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Regional Demand for Natural Beef Products in Colorado: Target Consumers and Willingness to Pay

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Interest and sales in natural meats continue to grow, with increased offerings in supermarkets and other mainstream marketing channels. Producers interested in direct marketing also consider natural meats an attractive niche market. This study focuses on the market for natural meat, including freezer beef, in Colorado with special attention to whether consumers in different areas of the state differ in their price and product choices. Findings show that about 20% of Front Range Colorado consumers purchase at least some of their meat from specialty shops or natural food stores, while 24% of rural, Western Slope consumers buy at least some meat directly from producers.

Key Words: consumer targeting, freezer beef, natural beef

Prodigious growth in the organic and natural foods sector during the 1990s has led livestock producers to target natural meat consumers as an alternative to accepting the low margins received in commodity meat markets (Wheatly, 2001; Roosen, Lusk, and Fox, 2003; McGarry Wolf and Thulin, 2000; Wilson, 2002). Still, there is limited information on the feasibility of marketing livestock as “naturally produced” or “locally produced.” In 1998, Rocky Mountain Farmers’ Union and the Colorado Community College Federation sponsored a study of consumer demand for natural beef and pork in Colorado and New Mexico. The main purposes of the study were threefold: (a) to quantify consumer willingness to pay a premium for “natural meat” products (only loosely defined at the time), (b) to identify those consumers willing to pay various premia, and (c) to identify which properties of “natural meats” are most important to these consumers.

Previous work using data from this survey has resulted in some interesting findings and conclusions (Sparling, Thilmany, and Grannis, 2001; Grannis and Thilmany, 2001). Specifically:

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- Consumers are willing to pay a higher percentage premium for natural ground beef than for natural beefsteak. At a premium of 36%, the market share of natural ground beef was estimated to be 25%.
- Among attributes, a substantial majority of all respondents view “no hormones” as “important” or “very important.” “No antibiotics” and environmental factors are nearly as important.

Other findings of interest include differences in consumers’ willingness to pay (WTP) for natural meats across regions and income groups, and associations between willingness to pay and concern about factors such as hormones, antibiotics, and environmentally sound grazing practices. However, little attention was given to product form and marketing channels—issues of great relevance to local producers considering direct market strategies.

This study focuses on identifying market shares and characteristics of customers it would be realistic to target, with special emphasis on how market positioning would differ between the Western Slope (mostly rural) and Front Range (a major metropolitan area) of Colorado. Discussion on target markets is augmented with some information on the stated willingness to pay among different segments of the Colorado market. To counter concerns and past failures among producer groups with respect to retail outlets, this study focuses particularly on demand for direct-marketed freezer beef.

Literature Review

Greene, Dimitri, and Richman (2001) present a helpful summary of growth in the organic market since the late 1980s, but aggregate data provide less information on what type of consumers are likely to purchase natural and organic foods. Kotler and Armstrong (1994) outline the value of market segmentation, by socioeconomic or psychographic variables, as a way to differentiate consumer behavior and needs. In this review of previous literature, issues related to the organic food market, segmentation and elicitation of willingness to pay among consumers, and the methods employed to collect consumer information are summarized.

Defining Customers of Organic, Natural, and Non-GMO Food

Boland and Schroeder (2002) analyzed data from a producer-owned cooperative to develop a hedonic model of the value placed on specific wholesale primal beef attributes, including organic production methods. They found that, for customers of the alliance, the value of some wholesale primals was higher if produced under certified organic methods, but for other cuts, price decreased. They concluded, “When beef producers target specific consumer segments, they need to know the particular consumers’ preferences. . .” (p. 48).

In previous survey work by Misra, Grotegut, and Clem (1997), willingness to buy pork treated with the hormone pST was correlated with age, gender, education, marital status, household income, and concern about pST. However, inconsistent patterns are shown across past studies for demographic variables such as gender, education, and family size (McGarry Wolf and Thulin, 2000; McGuirk, Preston, and McCormick, 1990).

