VALUE OF BEEF STEAK BRANDING: HEDONIC ANALYSIS OF RETAIL SCANNER DATA

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Introduction

Branding of beef retail products has emerged from being nearly non-existent several years ago to becoming commonplace.[1] As potential value of product branding has become recognized, a proliferation of beef branding strategies has emerged. For example, a review of FreshLook retail data reveals more than 100 beef brands are now present in U.S. retail markets.

Product differentiation through branding is especially prevalent in steak cuts. The steak market is intriguing because the interaction between numerous physical attributes and marketing characteristics have been used to differentiate the product. However, limited information exists on consumer preferences for steak attributes and the equity of steak brands. Revealed preference theory is used in this article to determine consumer preferences for retail steaks. This study determines the value consumers place on descriptive characteristics of steak, especially retail brands and estimates factors associated with brand premiums and discounts. Knowing brand value will provide important information to help design beef industry product branding strategies.

This study employs a two-stage hedonic analysis. First, an hedonic model is used to recover implicit prices of retail steak characteristics and reveal information on underlying preferences for these characteristics. The retail steak market is transforming from offering relatively homogeneous to differentiated products and a proliferation of brands. This analysis also determines price premiums associated with product breed claims, organic labeling, and religious processing methods. Our second-stage differs from most second-stage hedonic

[1] In 2004, 42% of beef retail products were branded and this increased to 51% in 2007 according to the National Meat Case Studies conducted jointly by the Beef and Pork Boards and Cryovac.

analysis.[2] Estimated brand coefficients, unobserved effects, from the hedonic price model are utilized as a dependent variable to determine factors impacting brand premiums and discounts, or brand value. Knowing how branding initiatives affect brand value will help identify which brand strategy is best for targeting consumers.

Previous Research

Important for assessing implicit values of product attributes is an understanding of branding incentives and recognizing different brand categories offer a variety of quality and price components. Cotterill, Putisis, and Dahr (2000) analyzed price differentiation between private labels and national brands. Differences in prices between national brands and private labels narrowed in grocery markets focused primarily on local products and when private label share was high, price was important. In contrast, when private label share was low, price was not an important strategic component. In addition, when national brands displayed advertisements, private label share of the market was lower, suggesting retailers use price as a "strategic weapon". Results suggest the higher the price of either national brands or private label, the less share of the market they will have.

Froehlich, Carlberg, and Ward (2009) analyzed consumer willingness-to-pay for fresh branded beef in an experimental auction framework. They concluded that there was a significant preference by survey participants for branded products. As such, developing a well-recognized and favorable brand reputation will enhance product demand.

Parcell and Schroeder (2007) analyzed panel diary retail beef product purchase prices to determine how pricing varied among products, geographic location, store type, sale items,

[2] Typical second-stage analysis involves estimating uncompensated demands for the characteristics of the differentiated good. This requires information on the quantities of characteristics purchased, the marginal implicit prices of the characteristics obtained from the first-stage analysis, and the socio-economic characteristics of the purchasers (Taylor 2003).

composition (fresh, frozen, or cooked), and package size. Branded medium and high quality steaks commanded a premium of approximately $1.26/lb relative to unbranded products. In contrast, other brands appeared to be targeting price-sensitive consumers by selling lower-priced products where the brand premium was $0.76/lb. Hanagriff, Rhoades, and Wilmeth (2009) identified product guarantee, color, leanness, and health claims as the most influential when consumers purchase branded beef products.

Ward, Lusk, and Dutton (2008) documented the extent of branding and detailed characteristics of branded fresh beef sold at retail. They argued that branding represents cues for consumer purchasing decisions and found premiums for branded ground beef products ranging from $0.94/lb to $1.26/lb relative to unbranded product.

Morales et al. (2009) used focus group research to segment the Australian domestic beef consumer market and estimated the propensity to buy and the willingness-to-pay for differentiated beef products. They concluded branded would have to be differentiated from unbranded beef to garner a premium and incentives for suppliers and retailers would be required to support any brand innovation. Similarly, Martinez (2008) found that beef products receiving the largest premiums included branded beef alliances with specific production requirements, including natural, organic, source verified, grass-fed, and breed specific.

Past research relates to this study by assessing the valuation of branding in the national beef retail sector as well as other attributes that affect price. This study differs from and builds information relative to previous research in several important ways. First, we rely on retail scanner data rather than hypothetical surveys or experimental markets to infer values of product characteristics. The scanner provides a complete sample of sales of all steak products in the participating retail outlets over a five-year period. Second, rather than aggregating brands into

arbitrary groupings we estimate each individual brand's premium or discount, after adjusting for other product characteristics. This provides a full spectrum of pricing differentials associated with the specific brand. Third, we estimate factors driving brand value. As such, we gain insight into factors contributing to brand equity.

