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A Pilot Study of the Market for Energy Drinks

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Abstract

The energy drink market is one of the fastest growing markets in the non-alcoholic beverage industry. Yet, relatively little is known about this set of “new age” beverages. To fill this research void, we provide a historical perspective on this market and gather information from a local retailer located close to the campus of Texas A&M University to estimate the demand interrelationships for major energy drink brands (Full Throttle, Monster, Red Bull, and Rockstar). We employ the Barten synthetic demand system in this regard and obtain estimates of own-price, cross-price, and expenditure elasticities for the respective brands.

Keywords: energy drinks, Barten synthetic demand system, pilot study

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Background

The energy drink market is one of the fastest growing markets in the non-alcoholic beverage industry. Sales of energy drinks in the United States were expected to grow to \$10 billion by the close of 2011 (The Beverage Network 2011). Designed to combat physical and mental fatigue, energy drinks contain a variety of vitamins, herbal supplements, and stimulants. Main ingredients include caffeine, taurine, sucrose, glucose, and B-group vitamins. Japan is viewed as the pioneer of the energy drink phenomenon, starting in 1962 where Taisho Pharmaceuticals manufactured a beverage called Lipovitan-D (Penalty 2006). In 1987, an Austrian, Dietrich Mateschitz, formulated Red Bull which surged in popularity in Europe. In 1997, Red Bull was introduced to the U.S. market, paving the way for other brands of energy drinks. As exhibited by Figure 1, four brands: Red Bull, Monster, Rockstar, and Full Throttle currently comprise roughly 75 percent of the market for energy drinks in the United States.

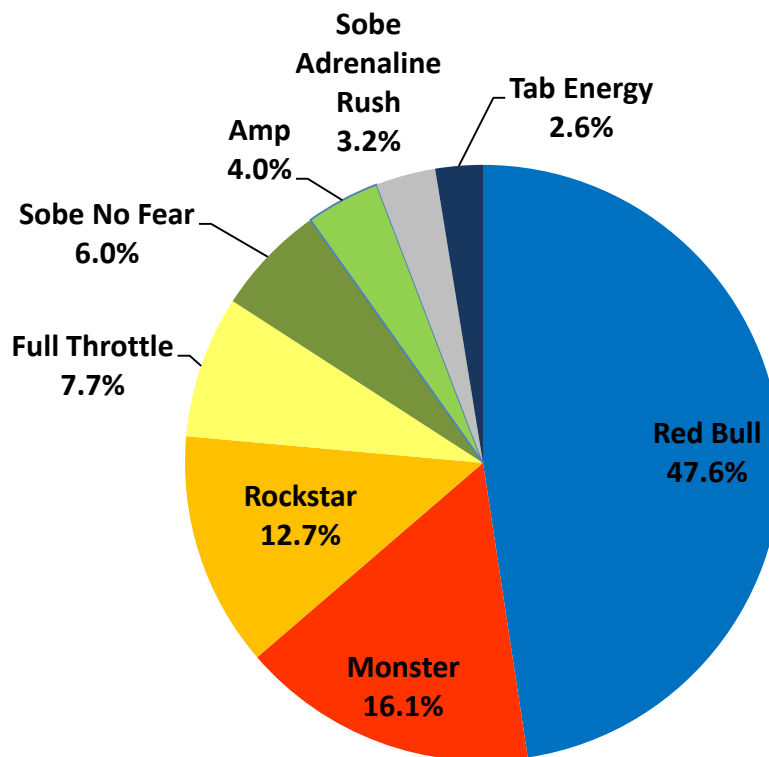


Figure 1. Share of the Energy Drink Market in the United States, 2010 (based on dollar sales)

Source: BevNET.com – The Beverage Network, 2010

Energy drinks are the “new soft drinks of the world” according to Chairman and Chief Executive Officer of Hansen, Rodney C. Sacks, the manufacturer of Monster (Palmeri 2005). Yet relatively little is known about this set of “new age” beverages. The motivation of this research is to shed light on the energy drink market and to examine the demand relationships of the major energy drink brands.

The objectives are threefold: (1) to provide a historical perspective on the nature of the market for energy drinks; (2) to gather information from a local retailer (H-E-B) in the Bryan-College Station area in order to investigate factors associated with the demands for the Red Bull, Monster, Rockstar, and Full Throttle brands; and (3) to provide strategic information to the local retailer principally via own-price elasticities and cross-price elasticities of the major energy drink brands. In essence, this work is a pilot study concerning the nature of demand interrelationships in the domestic energy drink market.

According to the Beverage Network (2011), the primary consumers of energy drinks are those under 35 years of age. In particular, college students are major consumers of energy drinks. Malinauskas et al. (2007) found that slightly more than 50 percent of college students consumed more than one energy drink per month. Given that the Bryan-College Station community encompasses Texas A&M University, this pilot study allows us to focus on purchases of energy drinks largely, although not exclusively, by college students.

Historical Perspective on the Energy Drink Market

To fulfill the first objective, we provide a historical perspective on the market for energy drinks. To that end, we describe the current manufacturers of energy drinks in the U.S. market, and we provide background information on each of the respective major brands (e.g. the date in which the product was introduced, characteristics of the product, distribution of the product, and market share). Also, we discuss various aspects of advertising/promotion for energy drinks.

