Home Bias in U.S. Beer Consumption

Rigoberto A. Lopez, Xenia Matschke
University of Connecticut, USA

Rigoberto.Lopez@uconn.edu

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Summary

We apply the Berry, Levinsohn and Pakes (1995) market equilibrium model (BLP) to data from 30 brands of beers sold in 12 U.S. cities over 20 quarters (1988-92) to estimate the consumers' taste for beer characteristics (price, alcohol content, and calories) as well as for the cultural region of origin (USA, Anglo-European, Germanic, and countries bordering the U.S.). Consumer heterogeneity is allowed with respect to age, income and gender. Overall we end up with 7,200 beer brand observations (30x12x20) and 13,920 (58 random draws x 12 x 20) consumer observations. Empirical results indicate that indeed there is home bias with respect to European beers and somewhat less so with respect to beers from bordering countries (Mexico and Canada). Home bias is more accentuated among older males who are more affluent. Furthermore, the own-price elasticities and the cross price elasticities of demand are higher for foreign beers, indicating a higher degree of loyalty and differentiation for domestic beers.

KEYWORDS: Home bias, beer, country of origin, demand, differentiated products

1. Introduction

We apply the Berry, Levinsohn and Pakes (1995) market equilibrium model (BLP) to 30 brands of beers sold in 12 U.S. cities over 20 quarters (1988-92) to estimate the consumers' taste for beer characteristics (price, alcohol content, and calories) as well as for the cultural region of origin (USA, Anglo-European, Germanic and bordering countries). Overall, we confirm the existence of a home bias effect, but also decompose it by consumer types. For instance, older males with higher income tend to be more loyal to U.S. beers and be turned off by Germanic beers, regardless of price, promotion, alcohol content or calories. Thus, the results provide a detailed picture of the American consumer home bias toward home vs. foreign made beers.

2. Background

A growing trade literature finds that nations trade far less internationally than they do within their borders, an empirical regularity that has been commonly referred to as the border or home bias effect. Empirical studies on home bias employ the highly successful gravity equation using rather aggregate levels of data and asserting supply-side causes by relating this phenomenon to, e.g., transportation costs, co-location of intermediate inputs, and increasing returns (Davis, 1998; Hillberry and Hummels, 2002; Head and Ries, 2001). Yet, such studies tend to ignore domestic consumer preferences for the products in question, let alone the fact that consumer preferences in a country like the United States are not monolithic as there is a large variation in consumer characteristics which might influence the degree of home bias.

3. Objectives

This paper examines the effects of domestic consumer heterogeneity on choices of foreign and domestic beers using data at the product brand level. Beers provide an interesting case study for examining home bias. First, the country of origin can be easily identified by consumers. Second, beer comes in differentiated brands. Third, consumer heterogeneity can play a crucial role in shaping home biases. Fourth, foreign beers play a growing role in terms of their share in the American beer market. Last, home bias has not been tested at the product brand level for beer or any other product.

4. Data and methodology

In the BLP model (summarized here for expository purposes), the consumer, in choosing a beer brand among competing products, maximizes utility driven by the brand characteristics as well as his/her own characteristics. The indirect utility of consumer *i* from buying the brand *j* is given by

$$U_{ij} = \beta_i x_j + \alpha_i p_j + \zeta_j + \varepsilon_{ij} \ , \qquad i = 1,...n;\ j = 1,...,J \qquad (1)$$

where x_j is a vector of the *observed* characteristics of brand *j* (excluding price), p_j is the price of the brand j, ζ_j denotes *unobserved* (to the researcher) product characteristics, α_i and β_i are parameters that depend on individual *i*'s taste, and ε_{ij} represents the distribution of consumer preferences around the unobserved product characteristics with a probability density function $f(\varepsilon)$.

Following BLP, let $\alpha_i = \alpha + \lambda D_i + \gamma v_i$ and $\beta_i = \beta + \varphi D_i + \rho v_i$, where D_i denotes observed consumer characteristics (i.e., demographics) with a probability density function $h(D)$, v_i denotes the unobserved consumer characteristics with a probability density function $g(v)$ assumed to be normally distributed; and $\theta_1 = (\alpha, \beta)$ and $\theta_{21} = (\lambda, \varphi, \gamma, \rho)$ denote fixed parameters. Substituting into (1) yields:

$$U_{ij} = \underbrace{\beta x_j + \alpha p_j}_{\delta_j} + \underbrace{\zeta_j + \phi D_i x_j + \rho v_i x_j + \lambda D_i p_j + \gamma v_i p_j}_{\mu_{ij}} + \varepsilon_{ij} \ . \qquad (2)$$