Lusk and Fox (2002) found consumers were willing to pay up to 17% and 10% more for beef labeled as coming from animals not administered growth hormones, or not fed genetically modified corn, respectively. Their results also revealed that concern about production practices (hormones and genetic modification) was a more significant factor than demographics in determining willingness to pay. Similar results were found among European consumers (Lusk, Roosen, and Fox, 2003). The above studies also highlighted the need for careful attention to the elicitation of values when using stated preferences.

Contingent Valuation (CV) Methods

The economics literature provides many examples where the CV stated preference method has been used (Arrow et al., 1993), including the elicitation of individual price premiums for purchasing food products with attributes not yet available, certified, or commonly available in the market (Lusk, Roosen, and Fox, 2003; Lusk and Fox, 2002; Misra, Grotegut, and Clem, 1997). Shortcomings of the application of CV methods in studies of food products were summarized by Caswell (1998) and Fox et al. (1998). Sample selection bias, nonresponse bias, and consumer unfamiliarity with the hypothetical product, price, or marketplace are all identified as potential shortcomings of the CV method. WTP treatments have favored dichotomous choice questions. These questions differ across subsamples, and are combined to create estimates of WTP. Since 1993, more sophisticated formats have been developed, including double- or multiple-bounded dichotomous choice.

Another question format is the payment card. The payment card method asks respondents to pick a value on a scale (discrete or continuous) that is above a specified base price they would be willing to pay (Arrow et al., 1993). Some of the potential biases of the question formats discussed here include WTP values which cannot be collected in the real world because of budget constraints, or starting point and ending point biases from the values suggested to the respondent in the elicitation (Fox et al., 1998).

The Consumer Survey

This study is based on a 1998 mail survey conducted through the National Family Opinion, Inc. (NFO) panel. The two primary advantages of using the NFO panel are that it achieves an average return rate of over 60%, and extensive demographic data are integrated for all respondents and nonrespondents into the database. The target

Table 1. Surveys Sent and Returned, by Region and by “Natural” versus “Organic” Beef (1998)

Region	Surveys Sent	Surveys Returned	% Returned
Front Range “natural”	500	339	67.8
N. New Mexico/S. Colorado “natural”	500	255	51.0
Western Slope	430	292	67.9
Front Range “organic”	500	333	66.6
N. New Mexico/S. Colorado “organic”	500	255	51.0
Total	2,430	1,474	60.7

Note: The samples for the Front Range and Northern New Mexico/Southern Colorado were split into two different survey versions to determine if there was a difference between willingness to pay for “natural” beef and “organic” beef.

audience was determined to include three geographic regions: the Front Range of Colorado, the Western Slope of Colorado, and Northern New Mexico/Southern Colorado. We specifically focus on the Colorado Front Range, including only the metropolitan counties at the eastern foot of the Rocky Mountains (following U.S. Census MSA designations), and for comparison, the Western Slope of Colorado, representing five counties on the state’s western side with a few sizable towns (including one metro area, Grand Junction) in an otherwise rural area.

A questionnaire was designed to determine what consumers felt about potential characteristics of naturally produced meats. In this context, “naturally produced meats” were defined as coming from “animals raised using sound grazing practices with no antibiotics or hormones, and never confined to small or crowded pens.” Focus groups were then held in each of the three regions. Because discussion within these groups suggested there are varying perceptions associated with the term “natural beef,” the above definition was included in the survey, thereby suggesting some differences in production practices to the consumer. In the process of conducting the focus groups, many participants noted purchases of freezer beef in response to the question on meat purchase location. Therefore, a question on interest in freezer beef was also included in the survey.