Energy drinks provide attractive margins to distributors and to retailers. Additionally, these beverages do not require much shelf space. Energy drinks are distributed in convenience and gas stores, supermarkets, and other outlets. A near-majority of sales takes place in convenience and gas stores; immediate gratification destinations. Over the period 2004 to 2009, roughly 46 percent to 53 percent of the volume sold of energy drinks took place in convenience and gas stores, about 10 percent of the volume sold took place in supermarkets, and approximately 13 percent of the volume sold took place in food service outlets (The Beverage Network, 2011). The marketing of energy drinks typically rests on the use of nontraditional outlets, for example, extreme sports, NASCAR, and celebrity endorsements. Not much is done through the use of television, radio, and print advertising (The Beverage Network 2011).

Roughly two-thirds of the consumers of energy drinks are male. The majority of consumers are under 35—primarily ages 12 to 30, and heavy consumers are 20 to 30 years of age. In Figure 2, we present the various reasons to consume energy drinks according to college students: (1) insufficient sleep; (2) need energy; (3) mix with alcohol; (4) studying; (5) driving long distances; and (6) treat a hangover (Malnauskas et al. 2007).

The energy drink market is characterized in economic parlance as monopolistically competitive, where the chief characteristics are a large number of sellers, ease of entry and exit from the industry, and product differentiation. We provide information on the market share for the leading brands of energy drinks: Red Bull, Monster, Rockstar, and Full Throttle. As well, we place emphasis on product differentiation in light of the monopolistic competitive market.

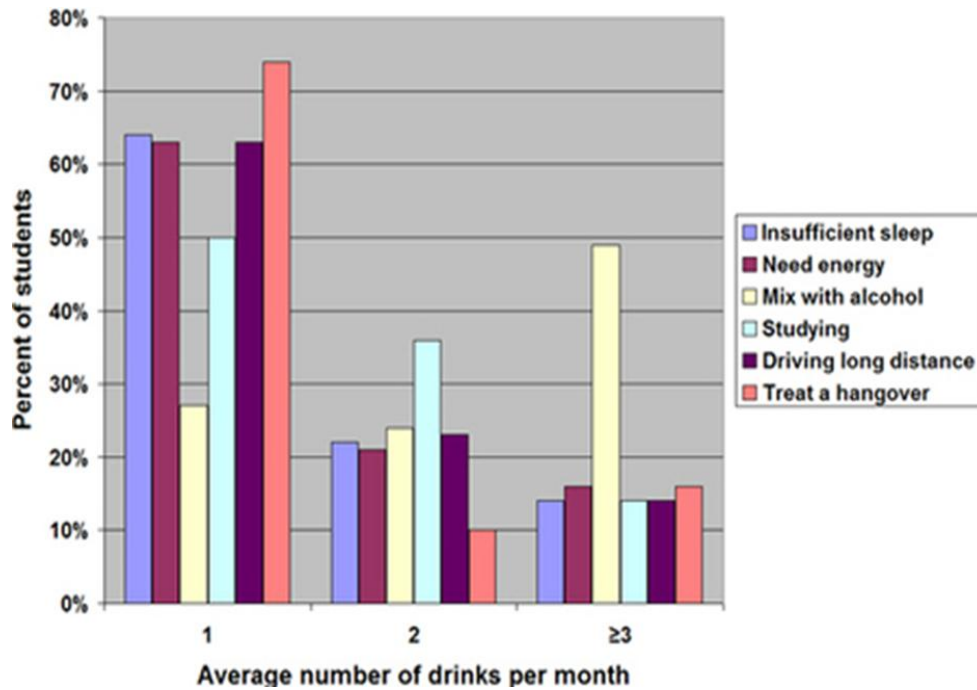


Figure 2. Percentage of College Students Reporting the Frequency of Energy Drink Consumption by Situation within a Month.

Source: Malinauskas et al. (2007)

Red Bull®

Red Bull is the best known and most widely consumed energy drink in the world. Red Bull was adapted from a Thai beverage called “Krating Daeng,” a popular drink with rickshaw drivers in Thailand. Established in 1984, the co-founders of this brand were Dietrich Mateschitz, an Austrian entrepreneur, and Chaleo Yoovidhya, owner of Krating Daeng. Red Bull is currently manufactured by Red Bull GmbH, an Austrian company. Its main ingredients include taurine (an amino acid) and glucuronolactone (a carbohydrate). Proclamations made by the manufacturers of Red Bull include increased performance, increased concentration, increased reaction speed, improved vigilance, improved emotional status, and stimulated metabolism (Penalty 2006). Its slogan is “Red Bull gives you wings.” As with the majority of energy drinks, Red Bull is mainly advertised through sporting event sponsorships and celebrity endorsements. Currently, Red Bull occupies a market share of between 40 percent and 45 percent among energy drinks (The Beverage Market 2011).



Monster is manufactured by the Hansen Natural Corporation in Corona, California. Introduced initially in 2002, this brand was one of the first energy drinks marketed in a 16-ounce can, nearly twice the size of the typical “bullet” size. The slogan for Monster energy drinks is “unleash the beast.” The drink typically comes in a black can with a green “M” logo. Monster pull tabs are unique from standard pull tabs in that they are punched with an “M” instead of a large hole (Penalty 2006). Monster contains ingredients of l-carnitine, taurine, ginseng, and B vitamins. The manufacturer’s advertising methods include the sponsorship of extreme sporting events such as Supercross, Nascar, snowboarding, and drag racing. At present, the market share for Monster is around 15 percent (The Beverage Market 2011).