Hedonic Model

An underlying assumption of the hedonic model is that goods can be distinguished by various product characteristics. Thereby, demand for the desired characteristics can be derived from consumer willingness-to-pay. As a result, marginal or implicit values can be estimated for each characteristic at the observed purchase price which is linked with the presence of the particular characteristic. The hedonic method is an indirect valuation approach because we cannot directly observe the value consumers have for a specific characteristic but instead we infer value from their purchases.

To begin, suppose a market good is composed of *n* characteristics,

(1) $$z = (z_1, z_2, \dots, z_n).$$

Prices can be related to the characteristics as:

(2) $$p(z) = p(z_1, z_2, \dots, z_n),$$

where it is assumed that each product has a market price, p, and the summation of product attributes can be expressed by z (Rosen 1974).

A vector of implicit marginal values is obtained by differentiating $p(z)$ with respect to its *i*th argument, z_i (Rosen 1974).

(3) $$p_i(z) = \partial p(z)/\partial z_i,$$

where p_i are the characteristics' marginal values.

Hedonic Retail Steak Model Using Price and Characteristics

An hedonic pricing model is applied to a panel of retail steak sales to estimate the impact various physical attributes, product claims, and brand factors have on retail steak pricing. A fixed effects estimator is hypothesized to control for the time invariant unobserved brand factors that may impact retail steak price.[3] Consider the model:

$$P_{ijt} = (\alpha + c_{ij}) + \boldsymbol{x}_{ijt}\beta + u_{ijt} \quad i = 1, \ldots, M, j = 1, \ldots, N_i, \text{ and } t = 1, \ldots, T_i, \tag{4}$$

where P_{ijt} denotes the price of the i-th steak package with the j-th product attribute for the t-th time period, α is the overall model intercept, c_{ij} is the time invariant individual brand effect considered part of the intercept, $\boldsymbol{x}_{ijt}$ is a $1 \times K$ row vector of observable variables, β is a $K \times 1$ parameter vector of marginal effects of these variables, and u_{ijt} are the idiosyncratic errors which change across i, j, and t (Wooldridge 2002 and Baltagi 2008).

At question is whether c_{ij} should be treated as a fixed effect or a random effect. The Durbin-Wu-Hausman test was used to test between fixed and random effects (Wu 1973).[4] The test was performed by obtaining the group means of the time invariant variables and adding them to the estimated random effects model. Then testing the joint hypothesis that the coefficients on the group means are all zero is equivalent to the Hausman test, but avoids the problem of singular covariance matrix. The hypothesis that the individual effects are uncorrelated with the other regressors was rejected (i.e., there is correlation between an effect and the explanatory

[3] There are two preconditions for using random effects modeling; if either is violated, fixed effects should be used. One precondition is that the observations can be described as being drawn randomly from a given population. In most cases, as is the case here, this is not a reasonable assumption. In addition, the fixed effects estimator has one considerable virtue; there is little justification for treating the individual effects as uncorrelated with other regressors, as is assumed in the random effects model (Greene 2003). Because brands are a subset of the population and are expected to be correlated with individual steak characteristics a fixed effects estimator is hypothesized.

[4] A Hausman (1978) test is typically used to test between fixed and random effects; however, when performing the test, the variance covariance matrix was not able to be inverted. This happens in the presence of time invariant variables (e.g., brand variables) in the model.

variables). This suggests that these effects are correlated with other variables in the model, thus the fixed effects model is appropriate.

An *F*-test can be used to test the hypothesis that the $c_{ij}'s$ (individual brand effects) are all equal (Greene 2003). Under the null hypothesis of equality, the efficient estimator is pooled least squares. The test statistic is:

$$F(n-1, \sum_{i=1}^{n} T_i - n - K) = \frac{(R^2_{LSDV} - R^2_{Pooled})/(n-1)}{(1-R^2_{LSDV})/(\sum_{i=1}^{n} T_i - n - K)}, \quad (5)$$

where *LSDV* indicates the dummy variable model and *Pooled* indicates the pooled or restricted model with only a single constant term. The R^2 is 0.66 in the pooled model and 0.74 in the *LSDV* model. The value of the *F* random variable is F(60, 198,555) = 5394.25 (p-value < 0.00). Thus, the brand-specific constants differ and a pooled model with one intercept is not appropriate. Thus, we opt for using a fixed effects model.

