Shopping for Meat: Empirical Demand Estimation for Natural Beef Across Store Choices

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Abstract: Conventional supermarkets concentrate on capturing the largest pool of consumers to generate profits from the industry's low margins. Selling to the largest pool of customers means that marketing, promotion, stocking and service decisions are based on the tastes and preferences of an *average* consumer. Innovators in the grocery industry, recognizing a shift in consumer tastes and preferences, are changing the industry to attract smaller segments of consumers. The theory presented here demonstrates a method to understand the value of product diversification and a model of the gains from providing products that may not have broad appeal to the *average* customer base. The increase in retail returns through this approach of developing in-store niches lies not in increased single-item purchases of any one consumer, but through the increased number of items purchased (a larger bundle) by an individual on a single shopping trip.

Retail Store Demand: Product Characteristics

A supermarket sells a mix of products and services to customers who may shop for those products at more than one outlet. Conventional supermarkets concentrate on capturing the largest pool of consumers to generate profits from the industry's low margins. The interior of today's supermarket is an open format with a large floor size (minimum of 17,000 square feet), a consequence of the fact that volume driven sales are still the industry measure of profitability (Lewis, 2000). Selling to the largest pool of customers means that marketing, promotion, stocking and service decisions are based on the tastes and preferences of an *average* consumer while *non-average* consumers are disregarded.

Unfortunately, the *average* American has changed, and a single pool of reliable and loyal customers with similar tastes may no longer exist. New store-formats cater to price-sensitive consumers (warehouse and club stores); up-scale markets service the least price-sensitive, quality-oriented shoppers (Wild Oats, Stew Leonard's); and hypermarkets provide one-stop shopping for time-constrained customers (Super Wal-Mart, Super Kmart). Each new format results in a further segmentation of the pool of grocery consumers to cater to unique demands not met when a business plan targeting *average* customers is followed.

Any model that develops a testable framework of the supermarket must describe both the changing purchasing decisions of customers as well as illustrate the rationale of store formats that do not cater to the *average* consumer. The traditional approach of concentrating on the *average* consumer is rooted in competitive market analysis. Homogenous products and pricing theories are effective in understanding the behavior of mass-marketers trying to capture the *average* (homogenous) consumer. To understand a theory that values the *non-average* (heterogeneous) customer, an understanding of industrial organization (IO) theory is needed. The theory presented here demonstrates a method to understand the value of product diversification and a model of the gains from providing products that may not have broad appeal to the *average* customer base. The increase in retail returns through this approach of

developing in-store niches lies not in increased single-item purchases of any one consumer, but through the increased number of items purchased (a larger bundle) by an individual on a single shopping trip.

The Changing Supermarket Industry

Past evidence shows that customers make purchases from more than one supermarket (Janoff, 2000). The introductions of "loyalty" programs (cards, frequent shopper discounts) were developed to fortify the long-term, store-customer relationship since the attraction of new consumers is significantly more expensive than the retention of existing customers (Wolf, 2001). The following statements can be used to describe today's grocery shopper: 1.) any single customer can be assumed to make food purchases from more than one grocery outlet, 2.) these customers are valuable to whatever outlet they are currently making the majority of their purchases from, and, 3.) they are being sold products that are designed to satisfy the *average* consumer of that store. The sub optimal product diversification within stores contributes to consumers shopping at multiple markets to satisfy their demand for certain elements of their market basket.

A hypothesis regarding consumer demand for retail food outlets can be drawn directly from the preceding three descriptive statements.

> Hypothesis$_{consumer}$: A consumer will shop at the grocery outlet that provides a set of characteristics that most closely resembles the customer's utility maximizing bundle of characteristics. Purchases are made from multiple outlets when the foregone benefits due to the average product not satisfying a consumer's preferences outweigh the costs of shopping in multiple outlets.

The set of characteristics are aggregated to form the product that is purchased by the consumer, thereby implying that the aggregate product may be the store itself. Profits for a single store could increase if customers find their optimal product mix and no longer make purchases at multiple outlets. For example, if a consumer is concerned about the use of hormones in the production of beef, they could purchase hormone-free beef at the supermarket rather than having to buy hormone-free beef from another store. The supermarket maintains the purchases of the hormone sensitive consumer, and may be able to attract new customers since they have added a characteristic to their store. The linear city, circular city

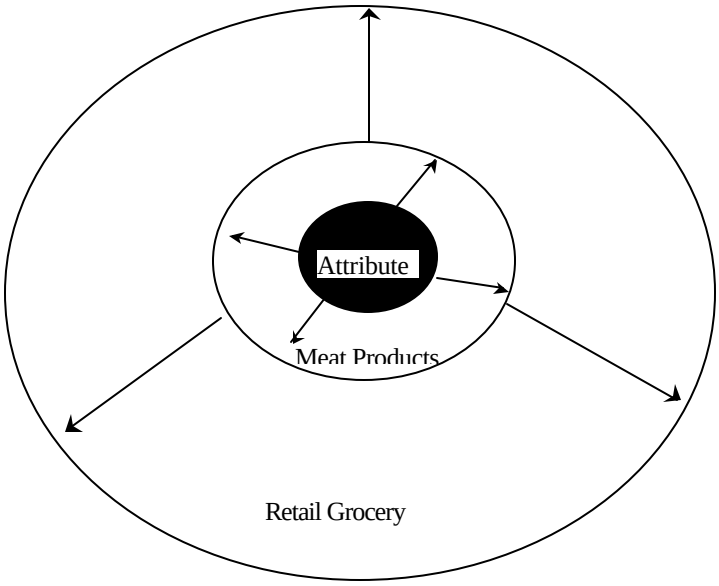
and characteristics demand models will be extended to form the final model of product driven diversification. This theoretical concept is illustrated using an empirical estimation that tests the importance of optimal market characteristics in the choice of store from which to purchase meat.