Rockstar was created in 2001 by Russell Weiner, son of the renowned herbalist, Michael Weiner. The slogan for this brand is “party like a rockstar.” The official website is black and red and bursting with photographs of celebrities drinking or holding the beverage. Manufactured by Rockstar, Inc. based in Las Vegas, Nevada, Rockstar was the first energy drink to be available in 16 and 24 ounce cans. Weiner sought to differentiate Rockstar from the industry leader Red Bull, claiming that the drink was “twice the size of Red Bull for the same price.” Rockstar also differentiates its product by featuring ingredients that are “scientifically” formulated to speed the recovery time of those who lead active and exhausting lifestyles (Penalty 2006). Rockstar is also available in many different flavors. At present, the market share for Rockstar is between 10 percent and 12 percent among energy drinks (The Beverage Network 2011).



Full Throttle is made with 100 percent premium Arabic coffee. Its slogan is “no choke mixture...full flavor you don’t have to force down...No mystery ingredients. No bull.” (Penalty 2006). Full Throttle is available in several different flavors. Currently, the market share for Full Throttle is between 5 percent and 10 percent (The Beverage Network 2011).

Data from a Local Retailer Concerning Major Energy Drink Brands

To satisfy the second objective, we solicited data related to weekly sales, volume, and price information as well as weekly customer counts for Red Bull, Monster, Rockstar, and Full Throttle energy drinks from a local H-E-B supermarket in close proximity to the campus of

Texas A&M University. This information spanned a period of 153 weeks, beginning with the week of October 29, 2007 to November 4, 2007 and ending with the week of September 27, 2010 to October 3, 2010. With this information we provide descriptive information concerning weekly brand sales in dollars, weekly volume in ounces, and weekly prices in dollars/ounce. Additionally, for this supermarket, we provide weekly market share information over the 153-week period.

As depicted in Figure 3, weekly customer counts ranged from 24,000 to 36,000 over the three-year period. The median weekly customer count was roughly 29,700 patrons. In Figure 4 (see Appendix 1), we exhibit the dollar sales associated with the four major brands over the period October 29, 2007 to October 3, 2010. For this local retailer, weekly nominal dollar sales for Monster and Red Bull exhibited an upward trend, while dollar sales of Full Throttle exhibited a downward trend. Weekly dollar sales for Rockstar declined initially then rose, before leveling off at the end of the three-year period. Weekly median nominal dollar sales were \$112.72 for Full Throttle, \$286.22 for Rockstar, \$610.64 for Monster, and \$1,007.28 for Red Bull.

