0.005	0.070
Female head only	0.250	0.433
Male head only	0.096	0.295

Table 2 Summary statistics for observed prices and imputed prices for each beverage				
	Observed Price (*dollars per ounce*)		**Imputed Price (*dollars per ounce*)**	
	Mean	**Standard Dev**	**Mean**	**Standard Dev**
Chocolate milk	0.049	0.024	0.051	0.007
Energy drink	0.129	0.057	0.131	0.007
Sports drink	0.052	0.149	0.110	0.028

Table 3 Correlation Test for Beverage Price

Chocolate milk price	Energy drinks price	Sports drinks price
1.00000	0.13117	0.00784
	<.0001	0.0510
0.13117	1.00000	-0.00033
<.0001		0.9347
0.00784	-0.00033	1.00000
0.0510	0.9347	

Table 4 summary statistics for price, quantity and market penetration

	Market penetration	Average Price	Average conditional quantity(ounce)	Average unconditional quantity(ounce)
Chocolate milk	26.09%	0.049	423	110.38
Energy drink	7.23%	0.13	441.12	31.87
Sports drink	35.78%	0.052	756.55	270.73

Table 5 Tobit regression results

	Chocolate milk		Energy drinks		Sports drinks	
Variable	**Estimate**	**P-value**	**Estimate**	**P-value**	**Estimate**	**P-value**
Intercept	-4813.94	<.0001	-5204.96	<.0001	-6854.30	<.0001
Price of chocolate milk	-1008.42	<.0001	2460.87	<.0001	-83.27	0.0118
Price of energy drink	-146.67	0.0030	-1506.67	0.0064	-324.804	<.0001
Price of sports drink	-161.25	<.0001	-179.82	<.0001	-1587.14	<.0001
Household size	75.45	<.0001	145.63	<.0001	166.49	<.0001
Household income	-18.49	0.0926	8.99	0.6707	26.43	0.0619
Age of household head 25-29	-37.25	0.8037	-136.99	0.5370	-81.87	0.6467
Age of household head 30-34	43.27	0.7670	-205.93	0.3412	-120.19	0.4908
Age of household head 35-44	78.05	0.5875	-493.84	0.0202	-162.82	0.3429
Age of household head 45-54	100.96	0.4818	-614.89	0.0037	-239.68	0.1616
Age of household head 55-64	16.20	0.9101	-962.17	<.0001	-515.28	0.0026
Age of household head 64 or older	-187.13	0.1933	-1369.22	<.0001	-730.09	<.0001
Employment status part-time	-11.39	0.5185	-48.40	0.1739	-14.43	0.5260
Employment status full-time	-2.43	0.8770	73.05	0.0174	38.59	0.0549
Education high school	-27.46	0.5002	-182.90	0.0177	67.73	0.1931
Education undergraduate	-111.11	0.0056	-328.261	<.0001	-7.43	0.8878
Education post-collge	-237.18	<.0001	-576.51	<.0001	-151.81	0.0085
Black	-336.19	<.0001	-29.92	0.4847	-16.69	0.5448
Oriental	-243.60	<.0001	-261.00	0.0004	-166.33	0.0005
Other	-77.73	0.0246	126.41	0.0314	82.16	0.0517
Hispanic	-74.54	0.0156	105.14	0.0449	22.01	0.5553
New England	-40.97	0.2667	-451.73	<.0001	78.22	0.0832
Middle Atlantic	169.63	<.0001	-374.22	<.0001	38.09	0.2537
East north central	116.35	<.0001	-401.72	<.0001	7.13	0.8273
West north central	161.00	<.0001	-349.84	<.0001	-21.72	0.5636
South Atlantic	63.86	0.0091	-337.75	<.0001	170.60	<.0001
East south central	201.58	<.0001	-298.10	<.0001	304.09	<.0001
West south central	120.92	<.0001	-128.10	0.0071	256.83	<.0001
Mountain	-65.70	0.0317	-78.48	0.1333	123.22	0.0010
Children less than 6 years	65.63	0.1028	-198.69	0.0069	-167.09	0.0010
Children 6-12 years	155.27	<.0001	-104.01	0.0659	100.92	0.0073
Children 13-17 years	173.56	<.0001	265.72	<.0001	490.59	<.0001
Children under6 and 6-12 years	103.174	0.0203	-460.37	<.0001	-319.55	<.0001
Children under 6 and 13-17 years	150.509	0.0893	-173.20	0.2788	24.31	0.8274
Children 6-12 and 13-17 years	112.65	0.0038	-152.66	0.0325	300.02	<.0001
Children under 6, 6-12, 13-17 years	103.38	0.2196	-321.23	0.0349	-20.57	0.8469

	Chocolate milk		Energy drinks		Sports drinks	
Variable	**Estimate**	**P-value**	**Estimate**	**P-value**	**Estimate**	**P-value**
Female head only	-69.18	0.0002	49.42	0.1780	-236.39	<.0001
Male head only	-101.56	<.0001	291.32	<.0001	-57.06	0.0725
Sigma	1141.31	<.0001	1531.57	<.0001	1551.58	<.0001