At the time of the survey, the U.S. Department of Agriculture was proposing its organic standards for the first time. Consequently, there was interest in knowing if consumers made any distinction between “organic” meat and “naturally produced” meat as defined in our study. To test whether consumers made such a distinction, we designed two versions of surveys sent to the two regions having natural foods stores: the Colorado Front Range and Northern New Mexico/Southern Colorado. Half the sample in each group received a questionnaire using the term “natural” and half received a questionnaire using “organic.” Further definition of these terms was not provided, to prevent any potential bias.

In early 1998, 2,430 surveys were mailed. Table 1 provides a breakdown showing where surveys were sent and reports the return rates for each region. “Natural” and “organic” versions of the surveys did not elicit different patterns of response or

Table 2. Significance Levels for Selection Bias Using Chi Square Tests

Region	Confidence Levels (") for:	
	Income and Education	Life Stages
Front Range "natural"	0.99	0.12
N. New Mexico/S. Colorado "natural"	0.75	0.013
Western Slope	0.89	0.58
Front Range "organic"	0.93	0.13
N. New Mexico/S. Colorado "organic"	0.91	0.18

Note: The samples for the Front Range and Northern New Mexico/Southern Colorado were split into two different survey versions to determine if there was a difference between willingness to pay for "natural" beef and "organic" beef.

willingness-to-pay levels. Therefore, these two subsamples were combined in the Colorado Front Range returns, and the terms are used interchangeably for the purpose of this study.

Selection bias is generally a concern in mail-out surveys (Heckman, 1979). Although it is unclear how demographic factors, such as age, income, family status, and education, will affect consumption behavior, it is important to determine whether the survey sample is representative using demographics. Use of the NFO panel allows us to statistically test for systematic differences in the demographics of different groups. In this case, we were interested in whether respondents differed from non-respondents in each geographic region, and between the "organic" and "natural" subsamples.

A 15-category multinomial distribution involving income (five categories) and education (three categories) was constructed for respondents versus the entire population. Each subsample was tested for differences using a chi square test. The same was done using a "life stage" variable comprised of nine categories which combine family and age. Chi-square alphas (confidence levels) are reported for each test in table 2. Although income and education appear to be represented proportionally, the sample frequency for "life stages" differs substantially from the population, resulting in an under-representation of younger households in Front Range responses.

Survey Findings

The actual logistics of getting product to customers, directly or through retail accounts, is often the most challenging aspect of targeting a market niche (Wilson, 2002). Thus, the initial analysis focuses on current shopping choices among consumers.

Meat Shopping Behavior

Consumers were asked to identify the places where they purchased products, the amount they spent on groceries each week, and whether they had ever purchased meat identified as "natural beef." Specifically, consumers were asked to note where

Household Income and Source of Meat Purchase

Figure 1 illustrates how Front Range special source buyer groups are distributed among five income categories. As observed from figure 1, responses from all those who buy from outlets other than supermarkets are under-represented in the three lowest income levels. Figure 2 provides a similar illustration for the Western Slope, but with fewer bar columns since specialty stores and natural food stores were not located in this region in 1998. Hence, in figure 2, the comparison is between the respondents who buy from producers ($N = 71$) and all respondents in the Western Slope region ($N = 280$).

Households with hunters were targeted because of interesting traits they have in common with potential direct buyers. If hunters try for large game (elk, deer, or antelope), they are likely to have freezers for storage of large quantities of meat. They are also more likely than others to come into contact with ranchers in the course of obtaining permission to hunt or in having meat processed at local meat shops. Tables 4 and 5, respectively, summarize the Front Range and Western Slope numbers of households with hunters, freezers, and respondents who report purchasing beef from producers, as well as the interactions among those categories.