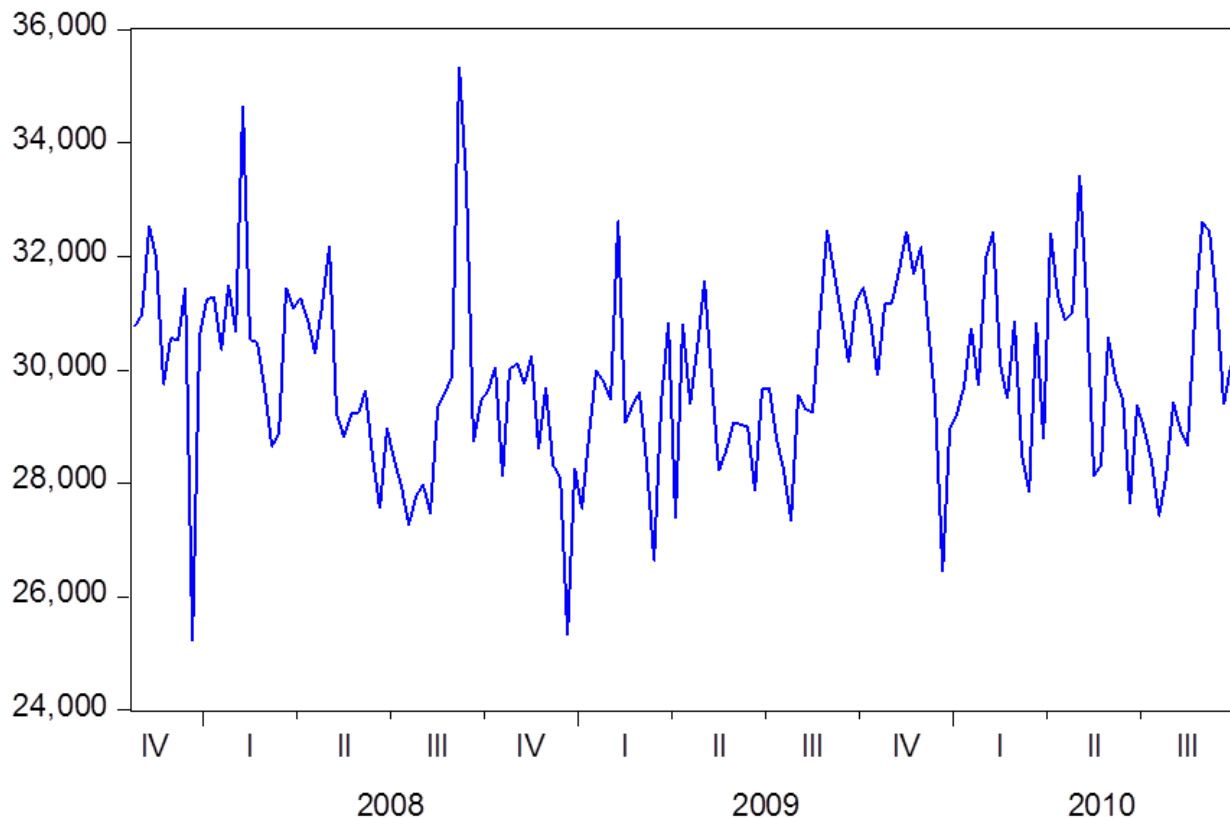


Figure 3. Weekly Customer Count of the Local H-E-B Supermarket in the Bryan-College Station Area*

*Period: Week beginning 10/29/2007 to 11/4/2007 through week ending 9/27/2010 to 10/3/2010.

Source: H-E-B.

As presented in Figure 5 (see Appendix 2), ounces sold for energy drinks from October 29, 2007 to October 3, 2010 exemplified the same types of patterns as for dollar sales. Median ounces sold were 944 for Full Throttle, 2,615 for Rockstar, 4,918 for Red Bull, and 5,569 for Monster. Market shares for the four energy drink brands are given in Figure 6. On average, the market share was about 49 percent for Red Bull, 31 percent for Monster, 14 percent for Rockstar, and six percent for Full Throttle. The market share information for this local retailer is consistent with the national situation for energy drinks. Clearly the industry leaders are Red Bull and Monster.

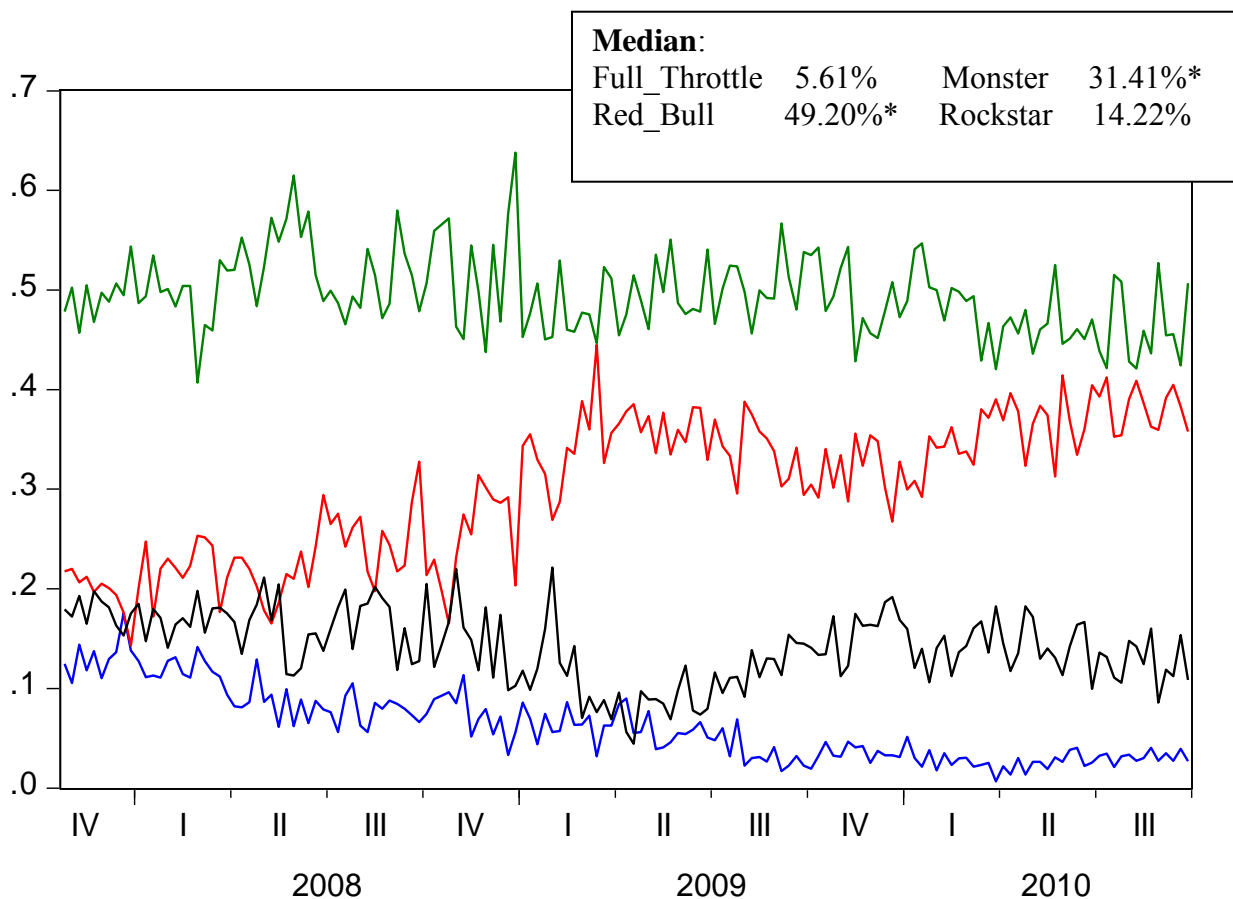


Figure 6. Market Shares for the Local H-E-B Supermarket in the Bryan/College Station Area*
 *Period: Week Beginning 10/29/2007 to 11/4/2007 through Week Ending 9/27/2010 to 10/3/2010.