The data utilized in this study have repeated observations per cross-section and over time for individual brands. As a result, the errors are potentially serially correlated (i.e., correlation over *t* for a given *i* and *j*) and/or heteroskedastic. Inclusion of fixed individual-specific effects can reduce serial correlation in the errors (Cameron and Trivedi 2005).[5] A Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis that the error variances are equal. White's heteroskedasticity consistent covariance matrix is used to estimate standard errors.[6]

[5] In order to test for serial correlation, a time variable must be specified. However, for this data there was not a consistent time variable because we often have zero or more than one observation per time period per cross section. This makes it impossible to conduct a consistent test for serial correlation. As such, our model is specified as having independent errors across observations.

[6] White's robust standard error estimation was used instead of feasible generalized least squares (FGLS) because given the large sample size the loss of efficiency in parameter estimates is rather small. Results using the FGLS estimator were quantitatively similar.

The retail steak price is modeled as:

$$Price_{ijt} = \alpha + \sum_{j=1}^{62} \beta_{1j} Brand_{ij} + \beta_2 Year_{ijt} + \beta_3 Breed_{ijt} + \beta_4 (Breed_{ijt} * Year_{ijt})$$

$$+ \beta_5 Organic_{ijt} + \beta_6 (Organic_{ijt} * Year_{ijt}) + \beta_7 Religious_{ijt} \quad (6)$$

$$+ \beta_8 (Religious_{ijt} * Year_{ijt}) + \beta_9 Bone_{ijt} + \sum_{j=1}^{33} \beta_{10j} Cut_{ijt} + \beta_{11} MeanPrice_{ijt}$$

$$+ u_{ijt},$$

where *i* refers to steak package (package is used here to refer to weekly sales of the specific product), *j* refers to product attribute, and *t* refers to time period. All other variables are defined in table 1.

Brand Value Model

Brand value is the value beyond the physical characteristics associated with the product's production or processing. Brand value is therefore based on consumer perception as opposed to an objective measure. Numerous steak brands are present appealing to different consumer perceptions. As such, it is difficult to distinguish characteristics driving individual brand premiums and discounts from just the hedonic model parameter estimates on binary brand variables. For example, brands may differ across many dimensions, such as brand longevity or breadth of national distribution. Implicit values needed to determine brand value differences are obtained from estimating equation (6). These implicit values are used to determine factors contributing to brand value. The brand value determination model takes the form:

$$BrandValue_j = \alpha + \sum_{a=1}^{4} \beta_{1a} BrandAge_{aj} + \sum_{l=1}^{3} \beta_{2l} Location_{lj} + \sum_{p=1}^{4} \beta_{3p} Positioning_{pj} \quad (7)$$

$$+ \beta_4 ChoicePlus_j + \beta_5 MultiMeat_j + \varepsilon_j,$$

where *j* refers to brand and all other variables are defined in table 2.

Data

Scanner data of steak purchases in U.S. retail outlets over the period 2004 through March 2009 were obtained from FreshLook Marketing Group. FreshLook Marketing Group collects meat department InfoScan random weight sales data from more than 14,000 retail food stores nationwide. Data recorded for each sale included: sales value, pounds sold, brand name, breed claim, organic labeling, religious processing claim, bone presence, and individual steak cut. The data set contains 198,719 weekly aggregated steak sales observations. Weekly aggregations are pounds sold each week by brand name, steak cut, breed, organic, and religious processing claims, and presence of bone.

Due to confidentiality, specific breed names cannot be identified. As such, we name the brands *Brand 1* through *Brand 62*. Likewise, we simply note whether a specific breed claim was present or not. Organic claims are certified by an accredited certifying agent as utilizing a system of organic production and handling as described by the Organic Foods Production Act (OFPA) of 1990. Organic products must be handled without the use of synthetic chemicals and must be produced and handled in compliance with an organic plan agreed to by the producer and handler of the product and the certifying agent (USDA 2010). The religious processing claims consist of Kosher, Kosher-Glatt, Halal, and No Religious Claim. All religious claims were combined into a single binary variable equal to 1 if the product had a religious processing claim, and zero otherwise.

Previous studies (e.g., Parcell and Schroeder 2007 and Ward, Lusk, and Dutton 2008) included USDA quality grades Prime, Choice, Select, and not graded to categorize meat quality. There is considerable collinearity present in our data set between individual brands and quality

grades. As such, we estimate a model excluding quality grade variables as they are embedded in the brand effects.

Thirty-three different steak cuts (figure 1) were present in the data. Steak cuts that are considered premium cuts are expected to have positive coefficients in the hedonic model and everyday steaks are expected to have negative coefficient estimates. In addition, cuts with the presence of a bone (*Bone*=1) are expected to have a lower retail price per pound than boneless cuts.