Table 4 is a more detailed interaction table, developed to cover several categories, and to allow for comparisons to categorical means.² For example, we can see that Front Range hunters are 52% of the buyers from producers, compared to 21% of the entire population. Similar results are presented in table 5 for the Western Slope, although there are fewer categories since shopping choices were more limited in these areas. Several results are worth noting here. One is the wide difference between the rural and urban region with respect to both hunters and freezer ownership. Where hunters are convenient to ranches, they are likely to purchase at least some of their beef from producers—62% of Western Slope hunting households already buy beef from producers. Families with children were significantly more likely than the population as a whole to express interest in buying freezer beef. Seventy-two percent of Front Range and 89% of Western Slope respondents expressing interest in freezer beef already owned freezers. The large number of hunters in urban areas who have freezers but do not purchase beef from producers suggests a market opportunity.

Willingness to Pay

To guide the pricing strategies for this set of producers, willingness-to-pay estimates were developed from survey responses on two hypothetical beef products, as well as a per pound price for freezer beef quarters and halves. Respondents were asked to envision themselves at a meat counter and to imagine that they could choose between a conventional beef product and a natural beef product of the same apparent quality. They were then asked to specify three prices for each product: one they felt

² For ease of comparison, cells in table 4 corresponding to cells in table 5 are shaded.

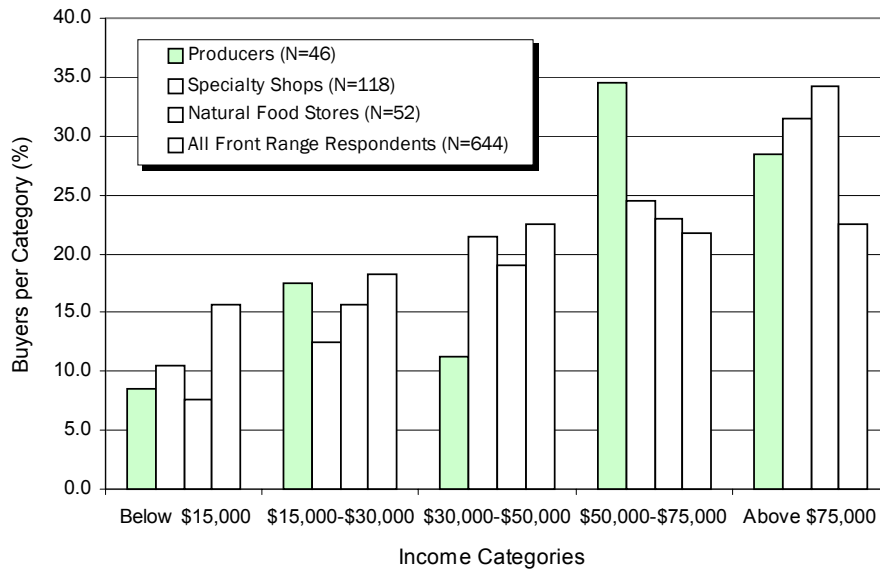


Figure 1. Income distribution of Front Range consumers by source of meat purchase (other than supermarkets)