Source: H-E-B.

Understanding Interdependencies of Demand among Major Energy Drink Brands

To accomplish the third objective, we use a formal demand systems approach to estimate own-price and cross-price elasticities for the four brands. With the estimated own-price elasticities, we are in position to determine the degree of price sensitivity for local customers of Red Bull, Monster, Rockstar, and Full Throttle. With the estimated cross-price elasticities, we are in position to identify major substitutes among brands.

One of the compelling features of demand system models is that they maintain flexibility while simultaneously satisfying the adding-up, homogeneity, and symmetry restrictions in accordance with demand theory. However, there is little to guide researchers when attempting to choose a particular functional form among various alternatives. In this light, Barten (1993) developed a synthetic system which nests four popular differential demand systems including the Rotterdam, LA/AIDS, CBS (Central Bureau of Statistics), and NBR (National Bureau Research). Maynard and Veeramani (2003) also demonstrate that synthetic models help avoid specification bias through the use of generalized functional forms.

The Barten model is specified as follows:

$$(1) \quad w_i d \ln q_i = (b_i + \delta w_i) d \ln Q + \sum_j [c_{ij} - \gamma w_i (\delta_{ij} - w_j)] d \ln p_j + e_i$$

where $\delta_{ij} = 1$ if $i = j$ and $\delta_{ij} = 0$ if $i \neq j$. $d \ln Q$ represents a Divisia Volume Index; w_i and q_i denote expenditure share and sales quantity of i^{th} energy drink brand, respectively and p_j denotes the price of j^{th} energy drink brand. b_i, c_{ij}, δ , and γ are the parameters to be estimated in the demand system. When $\delta = \gamma = 0$, this specification statistically is equivalent to the Rotterdam model. When $\delta = \gamma = 1$, the specification is tantamount to LA/AIDS; when $\delta = 1$ and $\gamma = 0$, the Barten model is equivalent to the CBS model and when $\delta = 0$ and $\gamma = 1$, the Barten model and the NBR model are indistinguishable. Theoretical demand restrictions are homogeneity, symmetry and adding-up, which are given by

$$(2a) \quad \sum_j c_{ij} = 0 \text{ for all } i \text{ (homogeneity),}$$

$$(2b) \quad c_{ij} = c_{ji} \text{ for all } i \text{ and } j \text{ (symmetry),}$$

$$(2c) \quad \sum_i c_{ij} = 0 \text{ for all } j \text{ (adding-up), and}$$

$$(2d) \quad \sum_i b_i = 1 - \delta \text{ (adding-up).}$$

In our demand system i and j run from 1 to 4; e_i represents the disturbance term for the i^{th} brand. To account for potential seasonality, we add dummy variables pertaining to 13-week periods to the demand system specification. To avoid the dummy variable trap, the reference quarter is the fourth quarter of the year. We also account for variations in weekly customer count by appending this variable to each equation of the demand system. Dynamics are formally incorporated in the use of this demand system because the respective quantity, price, and total expenditure terms are expressed in terms of logarithmic changes.

Weekly nominal median prices of the energy drink brands over the three-year period were \$0.1152/ounce for Full Throttle, \$0.1107/ounce for Monster, \$0.2023/ounce for Red Bull, and \$0.1121/ounce for Rockstar. The median prices of Full Throttle, Monster, and Rockstar were

very similar. The median price of Red Bull was nearly double the median prices of the remaining major brands for this local retailer. The range of the nominal prices was \$0.0999/ounce to \$0.1431/ounce for Full Throttle, \$0.1013/ounce to \$0.1231/ounce for Monster, \$0.1900/ounce to \$0.2283/ounce for Red Bull, and \$0.0928 to \$0.1328/ounce for Rockstar. Pairwise correlations among the respective prices were not high by any means, ranging from -0.1937 to 0.3324.

In estimating the Barten synthetic demand system, one equation was dropped to avoid estimation problems due to the singularity of the variance-covariance matrix of disturbance terms. The equation pertaining to the Rockstar brand was chosen arbitrarily to be omitted from the system. The parameter estimates associated with this omitted equation are recovered through the use of the aforementioned theoretical restrictions given by equations (2a) to (2d).

An Iterated Seemingly Unrelated Regression (ITSUR) technique is applied, taking into account the contemporaneous correlation of the disturbance terms among the equations. As well, we allow for the presence of first-order serial correlation [AR(1)] in the disturbance terms in each of the equations. The “mechanical” correction accounts for other systematic factors (e.g. advertising and promotion, the prices of other non-alcoholic beverages, etc.) that do not explicitly appear in the demand system due primarily to the lack of available data. These other systematic factors may affect the dependent variables in the system. Because of adding-up, a common AR(1) coefficient was estimated for the system of equations.

