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Assessing the Impact of Carbonated Soft-Drink Marketing Practices on U.S. Consumers





1945 50 55 60 65 70 75 80 85 90 95 1947 is the first year for which soft drink consumption data ar available. Source: USDA's Economic Research Service.

All Obs. = 2,291,540

	Variable	Mean	Std. Dev.	Min	Max			
	dependent							
HH TotOz Purchased for Week		105.058	282.601	0	12235.6			
	marketing mix							
AvgBrandP/	wk (wtd, USmktshare)	1.026	0.276	0.086	1.832			
DiscSale	(sale only)	0.092	0.289	0	1			
DiscCoupn	(coupon or w/other)	0.017	0.128	0	1			
HH GRP / W	k (advertsg exposure)	173.162	126.578	2.752	748.196			
	demographic							
HH Income ^a		20.994	5.864	3	27			
HH size	(actual # residents)	2.412	1.339	1	9			
Female HH head, Edu ^b		3.768	1.678	0	6			
Male HH head, Edu ^b		3.158	2.120	0	6			
FemUndrEmp (un-, or <35hrs/wk)		0.497	0.500	0	1			
Man <full ei<="" th=""><th>mp (<35hrs/wk)</th><th>0.061</th><th>0.239</th><th>0</th><th>1</th></full>	mp (<35hrs/wk)	0.061	0.239	0	1			
Man No Emp)	0.199	0.400	0	1			
African Ame	rican ^c	0.141	0.348	0	1			
Asian		0.045	0.208	0	1			
Other Race		0.058	0.234	0	1			
Hispanic ^d		0.076	0.265	0	1			
Male HH head, Age ^e		5.126	3.415	0	9			
Female HH head, Age ^e		6.095	2.764	0	9			

^a HHinc = in the data set, HH income is divided at ½ the poverty level for a family of 4, at 1x, 2x, 3x, 4x with above 4x (>US\$100k) used as the control (3 – 27 is the A.C. Nielsen category assignment)

b xxxEdu = measured for head of HH, by highest level completed: 1-grade school, 2-some high school, 3-high school, 4-some college, 5-college, 6-some graduate school or more

° "White" is used as control for race variables

^d **Hispanic** = a yes/no category external to the White/Afr.Amer./Asian/Other race categories in A.C. Nielsen data

* xxxAge = one of nine categories, youngest 1 to oldest 9

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Research Objective: Discover which demographic characteristics are associated with largest purchase responses to the marketing mix for sweetened CSDs.

 Meta-Analysis of studies on effects of soft-drink consumption find "clear association" with increased body weight, lower nutrient intake, and increased risk of severe medical problems (Vartanian, et. al., 2006).

2) Consumers vary in tastes and responses to marketing. Can these differences be identified by demographic characteristics using nationwide purchase patterns?

ie wone.

Rejecting assumptions of strict preference ordering and informed utility maximization for CSD consumption, a reduced form model derives answers straight from data, without filter of economic theory.

$$Q_{iet} = \beta_0 + \beta_1 P_{et} + \beta_2 Sale_{iet} + \beta_3 Coupn_{iet} + \beta_4 Adv_{et} + \sum_{k=5}^{24} \beta_k X_i + \sum_{m=2}^{4} Ssn_m + \varepsilon_{iet}$$

 $P_{ict} = \text{CSD volume in oz purchased by HH in week (1 wk.=t)}$

- > $\beta_0 = \text{model intercept}$
- > P_{ct} = cross-brand price index for all sweetened CSDs in DMA, weighted by U.S. market share over data set, at week *t*

 $> Sale_{c^{+}}$ HomeScan entry indicates sale (only discount) item at time of purchase $> Coupn_{c^{+}}$ HomeScan entry indicates coupon (only, or other deal) at time of purchase

 Adv_{cr} = Gross Rating Point (GRP) advertising exposure to representative HH

in DMA at week *t*, composite across all sweetened CSD manufacturer/advertisers > X_{ki} = time-invariant demographic characteristics, including:

HH size; education-level, employment (35+hrs/wk=control), and age for head of HH by sex; 5 x Inc (\$100k+=control); 3 x Race (Wh=control); Hispanic (Y/N)

- Ssn_m = seasonal dummy (spring=Ssn1=control)
- $\succ \mathcal{E}_{int} =$ an idiosyncratic i.i.d. error component.