The indirect utility given in equation (4) is decomposed into two parts: a mean utility term δ_j, which is linear (common to all consumers), and a brand- and consumer-specific deviation from that mean μ_{ij}. Let $k = 0$ denote an outside good if the consumer decides not to buy any of the J brands in the set of brands (*j=1,…,J*). As each consumer purchases a unit of the brand that yields the highest utility or the outside good, aggregating over consumers, the market share of the j^{th} brand corresponds to the probability the j^{th} brand is chosen. That is,

$$s_j(\delta, x, p, \theta_2) = \int I\{(D_i, v_i, \varepsilon_{ij}) : U_{ij} \geq U_{ik} \forall k = 0,..,J\} dH(D) dG(v) dF(\varepsilon), \quad (3)$$

where *H(D)*, *G(v)* and *F(ε)* are cumulative density functions for the indicated variables and are assumed to be independent.

The price elasticities of the market shares for individual brands are:

$$\eta_{jk} = \frac{\partial s_j}{\partial p_k}\frac{p_k}{s_j} = \begin{cases} \frac{p_j}{s_j}\int \alpha_i s_{ij}(1-s_{ij})dH(D)dG(\nu), & for\ j=k, \\ -\frac{p_k}{s_j}\int \alpha_i s_{ij}s_{ik}dH(D)dG(\nu), & otherwise. \end{cases} \tag{7}$$

We use data from 30 brands of beer in 12 cities over 20 quarters (1988-1992). In total, 7,200 beer brand observations are used (30 brands x 12 cities x 20 time periods). The cities are: Atlanta, Buffalo, Chicago, Cincinati, Cleveland, Columbus, New Orleans, New York, Omaha, San Antonio, San Diego and St. Louis. The data consist of two types of information: product characteristics and consumer characteristics.

The product characteristics data include the brand-level market share, the retail price and percent volume sold under promotion. These data came from the Information Resources, Inc. (IRI) Infoscan database at the Food Policy Marketing Center of the University of Connecticut. The potential market size for each was computed by multiplying the state-specific per capita consumption of beer in a given quarter (from the Brewer's Almanac) times the population. Market shares were then computed by dividing brand dollar sales by the potential market size. The retail price (dollars per case of 24-12 oz. containers) was deflated by the city or region specific Consumer Price Index (December 1992=1). In addition, the percent calorie and alcohol contents as well as the region of origin were obtained online. Four regions of origin are considered: USA, Germanic (Germany and the Netherlands), Anglo (Great Britain and Ireland) and border countries (Canada and Mexico).

Observable consumer characteristics were obtained from 58 random draws from the Current Population Survey for each city market and quarter (National Bureau of Economic Research, 2002). These variables are age, income, and gender. Another 58 draws from a normal distribution with zero mean and unit variance are obtained for the unobservable characteristics.

Instrumental variables are used to control for potential endogeneity of retail prices arising from their correlation with product characteristics (e.g., imported beers tend to be more expensive). Following Nevo (2001), 120 interactions between 30 brand dummies and four input prices are used as instruments. Input prices include the city-specific wages for supermarket workers, petroleum prices, 3-month interest rates and the price of malt. In addition, state taxes on beer and ale/lager dummies are used as additional instruments.

For estimation purposes, we define a market as a city-quarter combination, resulting in 240 markets, each with 30 brands of beer and 58 consumer observations. Overall we end up with 7,200 beer brand observations and 13,920 consumer observations. We adapt the MATLAB algorithm of Nevo (2000) to the beer case. This algorithm minimizes the distance between observed and estimated market shares, using the Generalized Method of Moments. The results are presented in the following section.

5. Results

Table 1 shows the BLP parameter estimates and their distribution statistics. One should keep in mind that we obtain a distribution consisting of 13,920 parameters, one for each individual consumer in the sample (58 draws x 20 periods x 12 cities). Thus, the 'standard errors' represent standard deviations rather than the usual interpretation for fixed point estimates. The parameter estimates of the mean utility (δ_j), which are common to all individuals, are (jointly) statistically significant at the 5% level and most have the expected signs. Price has a negative effect independent of consumer characteristics and promotion has a positive effect on the mean utility, as expected. The mean utility results clearly point to a home bias in U.S. beer consumption with respect to Anglo and bordering countries' beers but not with respect to Germanic ones.