Because the data span more than five years, a market steak price indicator was needed to adjust for changing price levels over time. To adjust for changing aggregate meat prices over time, a base price was calculated that reflects changing aggregate market supply and demand conditions each week. Ideally, we would like this price to be an external aggregate market price (e.g., Schroeder 1997; Parcell and Schroeder 2007). However, no publicly reported weekly retail steak price is published or available. Thus, we use the scanner data to calculate a volume-weighted-average aggregate weekly retail steak price (*MeanPrice*). Since our data comprises a large share of the overall U.S. retail steak market with more than 14,000 stores included in the data, even if an externally reported price quote existed, it would essentially be comprised of the same data we have in our scanner data set.

In addition to details of aggregate weekly sales, information describing each individual brand were collected that was hypothesized to affect brand value. Variables defined in table 2 are used in stage two of the analysis where the estimated product brand premiums and discounts from the hedonic model are regressed against factors associated with each brand name. Brand longevity is the continued presence of a brand in the relevant market (Banbury and Mitchell 1995; Li 1995). The longevity of brands is essential for a firm's survival as it is linked to

performance measures such as profitability and market share (Kanter and Brinkerhoff 1981; Suarez and Utterback 1995). Brand longevity was categorized into five segments of 1) three years and less (7%), 2) four to six years (18%), 3) seven to ten years (5%), and 4) eleven years and greater (69%). Brands having a longer presence in the industry are expected to have greater consumer recognition and thus higher brand value.

The data set consisted of 60 steak brands that were classified into the following geographic distribution categories for use in our brand value model.[7] A *local* brand is a brand that is only distributed within a local geographic area and is privately owned and controlled by a small company. A *regional* brand is a brand distributed regionally to retail outlets and is owned and controlled by a private company. Distribution is to one or more regions but not nationwide. A *national* brand is a brand that is distributed to retail locations nationwide and is controlled by the company or the supplier(s) who own the brand. Of the 60 brands, 8, 27, and 25 brands were classified as local, regional, and national, respectively.

Brand prominence could have either positive or negative relationship with price. If local brands are targeting consumers who prefer locally produced products and being marketed as such, they could garner a premium to other brand categories. We hypothesized that regional brands would signal local production, and would command a similar premium or discount in the marketplace. Jekanowski et al. (2000) surveyed consumers in Indiana and concluded that consumers were willing to pay a premium for locally produced meats. This is consistent with similar results obtained for consumers from California (McGarry-Wolf and Thulin 2000), Colorado (Thilmany et al. 2003), and Chicago and Denver (Umberger et al. 2003). National brands have much larger overall volume, greater advertising expenditures, and as such garner

[7] Unbranded products and products that were included in a conglomerate store grouping were not included in the data set used for stage two of the analysis. Thus, 62 brand categories was reduced to 60 brands.

broader general consumer awareness which might enable them to secure greater brand value and secure a higher price (Parcell and Schroeder 2007). Previous studies (Darby et al. 2006, Hu 2007) have shown that taste is the single most important attribute in repeated purchases of a food, and consumers are more likely to have had experience with a nationally branded food product than with a small distribution, local or regional brand.

Because different branded products are positioned to appeal to different consumers, brand positioning was included to determine how brand value differs between different types of brands. Brand types include: special (33%), program (7%), store (23%), and other (37%) which are consistent with the categories of Ward, Lusk, and Dutton (2008). Special brands are those that carried special labels related to production practices such as "natural." Special-label products have higher production costs than products without special labeling or production methods (Yanik et al. 1999). Therefore, for special brands to exist in the marketplace they are expected to have a high brand value. Program brands are breed-specific products. Generally we would expect a breed name on the package would help to promote consumer confidence and loyalty, due to the accountability and product assurance that come with the breed name. Retail product (*store*) branding has increased in recent years as average retailer size has increased. According to the National Meat Case Study 2007 whole muscle beef increased from 15 percent in 2004 to 31 percent in 2007. Other brands were those that could not be classified readily into one of the previous three brand types. Other brands have a tendency to be owned by a processor or meat market.

Quality grade variables were excluded from the retail price estimation because they are embedded with the brand effects. Because Prime and Choice quality grades signal quality they are hypothesized to increase brand value. As such, the proportion of pounds sold by a particular

brand grading Choice or Prime (*ChoicePlus*) was included in the brand value determination model.

Brand recognition can be strengthened by branding multiple food products. For example, certain brands offer combinations of beef, poultry, and/or pork products carrying the same brand name. Multiple-product brands might enjoy greater brand equity because of broader consumer recognition of, and loyalty to, the brand name across food products. Sixty-three percent of the brands in this sample represent products from companies having multiple meat species brands

Estimation of Implicit Prices of Retail Steak Characteristics

In empirical estimation, the theoretical foundation for hedonic models provides little guidance on appropriate functional form. Here, steak is assumed to be separable and additive in the various characteristics (e.g., breed claim, organic claim, religious processing claim, cut) suggesting a linear relationship for estimation purposes. This implies steak characteristics can be unbundled, repackaged, and purchased in any combination. We also considered a log-linear model. Results were quantitatively similar and are not presented for brevity, but are available upon request.[8] Empirical results for the hedonic pricing model are presented in table 3.[9] Coefficient estimates refer to a change in retail steak price in $/lb. from a one unit change in the independent variable, *ceteris paribus*. Positive coefficients represent a premium for the particular steak characteristic; while negative coefficients indicate a discount.