Product Demand: Concentric Unit Circle with Links

The production characteristics for goods sold within a grocery, (i.e. organic beef, pastured chicken, hormone free dairy, low-cholesterol eggs) can be the characteristics that are purchased to maximize an individual's utility (Lancaster, 1991). It is also possible to assign a characteristics set to a grocery store. For instance deli, floral, pharmacies, ready-to-eat meals and banking services were all introduced to add characteristics to the store that would contribute to consumer demand for that store. The production characteristics of products carried may also add a characteristics set to the grocery store. Finally, intangible characteristics, such as the perception of customer service, cleanliness, atmosphere, floor design, and speed of checkout are also demanded when a customer makes the choice of retail store.

The model can be interpreted as an expanding circle of products that are interrelated. Each successively larger ring corresponds to the next larger product that is described by a set of attributes or characteristics contained in the smaller circles. Figure 1 shows how the demand for the product *meat* is based upon the demand for the set of *attributes* that make up the meat. The demand for a particular grocery store is based, in part, on the demand for the set of *meat products* that a store carries, the demand for which is based upon the attributes that the meat contains. The larger space between the *meat products* ring and the *store* ring is meant to symbolize the fact that there are many product levels not directly addressed in this study.

Figure 1: Visual Representation of Successive Attribute Based Product Demand



Industrial Organization Models

In both the unit line model and the unit circle model, the demand for a product is based on the distance between the customer and the product offering on the line or circle. Distance serves as the diversification mechanism and this is analogous to product diversification through characteristics when separability is assumed (Krouse, 1990). These two models form the basis of a profit maximizing function of the retailer, with enough generality to accommodate an analysis of characteristic-based consumer demand. Lancaster's model of characteristic demand is added to the unit circle theory to form the model of product diversification.

The circular model is chosen since it seems to represent the current nature of the U.S. grocery market where shoppers have a number of brand-name retailers located within a certain local area. Any consumer could be located on the circle between two stores, neither of which are their optimal choice. Both consumers and producers are located uniformly around the circle, which has a perimeter of 1. As in the linear city model, an indifferent consumer is assumed to be located on the unit circle between two firms, i and j. Setting the two firms prices equal yields the same demand as in the linear city model with the same profit function and first order conditions (Tirole, 1988). While there may be a segment of the

population making shopping choices based on their distance from a store, survey results indicate that the top three reasons why a consumer chooses a particular store are, cleanliness, accurate price scanning and low prices while convenient store location is ranked eleventh (Janoff, 2000). The *Progressive Grocer* reported that, in 1999, the seventh most important factor in a choice of supermarket was the Meat Department (1-6 were services). Additionally, 50 percent of consumers indicated that they used the Service Meat section *almost always or frequently* (the most of any service usage reported), and a further 33 percent used it *occasionally*. Thus, there is evidence that the perception of meat products that the supermarket carries, which can be considered one of the market's characteristics, influences the purchase of the product from that outlet. Therefore, a model accommodating both utility maximizing criteria (characteristics and location) is needed.

This model is specified so that the demand for a product is based on the perceived price of a product, which in turn, is based on the underlying characteristics of the product. This can be demonstrated by actual store choices made by consumers. The consumer will maximize utility by purchasing from one of the J firms located uniformly around the circle, where J_0 is the firm used as an example here. The J-1 rivals to J_0 hold prices fixed at $\overline{P}$. It is also assumed that J is "big-enough," and all Ps are low enough for all neighboring brands to be competitive. The purchase of some brand Θ_j is associated with a utility surplus that can be measured as

$$U\left(\Theta_j, \Theta^\circ\right) - p_j . \qquad (3.1)$$

The consumer chooses one unit of the differentiated commodity to maximize utility:

$$\underset{j}{Max}\left\{U\left(\Theta_j, \Theta^\circ\right) - p_j\right\} \geq m. \qquad (3.2)$$

However, if the customer must take Θ_j over Θ°, and constant proportionality is assumed then a measurable level of disutility will be incurred,

$$U\left(\Theta_j, \Theta^\circ\right) = m^\circ - t\left|\Theta_j - \Theta^\circ\right|. \qquad (3.3)$$

Where t is a constant per unit cost of travel. If t >0, it implies that the consumers utility maximization problem can be rewritten as (Krouse, 1990).

$$\underset{j}{Max}(\boldsymbol{u} - \boldsymbol{t}\left|\Theta_j - \Theta^{\circ}\right| - p_j) \geq 0 \qquad (3.4)$$

This can be reinterpreted as demand for differentiated products that imply utility maximization when the optimal product can be purchased. Then Θ° can be further defined as a bundle of characteristics that contribute optimal utility to the consumer,

$$\Theta^{\circ} = f(\boldsymbol{a}_1, \boldsymbol{a}_2). \qquad (3.5)$$

If Θ° is a function of attributes, a_1 and a_2, then Θ_j is also a lower utility providing function of a_1 and a_2. It also follows that u is a function of attributes, since it is merely the difference in utility value from the consumption of the optimal product to the one that is actually purchased. The relevant attributes when considering a store as a product may be price, production practices (organic, natural, conventional, fair trade), distance from the consumer to the store, atmosphere of the store, services offered by the store, speed of checkout and variety of product lines offered. Additional attributes that may be important when the product is a food item include flavor, freshness, visual quality and storability. Applied research constraints may limit the collection of some attribute values, but the inclusion of product specific attributes make it possible to draw conclusions about store choice based on the available limited set of attributes. Rewriting the utility maximizing problem from the circular city model to include the information that Θ^{o}, $\Theta_{j,}$ m^{o}, and m are all functions of attributes yields:

$$\underset{j}{Max}\left[m^{\circ}(a_1, a_2, \ldots, a_n) - m_j(a_1, a_2, \ldots, a_n)\right] - t_j\left|\Theta_j(a_1, a_2, \ldots, a_n) - \Theta^{\circ}(a_1, a_2, \ldots, a_n)\right| - p_j \geq 0 \qquad (3.6)$$