Taking into account consumer heterogeneity, the taste parameter for price becomes smaller (less price elastic) with age, higher income and for the male gender. Higher income consumers tend to view beers less favorably that are high in calories or alcohol content. On the other hand, alcohol content and calories follow exactly opposite patterns with respect to age and gender. While older males tend to appreciate a higher calorie content, these same consumers tend to stay away from high alcohol content.

In terms of the cultural region of origin of the beers, although the mean consumer tends to prefer USA beers (a la par with Germanic ones), this preference tends to be accentuated as consumers get older and wealthier, particularly among males. This group of consumers is generally turned off by foreign made beers, particularly those of European origin.

Overall, we calculated 10,800 price elasticities of demand for beers (the square of 30 brands x 12 cities), side-stepping the problem of dimensionality that plagues differentiated product demand estimation. As Table 2 shows, all the estimated own-price elasticities are negative, as illustrated for the city of Chicago, Illinois. The own price elasticities seem a bit high for most beers relative to estimates in the literature, although most estimates are done at a more aggregate level. Nonetheless, domestic beers tend to have much lower price elasticities than foreign ones.

The elasticities of substitution with respect to the price of Budweiser (the leading beer) are lower for domestic than for foreign beers. The elasticities of substitution with respect to Harp (the most similar beer to Budweiser in terms of alcohol content, calories and lager type) are much lower in spite of its similarities to Budweiser which is a domestic beer. Also note that the cross price elasticities of substitution are higher for foreign beers than for domestic ones, attesting that in the eyes of the Chicago consumer, foreign beers are closer substitutes among themselves than with respect to American ones.

6. Final remarks

Although the presented results are preliminary, the methodology of Berry, Levinsohn and Pakes (1995) seems promising in analyzing consumers' taste for home vs. foreign products. Applying such methodology to a large data set involving 12 cities and 30 brands of beers, the results point to home bias with respect to U.S. beer consumption. Furthermore, this bias appears to be more accentuated in male consumers who are older and have higher income. The estimated price elasticities of demand further attest that American consumers are less sensitive to the prices of domestic beer and that they more easily switch to domestic beers than foreign ones in spite of common physical beer characteristics. This shows that the payoff to go beyond the common aggregate studies of home bias in international trade is potentially high as one tests not only for home bias, but also gets a detailed insight into consumer behavior and consumer heterogeneity with respect to home bias.

7. References

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Table 1. Demand Parameter Estimates

Variable	Notation	Parameter	BLP Estimate	BLP S.E.	Logit Estimate	Logit S.E.
Mean Utility						
Price	p_j	α	-1.333	0.831	0.054	0.019
Alcohol	X_{1j}	β_7	0.317	0.730	-0.016	0.211
Calories	X_{2j}	β_2	1.866	8.463	-2.438	0.026
Ale	X_{3j}	β_3	-0.601	16.043	-0.210	0.460
Promotion	X_{8j}	β_8	8.180	0.445	6.868	0.239
USA	X_{4j}	β_4	-6.694	4.375	-7.772	0.313
Anglo	X_{5j}	β_5	8.628	14.799	-10.793	0.279
German	X_{6j}	β_6	-6.6511	4.849	-9.212	0.277
Border	X_{7j}	β_7	-8.221	7.860	-9.72	0.085
Deviations						
Age	D_{1i}	λ_{11}	-0.605	329.091		
Age x Price	$D_{1i}p_j$	λ_{12}	0.330	1.7698		
Age x Alcohol	$D_{1i}X_{1j}$	φ_{11}	-0.163	2.1609		
Age x Calories	$D_{1i}X_{2j}$	φ_{12}	0.003	38.3673		
Age x Ale	$D_{1i}X_{3j}$	φ_{13}	0.086	32.312		
Age x USA	$D_{1i}X_{4j}$	φ_{14}	1.161	23.7919		
Age x Anglo	$D_{1i}X_{5j}$	φ_{15}	1.212	31.183		
Age x German	$D_{1i}X_{6j}$	φ_{16}	-0.280	3.695		
Age x Border	$D_{1i}X_{7j}$	φ_{17}	-0.591	6.9092		
Income	D_{2i}	λ_{21}	-1.305	NA		
Income x Price	$D_{2i}p_j$	λ_{22}	1.571	0.4103		
Income x Alcohol	$D_{2i}X_{1j}$	φ_{21}	-0.379	0.5773		
Income x Calories	$D_{2i}X_{2j}$	φ_{22}	-2.825	4.9781		
Income x Ale	$D_{2i}X_{3j}$	φ_{23}	0.267	NA		
Income x USA	$D_{2i}X_{4j}$	φ_{24}	0.247	NA		
Income x Anglo	$D_{2i}X_{5j}$	φ_{25}	-2.286	NA		
Income x German	$D_{2i}X_{6j}$	φ_{26}	-1.789	NA		
Income x Border	$D_{2i}X_{7j}$	φ_{27}	-0.786	11.383		
Male	D_{3i}	λ_{31}	-0.466	NA		
Male x Price	$D_{3i}P_j$	λ_{32}	0.085	1.660		
Male x Alcohol	$D_{3i}X_{1j}$	φ_{33}	-0.185	1.5424		
Male x Calories	$D_{3i}X_{2j}$	φ_{32}	0.544	22.6878		
Male x Ale	$D_{3i}X_{3j}$	φ_{33}	-0.366	NA		