Data and Estimat

(13,379 Households over 16 Designated Marketing Areas [DMA] in U.S.) * (152

weeks) + (fill-in non-purchase observations to avoid biasing of results) = 2,291,540 household-level observations, 2006-2008

Household (HH) characteristics: Income; Age, Education, and Hours of Employment of HH head; Race; HH size

Marketing mix: Brand-level prices (DMA cross-brand-avg./wk); Sales and Couponing on Actual Purchases; Advertising Exposure at HH-level

Source: A.C. Nielsen HomeScan Data & Advertising Data.

>Dependent variable: HH quantity (in ounces=oz) purchased in a week

➤Model selection: linear tobit

≻Estimator used: tobit ML

Designated Marketing Areas (**DMAs**) in data set: Atlanta, Baltimore, Boston, Chicago, Detroit, Hartford & New Haven, Houston, Kansas City, Los Angeles, Miami – Ft. Lauderdale, New York, Philadelphia, San Francisco – Oakland – San Jose, Seattle – Tacoma, Springfield – Holyoke (MA), Washington D.C.

Food Marketing Policy Center

Linear Tobit – Selected Results

	Variables	Coefficients	Std. Errors	t-ratios	
	Avg Brand P /wk	-9.627	1.934	-4.98	
	DiscSale	939.294	1.553	604.8	
	DiscCoupn	988.236	3.159	312.83	
	HH GRP /wk	0.129	0.005	27.64	
	0 to Half Pov4* Inc	224.293	3.279	68.41	
	Half to x1 Pov4 Inc	207.694	2.495	83.25	
	1 to x2 Pov4 Inc	149.914	1.925	77.9	
	2 to x3 Pov4 Inc	116.071	1.730	67.11	
	3 to x4 Pov4 Inc	69.612	1.695	41.07	
	Household size	95.755	0.424	225.62	
	Fem head, Edu Level	-17.705	0.470	-37.65	
coeffs	Male head, Edu Level	-5.621	0.514	-10.93	
f. to 1%,	Fem head, 0, <full emp<="" td=""><td>-29.527</td><td>1.226</td><td>-24.08</td><td></td></full>	-29.527	1.226	-24.08	
pt	Male head, <full emp<="" td=""><td>-26.841</td><td>2.289</td><td>-11.73</td><td></td></full>	-26.841	2.289	-11.73	
anic	Male head, 0 Emp	-69.011	1.673	-41.25	
	African American	44.430	1.521	29.21	
10000 = -	Asian	-111.518	2.789	-39.99	
141.5	Other Race	22.199	2.543	8.73	
	Hispanic (y/n)	3.670	2.252	1.63	
1,540	Male head, Age	11.440	0.326	35.14	
ensored = 621,763	Female head, Age	-8.900	0.302	-29.48	
	Summer	27.539	1.527	18.04	
S. poverty	Fall	17.333	1.557	11.13	
for	Winter	15.792	1.640	9.63	
ly of four	Constant	-793.849	3.825	-207.54	

Hisp •Log

All explanatory variables show expected signs and are correlated to increased soft drink purchase (versus control: White, >\$100k/yr, 35+hrs/wk, spring) to 1% statistical significance level; Hispanic, 10%.
 As this is not a structural model, causality cannot be inferred, and robustness checks must be done separately.
 >For the un- and underemployed, purchase quantity is less than the control, perhaps suggesting that people do not view sweetened CSDs as challenge vectors in practice.

Future Research

 Model with state dependence lags for cyclical "stocking" purchases.
 Check Public records of junk-food taxes at state and city level to discover natural experiments of policy-induced price shocks; examine variation in demand responses by demographic characteristics.

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