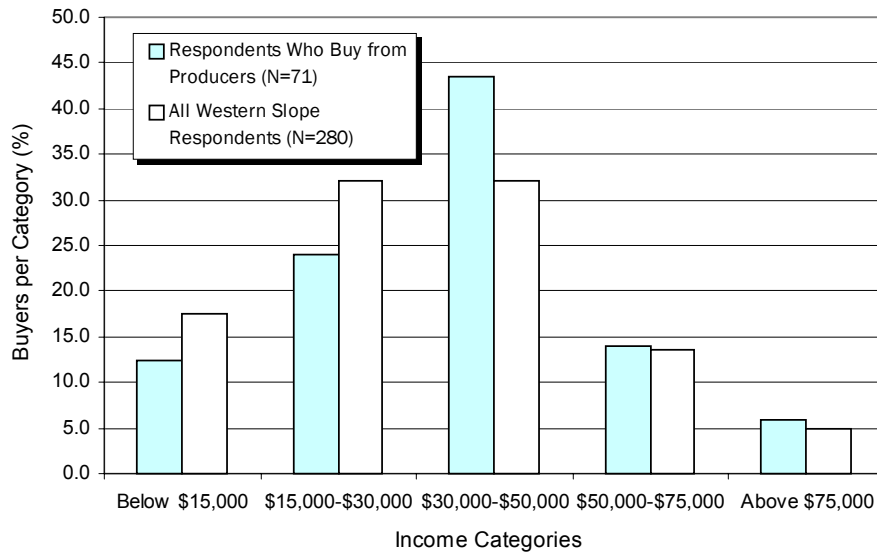


Figure 2. Income distribution of Western Slope consumers who buy from producers

Table 4. Intersection of Shopping Behavior and Demographics, Front Range

Description	(<----- (%) ----->)									
	Natural Foods Shoppers	Buy from Meat Shops	Buy Natural Beef	Hunters	Buy from Producers	Interested in Freezer Beef	Households with Children	Households with Freezers	Total Population	
Natural foods shoppers are what % of:	100	11	25***	7	11	7	6	7	6	
Those who buy from meat shops are what % of:	25	100	30***	24***	17	22*	20	22*	18	
Those who buy natural beef are what % of:	56	30***	100	16	24	22*	18	20	18	
Hunters are what % of:	17	27*	18	100	52***	30***	22	33***	21†	
Those who buy from producers are what % of:	10	7	10	18***	100	13***	8	6	7‡	
Households interested in freezer beef are what % of:	42*	57***	57***	69***	85***	100	62***	64***	48‡	
Households w/children are what % of:	33***	47	43	44	50**	57***	100	45	43†	
Households w/freezers are what % of:	25***	66***	59*	85***	95***	72***	56	100	54‡	

Notes: Single, double, and triple asterisks (*) denote significance at the 0.1, 0.05, and 0.01 levels, respectively, based on a two-tailed t-test. The superscript symbols † and ‡ denote that total population proportions differ from the Western Slope at the 0.001 and 0.05 significance levels, respectively. Shaded cells correspond to cells in table 5 (Western Slope).

Table 5. Intersection of Shopping Behavior and Demographics, Western Slope

Description	Hunters	Buy from Producers	Interested in Freezer Beef	Households with Children	Households with Freezers	Total Population
	<!!!!!!!!!!!!!!!!!!!!!! (%)!!!!!!!!!!!!!!!!!!!!!! >					
Hunters are what % of:	100	62***	59***	65***	56***	46
Those who buy from producers are what % of:	34**	100	36***	30	12	25
Households interested in freezer beef are what % of:	81***	90***	100	82***	74***	64
Households w/children are what % of:	48***	41	45***	100	35	35
Households w/freezers are what % of:	92***	92***	89***	77	100	78

Note: Single, double, and triple asterisks (*) denote significance at the 0.1, 0.05, and 0.01 levels, respectively, based on a two-tailed *t*-test.

was “reasonable,” one they felt “begins to be expensive,” and finally, one that is “just too expensive.”

Sensitivity functions were constructed for each respondent which defined the probability of the respondent choosing the product at each level. If the premium was at or below what the respondent defined as “reasonable,” the probability was defined to be 1.0, or certainty. If the premium was at or above what the respondent defined as “just too expensive,” the probability was defined to be zero. If the premium was at the level defined as “begins to be expensive,” the probability was set to 0.5, or an equal likelihood that the natural product would or would not be chosen. If the premium was between the markers, the probability was computed as a linear extrapolation.

Weights were assigned to each family according to the number of individuals in the household and the number of times the family prepared beef at home each week. These weights were then used as a proxy for the amount of beef the family bought relative to the total bought by all families. At each premium, the estimated market share is a function of the probability that each family would purchase the natural product and the weight assigned to the family based on purchase volume and frequency. When these shares are plotted on a graph with the horizontal axis being premium levels and the vertical axis being the share of all purchases, market share curves are derived for each product. Simple, piece-wise linear distributions were built for each respondent and then added up. It is possible to derive confidence intervals by using bootstrapping (Efron and Tibshirani, 1993).