Brand coefficients (figure 2), range from $5.81/lb. to -$1.32/lb. compared to unbranded steak products. Ward, Lusk, and Dutton (WLD) (2008) found premiums of -$0.00/lb. to

[8] A Box-Cox transformation could not be applied because all the attributes are expressed as binary or dummy variables, which are used with discontinuous factors (Linnen 1980 and So et al. 1996).
[9] Influence diagnostics were performed to determine if results were significantly influenced by outlier observations (Belsley, Kuh, and Welsch 1980). Overall, the parameter estimates are not significantly influenced by a specific subset of outlier data.

$6.20/lb. relative to generic or unbranded beef. While the range found by WLD is similar to our results, notable differences exist in measurement across the studies. Our study estimates individual brand coefficients as opposed to grouping brands into special, program/breed, store, other, and none/generic. Furthermore, our study employs nationwide retail scanner data; while WLD used data from a sample of retail stores in Oklahoma City and Tulsa, Oklahoma, and Denver, Colorado. Martinez (2008) found steak brand premiums from -$0.44/lb. to $4.15/lb. when utilizing Nielson Homescan Panel data.

The breed claim coefficient indicates steaks having a breed claim, *ceteris paribus,* had a $1.15/lb lower price on average than product without a breed claim and this discount increased at a rate of $0.03/lb per year during the time period covered in our data set. We expected breed claim to have a positive coefficient because one would anticipate that a breed claim is made in order to appeal to consumers that have a breed preference. Furthermore, the breed claim can always be omitted from the product label if it reduces product value. Perhaps breed claims have proliferated to the point where they do not, by themselves, garner steak product value enhancement. In further analysis that we cannot report due to confidentiality we determine that certain brands with a breed claim garner a premium while other brands with a breed claim are a discount. Thus, to predict the price of a steak that has a breed claim, one needs to take into consideration the brand parameter estimate together with the breed claim estimate.

Organic steak product garners a premium of $1.43/lb compared to a steak product that has no organic designation. Results are consistent with expectations because products that are organic tend to exhibit a higher price because they represent a particular niche market that is costly to supply relative to conventionally produced products. Furthermore, organic premiums were increasingly larger over time at the rate of $0.53/lb per year so that by 2009 the organic

premium was $4.10/lb. Religious processing claims had a premium of $0.79/lb. which increased $0.19/lb. per year. As expected, retail cuts with the presence of a bone have a lower retail price of $0.77/lb relative to boneless product.

Tenderloin, Porterhouse, T-bone, Ribeye, Top Loin, and Lip On Ribeye garner premiums (figure 3) relative to the default sirloin steaks. Premium steak cut coefficients reveal an average premium of $3.44/lb. The Tenderloin cut garners the highest premium of $7.60/lb relative to Sirloin steaks. Steaks categorized as "every day" steaks received discounts of $0.05 to $5.31. These steaks are associated with a discount because consumers perceive these cuts as being less flavorful and less tender. Often additional processing and preparation is necessary when cooking "every day" steaks. The steak cut coefficients coincide with The Beef Checkoff's (2008) classification of premium and every day steaks.

The sign of the volume-weighted average weekly price per pound of steak variable agrees with expectations. For a $1.00 increase in the mean price per pound of steaks in the market each week, the individual steak product prices per pound increase by $0.33/lb.

Estimation of Brand Value

The previous discussion highlights the value consumers place on descriptive characteristics of steak and identifies individual brand values. But what factors influence brand value? The second stage of the hedonic analysis was used to provide insight into this question.

Results of estimating equation (7) are presented in table 4. New brands, brands that have existed in the industry for three years or less, have $1.57/lb. premium relative to brands that have been in the industry for greater than ten years. When consumers have many brands to choose from, there is an emphasis on the development of new and different product attributes, rather than emphasizing the value found in a traditional product (Outlaw et al. 1997). The estimate

found here indicates that new brands are introduced with premium prices. Perhaps newly launched brands are targeting specific emerging consumer trends. How many of these brands will be successful in sustaining premium value over time is unknown, but likely some will fail. Estimates for medium age brands are not statistically significant.