Next, price can be solved for and substituted into the circular city profit maximization equation to reveal a characteristics model that uses measures of disutility to represent non-optimal product offerings. This p_j is now actually a perceived price, since one of the attributes determining the optimality of Θ may be the price of the physical product to be purchased, or a matrix of average prices in the case of a retail grocery outlet.

$$p_j = \left[t_j \left| \Theta_j(a_1, a_2, \ldots, a_n) - \Theta^{\circ}(a_1, a_2, \ldots, a_n) \right| - m^{\circ}(a_1, a_2, \ldots, a_n) - m_j(a_1, a_2, \ldots, a_n) \right] \tag{3.7}$$

The original definition of t as a fixed unit measure of travel is no longer applicable, since it is dependent on an individual consumer's utility preferences. It is bounded by 0 and 1. If Θ_j is a product identical to Θ° except for a slight difference (Kroger vs. Safeway), then t is small, but if the product represents something very different from the optimal brand, then the value of t will be higher (closer to 1). When the item in question is not a store, the former can be thought of as the situation where medications that have expired patents have generic competitors that contain identical ingredients. On the other end of the t scale, there are flash frozen organic vegetables and canned, shelf-stable competitors. Both are *vegetables*, but offer vastly different characteristic combinations. As Θ_j moves away from Θ°, $1/t$ decreases, since the implicit cost rises. When a product is very different from the optimal product, the direct cost will dominate and the indirect costs represented by the multiplication of $1/t$ and m^o- m will approach zero. If a product is similar to the optimal product, the indirect costs will play a greater role in the demand for that product.

Profit maximization for the retail level or product level can be written as (assuming 2 products i and j),

$$\Pi_i(p_i) = (p_i - c)\frac{(p_j - p_i + t_i)}{nt_i} \tag{3.8}$$

$$\Pi_i(p_i) = \left\{ \left[t_i \left| \Theta_i - \Theta^{\circ} \right| - \left(m^{\circ} - m_i \right) \right] - c \right\} \frac{\left\{ \left[t_j \left| \Theta_j - \Theta^{\circ} \right| - \left(m^{\circ} - m_j \right) \right] - \left[t_i \left| \Theta_i - \Theta^{\circ} \right| - \left(m^{\circ} - m_i \right) \right] + t_i \right\}}{nt_i} \tag{3.9}$$

and the First order conditions are:

$$p_j + c + t_i - np_i = 0 \tag{3.10.1}$$

$$p_i + c + t_j - np_j = 0 \tag{3.10.2}$$

Recalling that p_i and p_j have been redefined as a perceived price:

$$p_i(a_1, \ldots, a_n) = \left[t_i \left| \Theta_i(a_1, a_2, \ldots, a_n) - \Theta^{\circ}(a_1, a_2, \ldots, a_n) \right| - m^{\circ}(a_1, a_2, \ldots, a_n) - m_i(a_1, a_2, \ldots, a_n) \right] \tag{3.11.1}$$

$$p_j(a_1, \ldots, a_n) = \left[t_i \left| \Theta_j(a_1, a_2, \ldots, a_n) - \Theta^{\circ}(a_1, a_2, \ldots, a_n) \right| - m^{\circ}(a_1, a_2, \ldots, a_n) - m_j(a_1, a_2, \ldots, a_n) \right] \tag{3.11.2}$$

The following demand equations are the result:

$$D_i(p_i, p_j) = \frac{\left[t_j\left|\Theta_j - \Theta^\circ\right| - \left(m^\circ - m_j\right)\right] - \left[t_i\left|\Theta_i - \Theta^\circ\right| - \left(m^\circ - m_i\right)\right] + t_i}{nt_i} \qquad (3.12)$$

$$D_i(p_i, p_j) = \frac{\left\{\frac{t_j}{t_i}\left[\left(\Theta^\circ - \Theta_j\right) - \left(m^\circ - m_j\right)\right] - \left[\left(\Theta^\circ - \Theta_i\right) - \frac{1}{t_i}\left(m^\circ - m_i\right)\right] + 1\right\}}{n} \qquad (3.13)$$

$$D_j(p_i, p_j) = 1 - x = 1 - D_i(p_i, p_j) \qquad (3.13.1)$$

The first term in the numerator of the demand for *i* is the perceived price for product *j* and the second term is the perceived price for product *i*. The +1 is an artifact of the factoring out of the various *t* terms of the equation, which also leaves the denominator with only the single *n* term (which in this example would be 2). By defining price as a function of characteristics, the *perceived price* is expressed as a function of both travel cost, the actual cost of the product (i.e. ground beef), and various other attributes that influence the purchase of Θ° or Θ_j. This allows the model to be flexible enough to accommodate both an aggregate product like the supermarket, and a specific product such as ground beef.

The direct cost of not finding Θ° at a single retailer implies that Θ_j is purchased at the same market, or Θ° is purchased from an alternate market. In reality, the majority of customers shop at more than one market. The *Progressive Grocer* reports that 99 percent of people shop at supermarkets, 76 percent shop at mass merchandisers, 29 percent at wholesale clubs and 11 percent at specialty food stores, thereby demonstrating a willingness to pay the costs of shopping at multiple outlets. (Janoff, 2000). These people incur the direct cost of non-optimal brand purchase and the implicit costs of foregone utility ($m < m^o$) and t.

Testing the Hypothesis Using Applied Data

Now that the model for profit maximization has been defined, the applicability of the model to the actual supermarket retail industry is evaluated. This is done by utilizing a model to test the hypothesis outlined above. Recall the hypothesis:

> Hypothesis$_{consumer}$: A consumer will shop at the grocery outlet that provides a set of characteristics that most closely resembles the customer's utility maximizing bundle of characteristics. Purchases are made from multiple outlets when the foregone benefits due to the average product not satisfying a consumer's preferences outweigh the costs of shopping in multiple outlets.

This hypothesis can be reinterpreted in the light of characteristics as: (relate to costs?)