The estimated coefficients, standard errors, p-values, and goodness-of-fit statistics associated with the Barten synthetic demand system are presented in Tables 1a and 1b. The estimated coefficients with the c_{ij} 's are all statistically different from zero except for c_{14} . The estimated coefficients associated with the b_i 's are not statistically different from zero. Neither the coefficients pertaining to seasonality nor customer counts were statistically different from zero. The goodness-of-fit statistics indicate that the individual equations of the demand system explain a notable amount of variability in each of the dependent variables. The range of the goodness-of-fit statistics was from 0.427 to 0.812. Importantly, based on the estimates of δ and γ , the Barten model was statistically superior to the Rotterdam model, the LA/AIDS model, and the NBR model. The empirical analysis, however, was consistent with the CBS model.

Table 1A. Parameter Estimates, Standard Errors, p-values, and Goodness-of-Fit Statistics for the Synthetic Barten Model

Equation	Durbin-Watson	R-Squared	
Full Throttle	2.2662	0.4270	
Monster	2.0513	0.7244	
Red Bull	2.1806	0.8124	
Rockstar (omitted equation)	--	--	
	Coefficient	Standard Error	p-value
b ₁	-0.0016	0.0120	0.8922
c ₁₁	-0.0646	0.0213	0.0026
c ₁₂	0.0224	0.0280	0.3848
c ₁₃	0.0426	0.0323	0.1884
b ₂	0.0331	0.0471	0.4831
c ₂₂	-0.4295	0.0656	0.0000
c ₂₃	0.3005	0.0669	0.0000
b ₃	0.0594	0.0740	0.4226
c ₃₃	-0.4599	0.0950	0.0000
delta	0.9134	0.1446	0.0000
gamma	0.1283	0.1328	0.3344
rho	-0.4414	0.0431	0.0000
We recover the coefficients associated with the Rockstar brand (c ₁₄ , c ₂₄ , c ₄₄ , and b ₄) as theoretical::			
	Coefficient	Standard Error	p-value
c ₁₄ = -c ₁₁ -c ₁₂ -c ₁₃	-0.0004	0.0189	0.9812
c ₂₄ = -c ₁₂ -c ₂₂ -c ₂₃	0.1066	0.0355	0.0027
c ₃₄ = -c ₁₃ -c ₂₃ -c ₃₃	0.1168	0.0471	0.0131
c ₄₄ = -c ₁₄ -c ₂₄ -c ₃₄	-0.2229	0.0376	0.0000
b ₄ = 1-b ₁ -b ₂ -b ₃ -delta	-0.0043	0.0249	0.8628

Notes:

1. EVIEWS 7.1 was used to estimate the synthetic Barten model.
2. Rho refers to the common autocorrelation coefficient in the disturbance terms [AR(1)].
3. The estimated coefficient b_i's and c_{ij}'s correspond to equation (1). Subscript 1 represents Full Throttle, 2 represents Monster, 3 represents Red Bull, and 4 represents Rockstar.

	χ ²	p-value
4. Test of H ₀ : delta = 0 and gamma = 0 (Rotterdam Model)	40.95	0.0000
Test of H ₀ : delta = 1 and gamma = 1 (LA/AIDS model)	43.51	0.0000
Test of H ₀ : delta = 1 and gamma = 0 (CBS model)	1.28	0.5263
Test of H ₀ : delta = 0 and gamma = 1 (NBR model)	82.36	0.0000

Table 1B. Parameter Estimates Associated with the Quarterly Dummy Variables (Q₁, Q₂, and Q₃) and with the Customer Count Variable for the Synthetic Barten Model

Brand	Coefficient	Standard Error	p-value
Full Throttle			
Q1	-0.0015	0.0028	0.5842
Q2	-0.0002	0.0027	0.9285
Q3	-0.0009	0.0028	0.7315
Customer Count	8.72E-08	6.67E-08	0.1921
Monster			
Q1	0.0091	0.0058	0.1203
Q2	0.0027	0.0057	0.6302
Q3	0.0016	0.0057	0.7844
Customer Count	-1.18E-07	1.38E-07	0.3923
Red Bull			
Q1	-0.0075	0.0071	0.2876
Q2	-0.0018	0.0069	0.7938
Q3	-0.0021	0.0069	0.7642
Customer Count	-4.11E-08	1.67E-07	0.8060
		χ^2	p-value
H ₀ : no seasonality in the Full Throttle equation		0.37	0.9458
H ₀ : no seasonality in the Monster equation		2.90	0.4071
H ₀ : no seasonality in the Red Bull equation		1.30	0.7289

The uncompensated and compensated elasticity matrices are exhibited in Table 2. The price elasticities refer to the percentage change in volume sold due to unit percentage changes in prices. The expression for the uncompensated elasticity of brand *i* with respect to the price of brand *j* is (ϵ_{ij}) given in equation (3).

$$(3) \quad \epsilon_{ij} = \frac{[c_{ij} - \gamma w_i (\delta_{ij} - w_j)]}{w_i} - w_j n_i,$$

where w_i denotes the market share of brand *i*, w_j denotes the market share for brand *j*, $\delta_{ij} = 1$ if $i = j$ and $\delta_{ij} = 0$ if $i \neq j$, and n_i corresponds to the total expenditure elasticity of brand *i*. The expression for n_i is given in equation (4).

$$(4) \quad n_i = \frac{b_i + \delta w_i}{w_i}$$

The expression for the compensated elasticity of brand *i* with respect to the price of brand *j* (ϵ_{ij}^*) is given in equation (5).

$$(5) \epsilon_{ij}^* = \epsilon_{ij} + w_j n_i$$

Equation (5) rests on the use of Slutsky's equation which relates compensated and uncompensated price elasticities. The notions of substitutability and complementarity among the brands in our system are based on the compensated (Hicksian) cross-price elasticities. Substitutes in the Hicksian sense are evident for positive compensated cross-price elasticities, while complements in the Hicksian sense are evident for negative compensated cross-price elasticities.