Natural Ground Beef and Steak

Market share curves were generated in aggregate for both natural steaks and natural ground round for the Front Range and Western Slope (figures 3–6). Overall, consumer willingness to pay for natural ground beef is lower on the Western Slope.

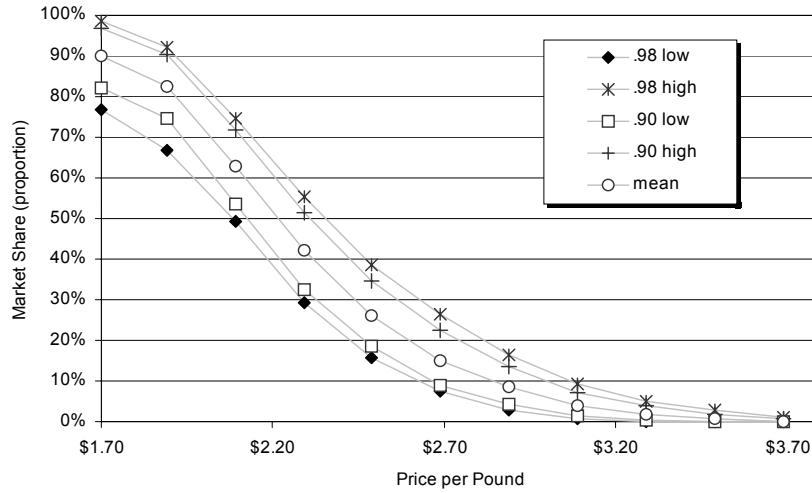


Figure 3. Estimated market share of natural ground beef as a function of premium, Colorado Front Range
 (Sample N = 644, Bootstrap N = 500; Conventional Price = \$1.69/lb.)

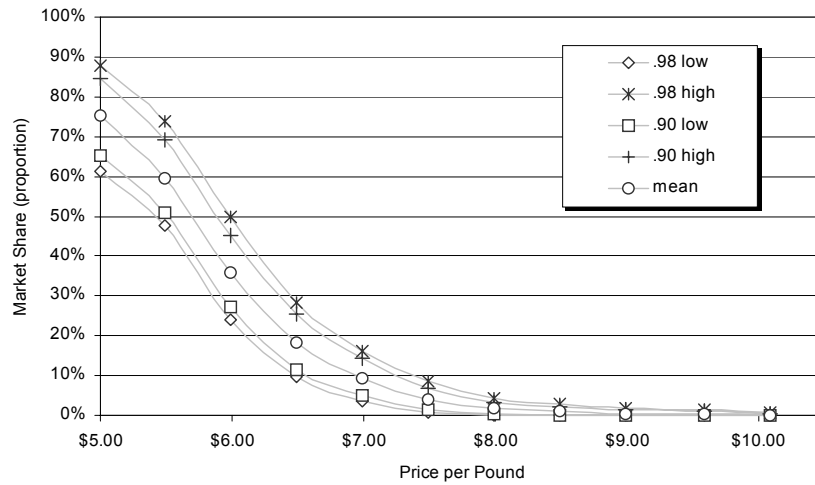


Figure 4. Estimated market share of natural steak as a function of premium, Colorado Front Range
 (Sample N = 644, Bootstrap N = 500; Conventional Price = \$4.99/lb.)