> Hypothesis$_{\text{consumer}}$: $D_C(\Theta) = f(a_{1c}, a_{2c},\ldots,a_{nc})$.

The characteristics that can be evaluated when the product is a traditional purchasable product (like beef) are: price, production practices, and flavor. However, because some characteristics, like taste, are subjective and differ across customers, information on the perceived characteristics content must also be evaluated. In the example that follows, the product is the retail store itself, and the characteristics set listed above for the purchasable product is a subset of the store's characteristics set: $D_{C,R}(\Theta) = (a_{1r}, a_{2r}, \ldots, a_{ir}(a_{1c}, a_{2c},\ldots, a_{nc}),\ldots, a_{nr})$. The characteristics investigated are: potential price (the state willingness to pay for the new beef product) and production characteristics.

To better understand the opportunities for supermarkets to retain customers who would otherwise shop for meat at natural markets, an econometric model of how consumers choose the purchase site for meat is developed. Until now, the introduction of organic products into supermarkets has been limited to a small number of products with low sales (Richman, 2000). By increasing the number of organic/natural products carried, the retailer can benefit by attracting customers who have purchased meat at other markets (Richman, 2000) and provide new products that retain existing customers by satisfying their demand for new products.

The results from a mail survey of Colorado and New Mexico shoppers are used to identify important predictors of the store at which meat is purchased. These results demonstrate the presence of a market for product-line extensions that rely on differentiation through meat production characteristics, whose solicitation was intended to address societal concerns about livestock production processes. The econometric model includes socio-demographic variables and the ratings of some production characteristics (attributes) for meat that are important to consumers. A measure of the potential losses due to the *average* consumer marketing retail strategy is also included and shows that the implicit and direct costs of non-optimal product availability are substantial to the supermarket.

Data Collection and Results

This data was collected in a mail survey conducted by the National Family Opinion (NFO) organization in 1998. The survey was developed and designed by Ed Sparling with support from the USDA, the Rocky Mountain Farmer's Union (RMFU) and various local producer groups. The survey was designed to elicit a respondent's stated preference for natural meat products (ground beef, steak, ham, pork chops, sides of beef), past meat shopping practices and concern about certain livestock production practices. Because the original focus of the model was to serve the producer-members of RMFU, the survey sample was drawn from the Front Range and the Western Slope of Colorado and New Mexico including the cities of Albuquerque, Santa Fe and Farmington. There was a concern that Hispanic respondents, considered a key market for some pork products, would not return the survey in a representative manner of their population. Therefore, Hispanic households were oversampled. However, results show that only 6.1% of the respondents were Hispanics, though the 2000 census estimated Colorado's Hispanic population at 17% and New Mexico's Hispanic population was estimated at 42%. Rural areas were also oversampled based on the assumption that responses from this area would be lower since direct marketing to residents who were located near to livestock producers was of interest.

In the survey instrument, *naturally produced meats* were defined as "..from animals raised using environmentally sound practices with no antibiotics or hormones and never confined in small or crowded

pens. Cattle grazing is managed to preserve streams and protect endangered species." Though the survey was written and conducted in 1998, it is similar to the National Organic Program final rules that include no use of hormones and antibiotics as being essential components of organic production. A detailed question specifically addressed store choice for meat purchases and excluded other types of grocery products (Figure 2).

Figure 2: Store Choice Question

	Most of My Meat	Some	None
Supermarket……			
Health/Natural foods store……			
Retail meat shop……...			
Rancher or Producer……..			

To collect the information on multiple store choices, the survey was structured to allow responses on where *most*, *some* and *none* meat purchases were made. The question matrix allowed each respondent to choose at least one store for *most* meat shopping and multiple answers for the *some* and *none* choices[1]. Results from the shopping matrix are reported in Table 1, and the overwhelming majority of respondents (87.7%) indicated that they did most of their meat shopping at supermarkets. Over 76 percent of respondents indicated that they only shopped at the supermarket for meat, but the remaining 24 percent of respondents represent a sizable market that can arguably be exploited with a more diverse product mix. The table shows the results of the urban (city/county >100,000 residents) and rural populations. The rural population was oversampled, and the responses show that there was a higher incidence of purchases from producers for the rural population, but it appears that a similarly small number of respondents did most of their meat shopping at natural foods store.

[1] The data was cleaned to remove multiple responses for *most*. This criterion rejected 43 responses.

Table 1: Meat Shopping Choices Across Store Outlets

	Supermarket	Natural Food Store	Meat Shop	Producer
MOST	87.7%	1.2%	1.8%	4.8%
SOME	7.9%	6.0%	14.3%	6.0%
NONE	4.4%	92.9%	83.9%	89.1%
Rural Population				
MOST	84.5%	1.4%	.8%	9.0%
SOME	9.0%	4.2%	11.9%	9.3%
Urban Population				
MOST	89.7%	1.1%	2.2%	3.3%
SOME	7.6%	6.6%	15.2%	5.0%

Characteristics, measured in this study as livestock production characteristics can be interpreted as both measures of disutility and the physical components of the store. The measurement of *no use of hormones* rated on a scale of one to five, with five being most important, is the inverse of the measure of *use of hormones* on the same scale. Therefore, what the respondent indicates is their disutility from the use of hormones in livestock production. These characteristics can also be considered as characteristics of the store that can influence consumers' choice of store. However, because of the nature of this study, it is very difficult to separate the two values with the information that the attribute-rating matrix provides, and thus, only the gross attribute rating is used.

Those respondents indicating they purchased *most* of their meat from producers, rated *no growth hormones, grazing managed to protect streams* and *grazing managed to protect endangered species* lower than respondents doing only *some* of their meat shopping directly with producers (Table 2). Those respondents doing *most* of their meat shopping from meat shops were relatively more concerned about the *use of confining pens, antibiotics, hormones, streams, endangered species,* and *grassfeeding*. These results suggest that respondents choosing to purchase at least some of their meat at outlets other than the supermarket have, on average, rated production characteristics higher than supermarket shoppers.