Regional brands garnered $0.72/lb. premium relative to national brands. This is a surprising result since regional brands have smaller market share and presumably less general consumer recognition. In contrast, local brands do not have statistically different brand equity relative to national brands.

Results support recent changes in firms' attempts to differentiate products through brand positioning. Estimates of this positioning show that *Special* brands have $2.36/lb. higher prices relative to *Other* brands; while *Program* and *Store* brands have $1.54/lb. and $1.34/lb increase in brand value, respectively. Store branding is relatively new and may show an increase in premiums moving forward because these products are many times associated with numerous production and processing characteristics.

Implications and Conclusions

The objective of this article was to determine the equity of beef steak brands. Certain brands garner premiums while others receive discounts relative to unbranded products. Additional steak product attributes were identified that exhibit premiums or discounts. Today's consumer exhibits complex purchasing behavior which different beef industry sectors are taking into consideration in order to provide a desired product. Results should help every sector of the beef industry understand what the consumer is actually purchasing and also what product attributes, particularly branding, contribute to the overall price.

Capitalizing on consumer ideals and demands for particular attributes is key to the success of a brand. This study found 55 of 61 retail steak brands received premiums while the remaining brands were discounted relative to unbranded products. Characteristics other than brand that garner a premium include organic claim, religious claim, and boneless products. Furthermore, organic and religious claims have seen an increase in premiums over time. Premium steaks, such as Tenderloin, Porterhouse, T-bone, Ribeye, Top Loin, and Lip On Ribeye exhibit premiums when compared to Sirloin steaks. Steak cuts perceived to be lower quality were discounted.

For a branded steak product to be successful there must be a strong link between consumer's attitudes and the attributes that the brand offers. For instance, new brands targeting emerging consumer trends, brands with regional prominence, those positioned as special-labels, program/breed specific, and store brand, are all examples of branded beef attributes that are garnering increased value.

This work should be beneficial in future efforts to estimate pricing models with similarly related but highly differentiable products. Moreover, the framework demonstrated here could be easily extended to a variety of data sets as more scanner data become available to researchers.

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Table 1. Description of Variables and Summary Statistics of Sale Observations

Variable	Description	Mean	Std. Dev.
	Dependent variable		
$Price_{ijt}$	Retail price for package *i* of cut *j* during week *t* ($/lb.)	7.85	4.27
	Independent variables		
$Brand_{ij}$	Binary variables for brand (*j*) for package *i*[a]	N/A	N/A
$Breed_{ijt}$	Binary variable =1 if a breed claim is present, =0 otherwise	0.48	0.50
$Organic_{ijt}$	Binary variable =1 if an organic claim is present, =0 otherwise	0.04	0.19
$Religious_{ijt}$	Binary variable =1 if a religious processing claim is present, =0 otherwise	0.06	0.24
$Bone_{ijt}$	Binary variable =1 if bone is present, =0 otherwise	0.20	0.40
Cut_{ijt}	Binary variables for retail cut (*j*) for package *i*	(see figure 1)	
$Year_{ijt}$	Continuous variable for year of package sale *i* (2004=0, …, 2009=5)	N/A	N/A
$MeanPrice_{ijt}$	Weekly weighted average price ($/lb.)	5.36	0.27

[a] Proportion of sales associated with each brand are not presented due to confidentiality.

Table 2. Description of Variables and Summary Statistics of Brands

Variable	Description	Mean	Std. Dev.
	Dependent Variable		
$BrandValue_j$	Implicit value of brand, c_{ij} ($/lb.)	2.35	1.75
	Independent Variables		
$BrandAge_{aj}$	Binary variables for age of brand *j*		
a =	1 - 3 years	0.07	0.25
	4 - 6 years	0.18	0.39
	7 - 10 years	0.05	0.22
	> 10 years	0.70	0.46
$Location_{lj}$	Binary variables for geographic scope of brand *j*		
l =	Local	0.13	0.34
	Regional	0.46	0.50
	National	0.41	0.50
$Positioning_{pj}$	Binary variables for positioning of brand *j*		
p =	Special	0.33	0.48
	Program	0.07	0.25
	Store	0.23	0.43
	Other	0.37	0.49
$ChoicePlus_j$	Proportion of brand *j's* total sale pounds labeled as grading Choice plus Prime over entire data set	0.18	0.38
$MultiMeat_j$	Binary variable =1 if multiple meat species brand, =0 otherwise	0.63	0.49

Table 3. Determinants of Steak Price per Pound, 2004 - March 2009

Variable	Parameter Estimate[a]
Intercept	4.72***
	(0.11)
$Brand_j$ (*default*: unbranded)	(see figure 2)
Year	0.04***
	(0.01)
Breed	-1.15***
	(0.04)
*Breed * Year*	-0.03***
	(0.01)
Organic	1.43***
	(0.10)
*Organic * Year*	0.53***
	(0.03)
Religious	0.79***
	(0.06)
*Religious * Year*	0.19***
	(0.02)
Bone	-0.77***
	(0.02)
Cut_j (*default*: sirloin)	(see figure 3)
MeanPrice	0.33***
	(0.02)
Observations	198,179
R^2	0.74