Table 6 median unconditional marginal effects

variable	Chocolate milk	Energy drinks	Sports drinks
Household size	14.92	7.71	42.22
Age of household head 25-29	-7.37	-7.25	-20.76
Age of household head 30-34	8.56	-10.9	-30.48
Age of household head 35-44	15.44	-26.14	-41.29
Age of household head 45-54	19.97	-32.55	-60.78
Age of household head 55-64	3.20	-50.94	-130.67
Age of household head 65 &older	-37.03	-72.49	-185.14
Employment status part-time	-2.25	-2.56	-3.66
Employment status full-time	-0.48	3.87	9.79
Education high school	-5.43	-9.68	17.68
Education undergraduate	-21.98	-17.38	-1.88
Education post-college	-46.93	-30.52	-38.50
Black	-66.53	-1.58	-4.23
Oriental	-48.21	-13.82	-42.18
Other	-15.38	6.69	20.93
Hispanic	-14.75	5.57	5.58
New England	-8.10	-23.91	19.84
Middle Atlantic	33.57	-19.81	9.66
East north central	23.02	-21.27	1.81
West north central	31.86	-18.52	-5.51
South atlantic	12.63	-17.88	43.26
East south central	39.89	-15.78	77.11
West south central	23.93	-6.78	65.13
Mountain	-13	-4.15	31.24
Children less than 6 years	12.99	-10.52	-42.37
Children 6-12 years	30.72	-5.51	25.59
Children 13-17 years	34.35	14.07	124.41
Children under6 and 6-12 years	20.41	-24.37	-81.03
Children under 6 and 13-17 hears	29.78	-9.17	6.17
Children 6-12 and 13-17 years	22.29	-8.08	76.08
Children under6,6-12,and 13-17	20.46	-17.01	-5.22
Female head only	-13.69	2.61	-59.94
Male head only	-20.10	15.422	-14.47

Table 7 median conditional marginal effect

variable	Chocolate milk	Energy drinks	Sports drinks
Household size	19.04	24.64	56.48
Age of household head 25-29	-9.4	-23.17	-27.78
Age of household head 30-34	10.9	-34.83	-40.77
Age of household head 35-44	19.69	-83.53	-55.24
Age of household head 45-54	25.47	-104.01	-81.31
Age of household head 55-64	4.08	-162.76	-174.81
Age of household head 65 &older	-47.22	-231.61	-247.68
Employment status part-time	-2.87	-8.19	-4.89
Employment status full-time	-0.61	12.36	13.09
Education high school	-6.93	-30.94	23.66
Education undergraduate	-28.04	-55.53	-2.52
Education post-college	-59.85	-97.52	-51.50
Black	-84.43	-5.06	-5.67
Oriental	-61.47	-44.15	-56.43
Other	-19.61	21.38	27.87
Hispanic	-18.81	17.78	7.47
New England	-10.34	-76.41	26.54
Middle Atlantic	42.81	-63.30	12.92
East north central	29.36	-67.95	2.42
West north central	40.63	-59.18	-7.37
South Atlantic	16.16	-57.13	57.88
East south central	50.87	-50.42	103.16
West south central	0.23	-21.67	87.13
Mountain	-16.58	-13.27	41.80
Children less than 6 years	16.56	-33.61	-56.69
Children 6-12 years	39.18	-17.59	34.23
Children 13-17 years	43.79	44.95	166.43
Children under6 and 6-12 years	26.04	-77.88	-108.41
Children under 6 and 13-17 hears	37.98	-29.30	8.25
Children 6-12 and 13-17 years	28.43	-25.82	101.78
Children under6,6-12,and 13-17	26.08	-54.34	-6.98
Female head only	-17.46	8.36	-80.19
Male head only	-25.63	49.28	-19.36

Table 8 median change in probability of consumption

variable	Chocolate milk	Energy drinks	Sports drinks
Household size	0.022	0.017	0.041
Age of household head 25-29	-0.01	-0.016	-0.020
Age of household head 30-34	0.013	-0.024	-0.029
Age of household head 35-44	0.023	-0.057	-0.040
Age of household head 45-54	0.029	-0.071	-0.059
Age of household head 55-64	0.004	-0.11	-0.127
Age of household head 65 &older	-0.054	-0.157	-0.179
Employment status part-time	-0.003	-0.006	-0.004
Employment status full-time	-0.001	0.008	0.009
Education high school	-0.008	-0.021	0.017
Education undergraduate	-0.032	-0.038	-0.002
Education post-college	-0.069	-0.066	-0.037
Black	-0.098	-0.003	-0.004
Oriental	-0.071	-0.030	-0.041
Other	-0.023	0.015	0.020
Hispanic	-0.022	0.012	0.005
New England	-0.012	-0.052	0.019
Middle Atlantic	0.049	-0.043	0.009
East north central	0.034	-0.046	0.002
West north central	0.047	-0.040	-0.005
South atlantic	0.019	-0.039	0.042
East south central	0.059	-0.034	0.075
West south central	0.047	-0.015	0.063
Mountain	-0.019	-0.009	0.030
Children less than 6 years	0.019	-0.023	-0.041
Children 6-12 years	0.045	-0.012	0.025
Children 13-17 years	0.050	0.030	0.121
Children under6 and 6-12 years	0.03	-0.053	-0.078
Children under 6 and 13-17 hears	0.044	-0.020	0.006
Children 6-12 and 13-17 years	0.033	-0.017	0.074
Children under6,6-12,and 13-17	0.030	-0.037	-0.005
Female head only	-0.020	0.006	-0.058
Male head only	-0.029	0.033	-0.014

Table 9 Unconditional and Conditional Own-price, Cross-price, and Income Elasticities of Demand for Chocolate milk, Energy drinks, and Sports drinks

	Chocolate Milk	Energy Drinks	Sports Drinks
Unconditional Own-Price, Cross-Price, and Income Elasticities			
Chocolate Milk	-2.049	-0.298	-0.328
Energy Drinks	0.253	-3.079	-0.368
Sports Drinks	-0.093	-0.364	-1.778
Income	-0.038	0.018	0.030
Conditional Own-Price, Cross-Price, and Income Elasticities			
Chocolate Milk	-0.624	-0.091	-0.099
Energy Drinks	0.047	-0.599	-0.071
Sports Drink	-0.038	-0.147	-0.718
Income	-0.011	0.004	0.012