Table 2: Average Attribute Ratings Across Store Choice and Frequency of Shopping

(n)=size of sub-sample	**PENS**	**ANTIBIOTICS**	**HORMONES**	**STREAMS**	**ENDANGERED**	**LOCAL**	**AGED**	**GRASSFED**
SUPERMARKET RATINGS								
Most (1204)	3.09	3.44	3.81	3.40	3.26	2.36	2.96	3.01
Some (108)	2.98	3.39	3.66	3.26	3.18	2.17	2.89	2.93
NATURAL FOOD RATINGS								
Most (16)	3.38	3.38	3.75	3.44	3.25	2.31	2.94	3.88
Some (82)	3.43	3.50	4.09	3.30	3.07	2.40	2.93	3.37
MEAT SHOP RATINGS								
Most (25)	3.12	3.76	3.96	3.60	3.60	2.28	3.00	3.56
Some (196)	2.95	3.42	3.68	3.31	3.12	2.54	3.12	2.96
PRODUCER RATINGS								
Most (66)	3.53	3.56	4.02	3.27	3.06	2.44	3.00	3.53
Some (83)	3.24	3.45	4.12	3.49	3.28	2.37	2.76	3.20

Model

To analyze the question of what motivated purchases of meat at particular outlets, a series of probit models were estimated. Each equation is specified so that the dependent variable was the stated incidence of meat shopping at one of the four outlets included in the survey (supermarkets, natural food stores, meat shops and direct from a producer). The equations follow models suggested by Thompson and Kidwell in their 1998 AJAE article, and were estimated using the maximum likelihood PROBIT procedure available in LIMDEP 7. The probit model was specified to investigate how the dependent variables influenced the probability of shopping at a particular market (noted as a 0-1 response by survey respondents). Descriptive variables are defined in Table 3.

Table 3: Definitions and means of Descriptive Variables

VARIABLE	PERCENT OF SAMPLE OR MEAN	DESCRIPTION
	Demographics	
GEN	66.5%	One if respondent was female
AGE9CAT	4.67	Average age of respondent
FEMEDU	3.76	Average education level (3= college, 4=graduate)
INC3	23.62%	$30,000 - 50,000 annual income
INC4	25.73%	$50,000 - 75,000 annual income
INC5	19.40%	Greater than $75,000 annual income
EXP1	22.7%	Less than $200 average weekly grocery expenditures
EXP2	44.9%	Greater than $200 average weekly grocery expenditures
YSINGLE	5.23%	Young Single, <35 (no children)
OSINGLE	8.94%	Old Single, >65 (no children at home)
YCOUPLE	6.76%	Young Couple, <45, no children
WRKOCPL	13.37%	Working Old Couple, >45, no children
RETOCPL	11.70%	Retired Old couple, no children
YPARENT	14.54%	Young Parent, <45, child <6
MPARENT	11.34%	Middle Parent, <45, child >6
OPARENT	13.15%	Older Parent, >45, any child
	Revealed Preference for Meat	
FRQBF	2.8	Average beef meals eaten at home
DNBFYES	17.0%	One if bought natural beef in the past
	Attribute Ratings	
PENS	3.04	No small or crowded pens
ANTIBIOT	3.40	No use of antibiotics
HORMONES	3.73	No use of growth hormones
STREAMS	3.74	Grazing managed to preserve streams
ENDANG	3.20	Grazing managed to protect endangered species
LOCAL	2.39	Animal born and raised within 250 miles
AGED	2.99	Meat aged at least 14 days
GRASSFED	2.94	Grass Fed
	Willingness to Pay for Natural Beef	
STKPAY1	1.3	Average WTP for natural steak, premium levels
GBPAY1	2.1	Average WTP for natural ground beef, premium levels
	Past Shopping Information	
ALTSHOP	.34	Number of alternate shopping outlets frequented for meat purchases
ALTSHOPN	.27	Frequency of shopping at a meat shop or direct from a producer
ALTSHOPS	.18	Frequency of shopping at a natural foods store or direct from a producer
ALTSHOPP	.23	Frequency of shopping at a natural foods store or meat shop

The dependent variables are defined from the store choice responses. The largest sub-group was *most*-Supermarket, represented by the MOST dependent variable. A second group combined *most* and *some* Natural Food Store shoppers (MOSTNAT). Similarly, the *most* and *some* subgroups were combined for the meat shop (MOSTSHOP) and producer (MOSTPROD) equations.

The ALTSHOP (ALTSHOPN, ALTSHOPS, ALTSHOPP) variables are included to measure the relationship between the probability of shopping at a supermarket and past decisions to shop at multiple markets. The variables were constructed differently for each equation since no explanatory variable should be directly related to the endogenous variable of interest. This variable corresponds to a measure of non-optimal store choices. Since nearly 90% of respondents did most of their meat shopping at a supermarket, the fact that the other variables are greater than zero indicates that it was necessary to make purchases at one of the alternate markets to satisfy their demand for an optimal product. The ALTSHOP variables can be considered a measure of the non-constant cost of having to shop at more than one store to achieve the most utility. In other words, the results of the ALTSHOP variable will be interpreted as a measure of the disutility concept defined above, where disutility was defined as: $U(\Theta_j, \Theta^\circ) = m^\circ - t|\Theta_j - \Theta^\circ|$.

Pricing is also an essential component in the probability of a consumer purchasing a product. However, no supermarket carried local, natural meat products at the time this survey was completed. The WTP information gathered in the survey is used as an estimate of both a range of possible supermarket prices (assuming natural beef would be offered at a premium), and a measurement of an individual consumer's probability of purchasing the product. Including the WTP results provided additional information about the relationship between willingness to pay higher premiums for this particular product, overall price sensitivity of consumers (more generally), and store choice.