[a] Asterisks indicate significance, where *=0.10, **=0.05, ***=0.01. Standard errors are in parenthesis under parameter estimate

Table 4. Determinants of Brand Value per Pound

Variable	Parameter Estimate[a]
Intercept	0.39
	(0.64)
BrandAge$_a$ (*default*: > 10 years)	
1 - 3 years	1.57*
	(0.83)
4 - 6 years	-0.72
	(0.59)
7 - 10 years	-0.33
	(1.03)
Location$_l$ (*default*: National)	
Local	0.02
	(0.63)
Regional	0.72*
	(0.43)
Positioning$_p$ (*default*: Other)	
Special	2.36***
	(0.49)
Program	1.54*
	(0.91)
Store	1.34**
	(0.64)
ChoicePlus	0.71
	(0.62)
MultiMeat	0.55
	(0.48)
Observations	60
R^2	0.43

[a] Asterisks indicate significance, where *=0.10, **=0.05, ***=0.01. Standard errors are in parenthesis under parameter estimates.

Figure 1. Retail Cut Frequency Distribution

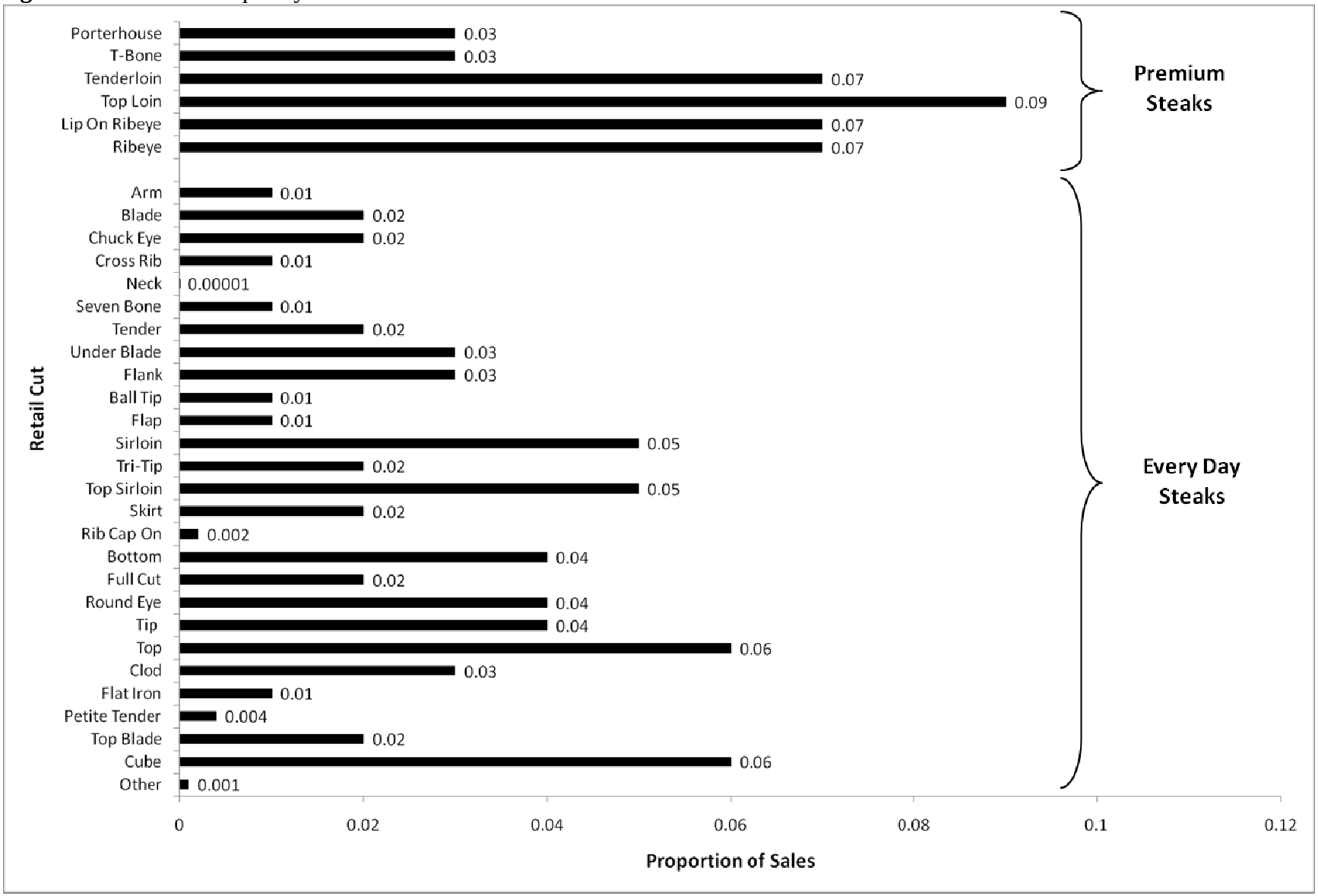

Figure 2. Brand Value of Steak Price per Pound, 2004 - March 2009

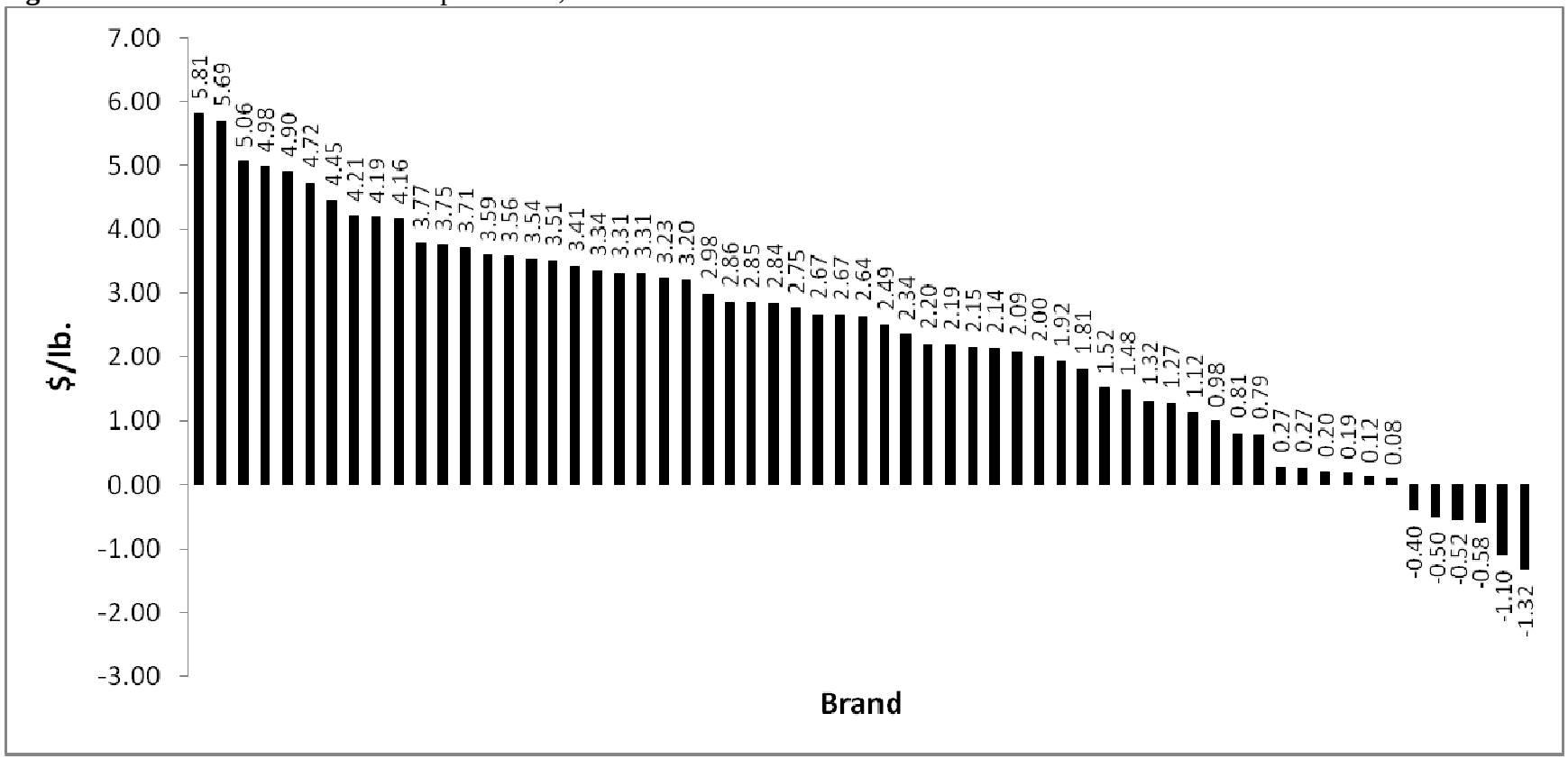

Figure 3. Retail Cut Value of Steak Price per Pound, 2004 - March 2009