The respective own-price, cross-price, and expenditure elasticities are functions of estimated parameters and market shares. We calculated the elasticities using the sample means of the expenditure shares. The magnitudes of the own-price elasticities were indicative of elastic demands for all energy drinks. This result is consistent with economic theory given the level of disaggregation of this market by major brands. Monster and Rockstar were the most responsive to price changes. On this basis, to raise revenue, at least in the short run, this retailer should lower prices of the major brands of energy drinks. On the basis of the compensated cross-price elasticities of demand, energy drink brands were substitutes for each other.

Table 2. Elasticity Matrices for the Respective Energy Drink Brands

Uncompensated Elasticities						
	Full Throttle	Monster	Red Bull	Rockstar	Expenditure	Market Share
Full Throttle	-1.2122	0.1315	0.3079	-0.1145	0.8873	0.0623
Monster	0.0187	-1.8240	0.5548	0.2272	1.0233	0.3012
Red Bull	0.0297	0.3345	-1.5054	0.1078	1.0334	0.4950
Rockstar	-0.0502	0.5259	0.4518	-1.8106	0.8830	0.1415

Compensated Elasticities				
	Full Throttle	Monster	Red Bull	Rockstar
Full Throttle	-1.1569	0.3988	0.7471	0.0110
Monster	0.0825	-1.5158	1.0613	0.3719
Red Bull	0.0941	0.6458	-0.9939	0.2540
Rockstar	0.0049	0.7919	0.8889	-1.6857

Red Bull was the major substitute for the respective brands. Monster was the leading substitute for Red Bull followed by Rockstar. Monster was the next best substitute for Full Throttle, Rockstar was the next best substitute for Monster, and Monster was the next best substitute for Rockstar. Among the major energy drinks considered, Full Throttle was the least substitutable brand. This set of results is consistent with the market shares among the brands.

Conclusions

This analysis allows a better understanding in regard to purchase behavior of major energy drink brands. This analysis may be replicated for other H-E-B stores, for other retailers, or for various convenience store and gas station outlets. This analysis will allow manufacturers of the major energy drink brands as well as retailers to improve strategic decision-making. Specifically, with our quantitative analysis, forecasts of item movement can be made to assist in inventory management, and pricing strategies can be developed to maximize sales revenue.

A number of limitations exist in the present analysis. The data pertain to only one store, H-E-B, and do not reflect competitor actions. Additionally, due to the lack of available data, the model does not take into account in-store promotion or local advertising effects. Moreover, other potential substitutes from the set of non-alcoholic beverages, particularly those rich in caffeine, are not considered (e.g., coffee, tea, and carbonated soft drinks). This work certainly may be replicated in other areas throughout the United States. To be sure, future work should accommodate a longer list of potential substitutes/complements from the non-alcoholic beverage category as well as the impacts of advertising and promotion. Nevertheless, our pilot study approach fills a research void on the examination of the energy drink market. Future research should provide dividends to analyses of this growing “new age” beverage category.

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Appendix 1.