Therefore, the model specified for store choice is,

$$\text{Prob}(\text{Store}_i = 1) = \Phi_i(b_0 + b_1\text{GEN} + b_2\ \text{AGE9CAT} + b_3\text{YCOUPLE} + b_4\text{WRKOCPL} + b_5\text{RETOCPL} + b_6\ \text{YPARENT} + b_7\text{MPARENT} + b_8\ \text{OPARENT} + b_9\text{YSINGLE} + b_{10}\text{OSINGLE} + b_{11}\ \text{FEMEDU} + b_{12}\text{EXP1} + b_{13}\text{EXP2} + b_{14}\text{URBAN} + b_{15}\text{FRQBF} + b_{16}\text{DNBFYES} + b_{17}\text{INC3} + b_{18}\text{INC4} + b_{19}\text{INC5} + b_{20}\ \text{PENS} + b_{21}\ \text{ANTIBIOT} + b_{22}\ \text{HORMONES} + b_{23}\ \text{STREAMS} + b_{24}\text{ENDANG} + b_{25}\ \text{GRASSFED} + b_{26}\ \text{LOCAL} + b_{27}\text{AGED} + b_{28}\text{GBPAY1} + b_{29}\text{STKPAY1} + b_{30}\text{ALTSHOP}_j) + e_{i1}$$

Where: $i = 1, 2, 3, 4$

Store_1 = MOST meat shopping at a Supermarket

Store_2 = MOSTNAT: Sum of Most and Some meat shopping at a natural foods store

Store_3 = MOSTSHOP: Sum of Most and Some meat shopping at a meat shop

Store_4 = MOSTPROD: Sum of Most and Some meat purchased direct from a producer

$j = 1, 2, 3, 4$

ALTSHOP = Summation of all other stores shopped at

ALTSHOPN = Summation of frequency of shopping at a meat shop or direct from producer

ALTSHOPS = Summation of frequency of shopping at a natural food store or direct from producer

ALTSHOPP = Summation of frequency of shopping at a natural food store or a meat shop

Prediction accuracy for the four equations was 87.2, 92.9, 84.2 and 89.3 percent, respectively. The modified R^2 (Greene, 1998) for each of these equations was .455, .503, .501 and .471. Log-Likelihood tests were used to confirm that the specification reported here was better than alternate specifications that excluded DNBFYES and the WTP variables (GBPAY1 and STKPAY1). GBPAY1, STKPAY1 and ALTSHOP were tested for endogeneity and all were determined to be exogenous (Thompson and Kidwell, 1998; Rivers and Vuong, 1988).

Results of Single Equation Store Choice Models

The econometric models depict the probability of shopping at one of the four stores. Results of the econometric equations and marginal effects (Greene, 1998) are reported for the means in the full table of results (see Table 5 at the end of the paper). Table 4 includes only the significant variables to summarize primary findings[2].

[2] These results should be interpreted carefully due to the oversampling of Hispanic and rural residents.

Meat Characteristics and Shop Choice

As expected from the conceptual model, the ALTSHOP variable is significant and negative in the supermarket equation, indicating that as respondents shopped at more alternate markets their probability of shopping for meat at a supermarket did in fact decrease. In short, this variable signals a willingness to visit many shops to obtain the optimal mix of meat products, thereby signaling that supermarkets that aim for *average* consumers will receive less of these individuals' meat business. However, the variable was not significant in any other equation. This is likely due to the fact that those individuals shopping at niche meat markets have already chosen such markets to secure their optimal meat product mix.

Meat production practices are some product characteristic that may influence consumers choice of optimal meat bundle. The importance of such concerns was also measured more directly through past purchases of natural meat. The *no small or crowded pens* and *grassfed* variables are significant and negative in predicting the probability of shopping at the supermarket (for each higher level that respondents rated these attributes, the probability supermarket shopping decreased by 2.3% and 1.4% respectively). Meanwhile, a higher concern about *hormone* usage increased the probability of shopping at a meat shop by 2%, but each increasing rating of the *local* attribute decreased the probability of shopping at a meat shop by 2%. Increased concern about small *pens*, *hormones* or *grassfeeding* contributed 1.6, 1.9, and 2.1 percent, respectively, to the increased probability of purchasing from a producer. However, higher concern about antibiotic use decreased the probability of purchasing direct from a producer by 1.4%. Finally, it was expected that those shopping at natural food stores would have the strongest concerns about production practices, but increasing concern about *hormones* and *local* meat production were the only significant variables, and they only increased the probability of shopping at a natural foods store by 2% (when combined).

Past purchases of natural beef increased the probability of shopping for meat at a natural food store by 7.6%. Past purchasers of natural beef were 7% more likely to shop at a meat shop. More frequent beef purchases and past purchases of natural beef also contributed to the probability of purchasing meat from producers. Willingness to pay for natural meats should also say something about shop choice.

Higher willingness to pay values decreased a respondent's probability of purchasing from a producer by nearly 2% (for each higher premium level marked). Finally, though they are small marginal effects, increasing values of WTP for beef were a positive predictor of purchasing meat at both supermarkets and meat shops.

Table 4: Significant Variables from Probit Equations

SUPERMARKET				
	Coefficient	**T-Ratio**	**Marginal Effects**	**P-value**
CONSTANT	1.786	3.214	23.97%	0.001
URBAN	0.254	2.164	3.41%	0.030
FRQBF	0.075	1.816	1.00%	0.069
INC4	-0.373	-2.424	-5.01%	0.015
INC5	-0.431	-2.524	-5.79%	0.012
PENS	-0.174	-3.082	-2.33%	0.002
GRASSFED	-0.104	-2.051	-1.40%	0.040
AGED	0.075	1.679	1.01%	0.093
GBPAY1	0.077	1.880	1.04%	0.060
ALTSHOP	-1.002	-11.844	-13.45%	0.000

MEAT SHOP				
	Coefficient	**T-Ratio**	**Marginal Effects**	**P-value**
CONSTANT	-1.606	-3.331	-36.79%	0.001
GEN	-0.178	-1.887	-4.09%	0.059
RETOCPL	0.402	1.928	9.20%	0.054
DNBFYES	0.421	3.853	9.63%	0.000
INC5	0.310	2.287	7.10%	0.022
GRASSFED	0.097	2.295	2.22%	0.022
LOCAL	-0.088	-2.239	-2.02%	0.025
STKPAY1	0.080	1.974	1.84%	0.048