Male x USA	$D_{3i}X_{4j}$	φ_{34}	0.031	NA
Male x Anglo	$D_{3i}X_{5j}$	φ_{35}	-0.471	NA
Male x German	$D_{3i}X_{6j}$	φ_{36}	-0.669	NA
Male x Border	$D_{3i}X_{7j}$	φ_{37}	0.226	7.466
Unobserved	ν_i	γ_1	0.654	2.5084
Unobs. x Price	$\nu_i p_j$	γ_2	-0.012	0.1981
Unobs. x Alcohol	$\nu_i X_{1j}$	ρ_1	-0.080	0.2154
Unobs. x Calories	$\nu_i X_{2j}$	ρ_2	0.511	2.2845
Ubobs. X Ale	$\nu_i X_{3j}$	ρ_3	0.474	0.9532
Unobs. x USA	$\nu_i X_{4j}$	ρ_4	-0.885	3.67
Unobs. x Anglo	$\nu_i X_{5j}$	ρ_5	-0.699	2.2773
Unobs. x German	$\nu_i X_{7j}$	ρ_6	-0.941	2.9821
Unobs. x Border	$\nu_i X_{7j}$	ρ_7	-0.359	4.4523

Table 2. Price Elasticity Estimates for Beer Brands in Chicago

Brand	Country of Origin	Own Price Elasticity	Cross Price Elast. w.r.t. Budweiser	Cross Price Elast. w.r.t. Harp
Amstel Light	Holland	-17.945	0.540	0.339
Bass	England	-21.001	0.574	0.308
Becks	Germany	-15.798	0.499	0.301
Budweiser	USA	-8.267	-	0.097
Budweiser Light	USA	-8.761	0.166	0.126
Busch	USA	-9.256	0.169	0.094
Colt 45	USA	-8.647	0.168	0.097
Coors	USA	-8.642	0.195	0.095
Coors Extra Gold	USA	-8.761	0.219	0.122
Coors Light	USA	-16.185	0.278	0.223
Dos Equis	Mexico	-21.651	0.273	0.314
Guinness	Ireland	-19.978	0.228	0.307
Harp	Ireland	-16.141	0.237	-
Heineken	Holland	-18.082	0.195	0.283
Kaliber	Ireland	-14.146	0.082	0.194
Labatt	Canada	-8.820	0.219	0.095
Lowenbrau	USA	-10.389	0.231	0.146
Michelob	USA	-10.563	0.524	0.160
Michelob Light	USA	-7.872	0.542	0.081
Miller	USA	-7.584	0.399	0.105
Miller Light	USA	-5.310	0.452	0.029
Milwaukees Best	USA	-15.125	0.222	0.209
Molson	Canada	-14.059	0.449	0.184
Molson Golden	Canada	-14.188	0.409	0.193
Moosehead	Canada	-6.036	0.425	0.037
Old Milwaukee	USA	-12.122	0.257	0.198
Rolling Rock	USA	-18.121	0.600	0.332
Schaefer	USA	-5.198	0.531	0.024
Schlitz	USA	-7.991	0.196	0.079
St. Pauli Girl	Germany	-7.242	0.384	0.063
Average: Home		-9.929	0.322	0.134
Average: Foreign		-15.007	0.347	0.218

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Contact information

Rigoberto Lopez
Department of Agricultural & Resource Economics
University of Connecticut
1376 Storrs Rd., U-4021
Storrs, CT 06268

Phone: +001-860-486-1921
Fax: +001-860-429-1932
Email: Rigoberto.Lopez@uconn.edu