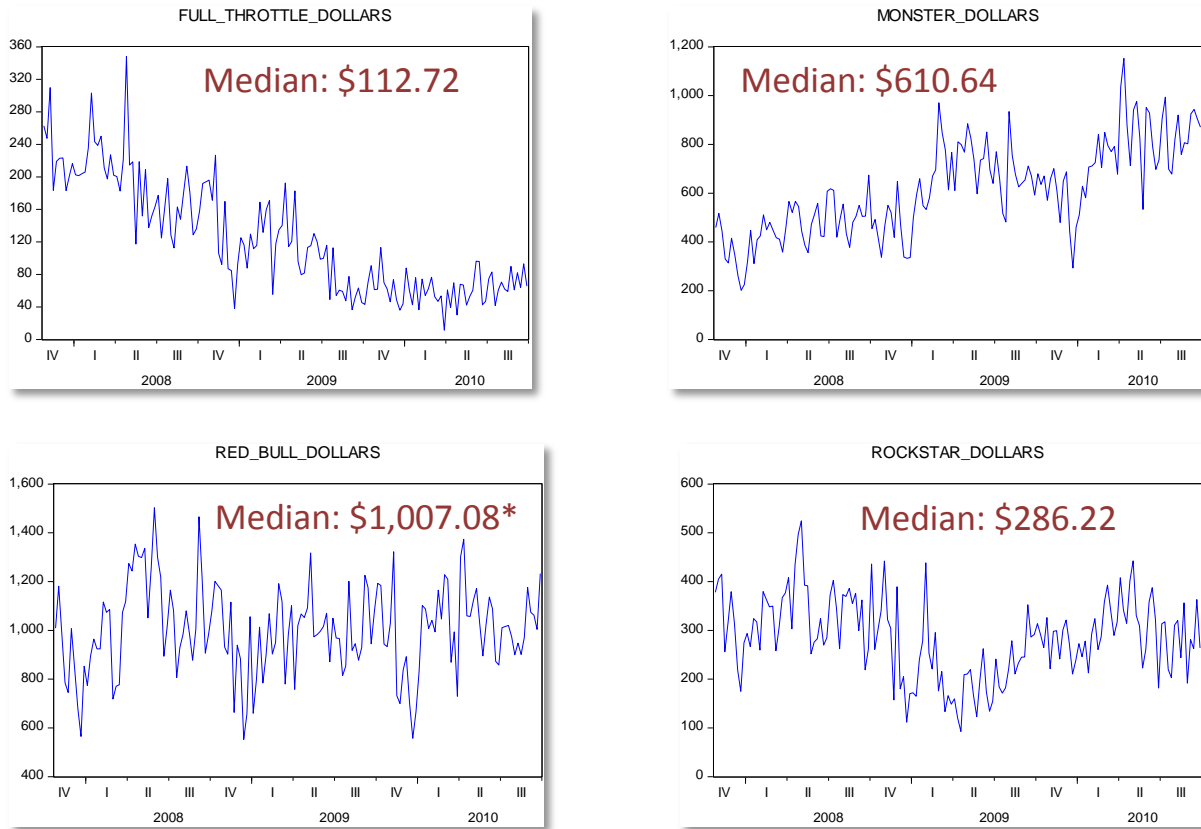


Figure 4. Nominal Dollar Sales Associated with Energy Drinks Sold at the Local H-E-B Supermarket in the Bryan/College Station Area*

*Period: Week Beginning 10/29/2007 to 11/4/2007 Through Week Ending 9/27/2010 to 10/3/2010.

Source: H-E-B.

Appendix 2.

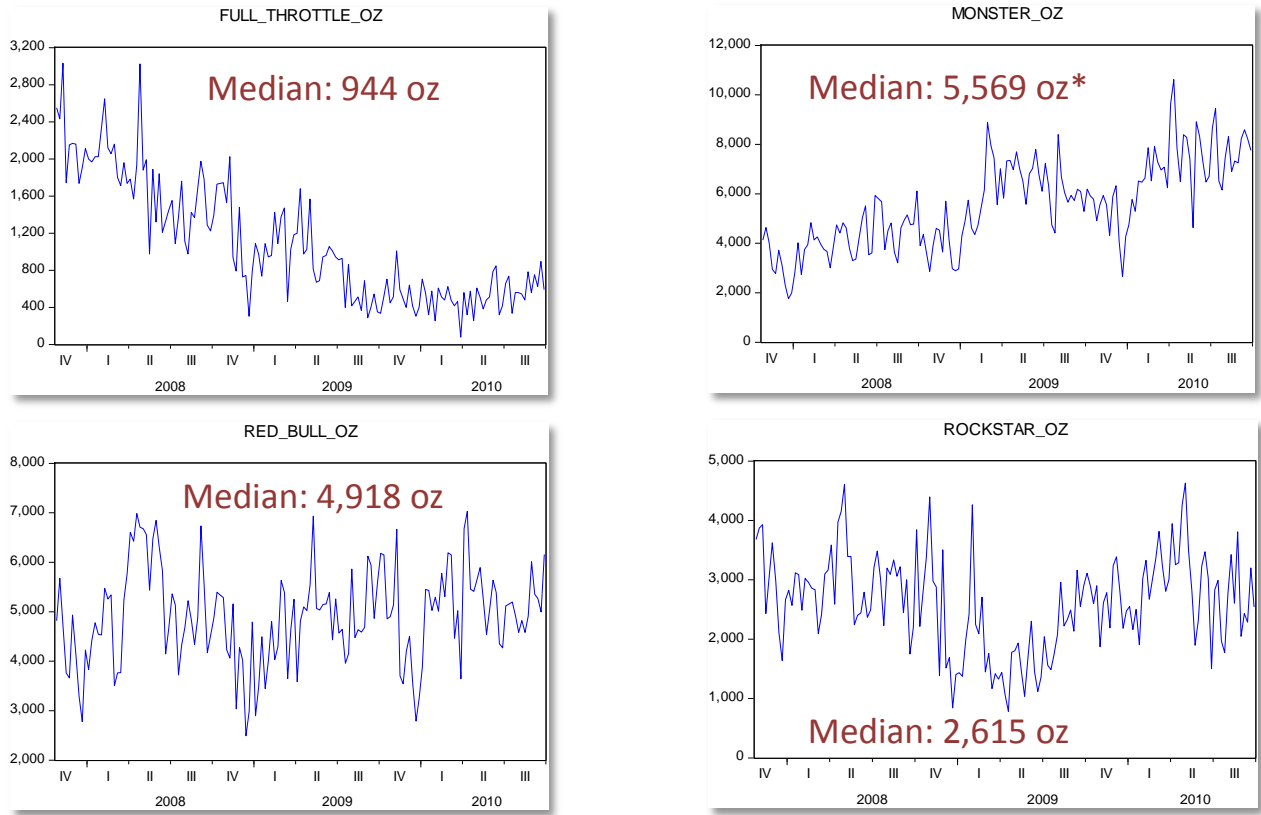


Figure 5. Ounces of Energy Drinks Sold at the Local H-E-B Supermarket in the Bryan/College Station Area*

*Period: week beginning 10/29/2007 to 11/4/2007 through week ending 9/27/2010 to 10/3/2010.

Source: H-E-B.