NATURAL FOOD STORE				
	Coefficient	**T-Ratio**	**Marginal Effects**	**P-value**
CONSTANT	-2.013	-3.163	-15.74%	0.002
GEN	-0.230	-1.726	-1.80%	0.084
EXP1	-0.591	-2.097	-4.62%	0.036
FRQBF	-0.187	-3.769	-1.46%	0.000
DNBFYES	0.978	7.512	7.64%	0.000
HORMONES	0.141	1.770	1.10%	0.077
LOCAL	0.109	1.951	0.85%	0.051

PRODUCER				
	Coefficient	**T-Ratio**	**Marginal Effects**	**P-value**
CONSTANT	-1.366	-2.423	-20.27%	0.015
AGE9CAT	-0.082	-1.696	-1.22%	0.090
URBAN	-0.425	-4.004	-6.31%	0.000
FRQBF	0.172	4.058	2.55%	0.000
DNBFYES	0.262	2.052	3.89%	0.040
PENS	0.114	2.253	1.69%	0.024
ANTIBIOT	-0.092	-1.810	-1.37%	0.070
HORMONES	0.133	2.316	1.98%	0.021
GRASSFED	0.144	2.961	2.13%	0.003
GBPAY1	-0.129	-2.979	-1.91%	0.003

Demographics and Shop Choice

Much of the literature suggests that incomes influence shopping behavior, so it was included in this model after controlling for those variables more closely aligned to meat products. Incomes greater than $50,000 corresponded to a lower probability of shopping at a supermarket (the marginal effects of the top two categories infer a 4.5% and a 5.25% decrease in the probability of shopping at the

supermarket, respectively). Alternatively, respondents with incomes greater than $75,000 were 7% more likely to shop at a meat shop.

Among other demographic results, retired, older couples with no children living at home are 9% more likely to shop at meat shops than all other lifestage categories. Residents of an urban area were 3.4% more likely to shop at a supermarket and 6% less likely to purchase meat from a meat producer than residents of rural areas. Women were 4% less likely to shop at meat shops and 1.8% less likely to shop at a natural food store than males.

Conclusions

This analysis has shown that the majority of all consumers shop at a conventional supermarkets, but that certain product attributes and past beef purchasing patterns are important to the decision to shop alternative stores. To attract and retain consumers, the supermarket needs to utilize an approach that embraces all customers, not just the *average*. Customers already shopping at the supermarket can be encouraged to increase their purchases by increasing the availability of products of greatest interest to them while customers not normally inclined to purchase meat at the supermarket can be attracted by the emphasis on production practice differentiated meats, thereby increasing sales. Overall, the current trend in supermarkets to "promote products that address mind/body balance (through use of natural ingredients, herbs or vitamins)," illustrates the changing shopping experience at the market (Hauptman and Cavanaugh, 2001). Markets that move from promoting service attributes of their stores to, "selling stories behind their products," will continue to attract customers and be well prepared for the changing nature of consumer demand (Rolf Jensen from T*he Dream Society* as quoted by Hauptman and Cavanaugh, 2001).

The theoretical concept of, consumers balancing the disutility of shopping in multiple venues with the benefits of an optimal product mix, was tested by including the ALTSHOP variable in the models. When the store itself is the product, the absence of a natural beef product (which has been defined as a characteristic of the store) means that the store is no longer the optimal product for everyone and consumers may shop at an alternate market. This concept is demonstrated by the fact that respondents

who shop at alternate markets are 11.8% less likely to do most of their meat shopping at the supermarket. Recent introductions of natural beef products into large supermarket chains indicate that large, regional beef producers have convinced supermarkets to exploit this niche[3], lending support to these findings and discussions.

The oversampling of rural areas may contribute to the results seen in the supermarket and producer equations. Thus, results should be interpreted and generalized with caution since urban areas and rural areas have markedly different retail food market structure. Though the rating of some production concerns are significant in each equation, the marginal effect of any is relatively small. Demographic information seems to have some value, but past purchases of natural beef, frequency of beef purchases and willingness to pay a premium for natural beef appear to be the most significant predictors for store choice across all equations. This finding may lend support to the *Progressive Grocer's* study showing that the meat counter is the most important non-service store characteristic, as well as the most frequently used department at the grocery store. It seems that store choice is highly influenced by the price, types and particular mix of meat products available.

[3] King Soopers, the Colorado-based Kroger chain, recently introduced Maverick Lean Natural Beef.

Table 5a: Results of Probit Equations for Supermarkets and Natural Foods Stores

	SUPERMARKET				NATURAL FOOD STORE			
	Coefficient	Marginal Effects	T-Ratio	P-value	Coefficient	Marginal Effects	T-Ratio	P-value
CONSTANT	1.786	0.240	3.214	0.001	-2.013	-3.143	-3.163	0.002
GEN	-0.069	-0.009	-0.576	0.565	-0.230	-1.729	-1.726	0.084
AGE9CAT	-0.024	-0.003	-0.508	0.612	-0.001	-0.027	-0.027	0.979
YCOUPLE	-0.132	-0.018	-0.398	0.691	0.037	0.101	0.101	0.920
WRKOCPL	-0.250	-0.034	-0.935	0.350	-0.093	-0.303	-0.303	0.762
RETOCPL	0.195	0.026	0.717	0.473	-0.196	-0.645	-0.646	0.518
YPARENT	-0.169	-0.023	-0.479	0.632	-0.231	-0.581	-0.582	0.561
MPARENT	-0.160	-0.022	-0.477	0.633	-0.258	-0.673	-0.674	0.501
OPARENT	0.062	0.008	0.206	0.837	-0.165	-0.505	-0.505	0.613
YSINGLE	-0.051	-0.007	-0.198	0.843	0.019	0.073	0.073	0.942
OSINGLE	0.327	0.044	1.194	0.233	-0.247	-0.841	-0.840	0.401
FEMEDU	-0.015	-0.002	-0.628	0.530	0.026	0.909	0.906	0.365
EXP1	0.217	0.029	0.797	0.425	-0.591	-2.074	-2.097	0.036
EXP2	0.120	0.016	0.369	0.712	-0.358	-1.045	-1.051	0.293
URBAN	0.254	0.034	2.164	0.030	0.134	0.896	0.892	0.372
FRQBF	0.075	0.010	1.816	0.069	-0.187	-3.697	-3.769	0.000
DNBFYES	0.051	0.007	0.379	0.705	0.978	6.219	7.512	0.000
INC3	-0.132	-0.018	-0.908	0.364	-0.072	-0.428	-0.428	0.669
INC4	-0.373	-0.050	-2.424	0.015	0.142	0.806	0.805	0.421
INC5	-0.431	-0.058	-2.524	0.012	0.109	0.552	0.552	0.581
PENS	-0.174	-0.023	-3.082	0.002	-0.065	-1.036	-1.037	0.300
ANTIBIOT	-0.040	-0.005	-0.727	0.467	0.051	0.752	0.754	0.451
HORMONES	0.056	0.007	0.918	0.358	0.141	1.801	1.770	0.077
STREAMS	0.048	0.006	0.688	0.491	-0.038	-0.482	-0.483	0.629
ENDANG	0.055	0.007	0.858	0.391	0.075	1.066	1.067	0.286
GRASSFED	-0.104	-0.014	-2.051	0.040	0.050	0.843	0.840	0.401
LOCAL	-0.040	-0.005	-0.852	0.394	0.109	1.962	1.951	0.051
AGED	0.075	0.010	1.679	0.093	0.000	0.002	0.000	.9998
GBPAY1	0.077	0.010	1.880	0.060	0.052	1.188	1.198	0.231
STKPAY1	-0.040	-0.005	-0.840	0.401	0.076	1.435	1.445	0.148
ALTSHOP	-1.002	-0.134	-11.844	0.000				
ALTSHOPN					0.149	1.292	1.298	0.194
ALTSHOPS								
ALTSHOPP								
Percent Predicted Correctly			87.2%		92.9%			
Modified R^2			.455		.503			

Table 5b: Results of the Meat Shop and Producer Equations

	MEAT SHOP				PRODUCER			
	Coefficient	**Marginal Effects**	**T-Ratio**	**P-value**	**Coefficient**	**Marginal Effects**	**T-Ratio**	**P-value**
CONSTANT	-1.606	-0.368	-3.331	0.001	-1.366	-0.203	-2.423	0.015
GEN	-0.178	-0.041	-1.887	0.059	0.138	0.020	1.163	0.245
AGE9CAT	-0.001	0.000	-0.038	0.970	-0.082	-0.012	-1.696	0.090
YCOUPLE	0.062	0.014	0.216	0.829	-0.018	-0.003	-0.051	0.959
WRKOCPL	0.157	0.036	0.691	0.490	-0.208	-0.031	-0.741	0.459
RETOCPL	0.402	0.092	1.928	0.054	-0.443	-0.066	-1.597	0.110
YPARENT	0.020	0.005	0.067	0.947	-0.328	-0.049	-0.904	0.366
MPARENT	0.155	0.035	0.546	0.585	-0.327	-0.049	-0.949	0.343
OPARENT	0.218	0.050	0.905	0.365	-0.490	-0.073	-1.581	0.114
YSINGLE	0.148	0.034	0.679	0.497	0.399	0.059	1.614	0.107
OSINGLE	-0.178	-0.041	-0.841	0.401	-0.252	-0.037	-0.971	0.332
FEMEDU	0.013	0.003	0.669	0.504	0.010	0.001	0.434	0.664
EXP1	0.102	0.023	0.417	0.677	-0.026	-0.004	-0.097	0.923
EXP2	0.118	0.027	0.415	0.678	0.139	0.021	0.439	0.661
URBAN	0.170	0.039	1.641	0.101	-0.425	-0.063	-4.004	0.000
FRQBF	0.035	0.008	0.981	0.327	0.172	0.025	4.058	0.000
DNBFYES	0.421	0.096	3.853	0.000	0.262	0.039	2.052	0.040
INC3	-0.004	-0.001	-0.035	0.972	0.134	0.020	1.017	0.309
INC4	0.023	0.005	0.180	0.857	0.264	0.039	1.819	0.069
INC5	0.310	0.071	2.287	0.022	0.149	0.022	0.885	0.376
PENS	0.002	0.001	0.055	0.956	0.114	0.017	2.253	0.024
ANTIBIOT	-0.033	-0.008	-0.710	0.478	-0.092	-0.014	-1.810	0.070
HORMONES	-0.017	-0.004	-0.340	0.734	0.133	0.020	2.316	0.021
STREAMS	-0.059	-0.014	-1.046	0.295	-0.058	-0.009	-0.908	0.364
ENDANG	0.067	0.015	1.269	0.205	-0.090	-0.013	-1.522	0.128
GRASSFED	0.097	0.022	2.295	0.022	0.144	0.021	2.961	0.003
LOCAL	-0.088	-0.020	-2.239	0.025	0.033	0.005	0.720	0.472
AGED	0.019	0.004	0.515	0.607	-0.071	-0.010	-1.612	0.107
GBPAY1	-0.019	-0.004	-0.556	0.578	-0.129	-0.019	-2.979	0.003
STKPAY1	0.080	0.018	1.974	0.048	0.008	0.001	0.168	0.867
ALTSHOP								
ALTSHOPN								
ALTSHOPS	0.081	0.019	0.783	0.434				
ALTSHOPP					-0.013	-0.002	-0.117	0.907
Percent Predicted Correctly			84.2%		89.3%			
Modified R^2			.501		.471			

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