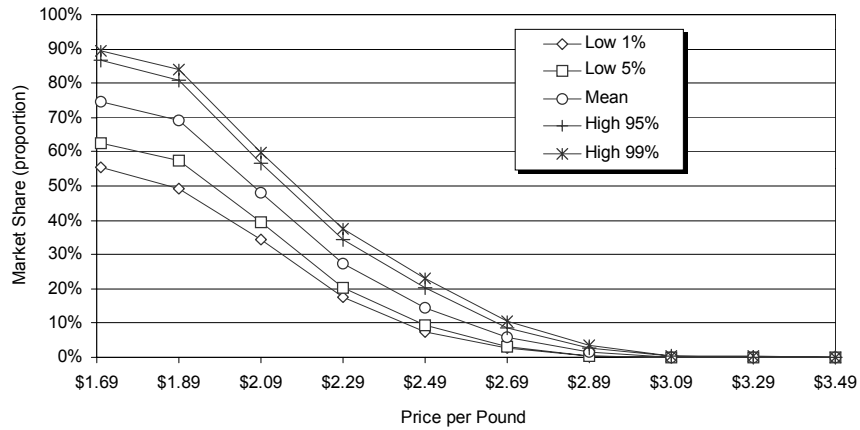


Figure 5. Estimated market share of natural ground beef as a function of premium, Colorado Western Slope
(Sample N = 280, Bootstrap N = 500)

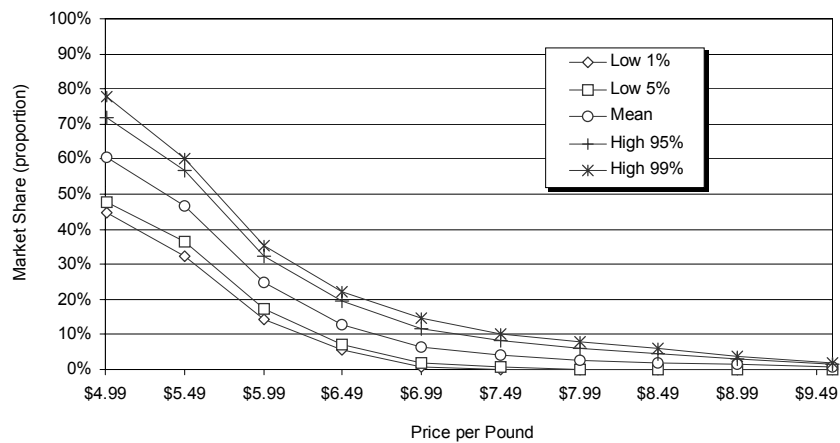


Figure 6. Estimated market share of natural steak as a function of premium, Colorado Western Slope
(Sample N = 280, Bootstrap N = 500)

As observed from these graphs, ground round is far less sensitive than steak to pricing. For example, at a premium of \$0.40 over prevailing market prices (a premium of about 24%), the market share of natural ground round would be between 50% and 70%. Meanwhile, at a 20% premium (\$1.00), the market share of natural steak would be between 20% and 40%.

Freezer Beef

The demand for freezer beef represents the number of head of natural freezer beef that could be sold at each premium level, assuming the cost of regular freezer beef is \$2.89 per pound. Respondents were asked if they would be interested in freezer beef. If “yes,” then they were asked whether they would prefer a quarter or a half carcass. The results for four Front Range counties are summarized in figure 7. Each curve represents the most likely number of beef animals that could be sold in each county at various price levels, assuming a representative sample. Note, at \$3.79 (a 30% premium), there is a substantial demand, but any increase above \$3.79 significantly reduces demand (a more elastic portion of the demand schedule). Ordinarily, economic analysis would suggest that setting a premium beyond \$3.79 would be ill advised since sales would drop by 50% to gain 10% in price (elastic demand). However, limited supply capacity may lead producers to prefer a lower demand and target the highest paying consumers.

Interest in freezer beef is particularly high in the Western Slope counties. It is encouraging that 25% of the sample already buys some beef from producers, and 64% of respondents expressed interest in buying at least a quarter of natural freezer beef at some premium. Because the total sample for the Western Slope was small ($N = 280$), treating counties individually was not feasible. Thus, Montrose and Delta counties form the basis for all Western Slope results presented here. Figure 8 shows that a premium of 20% decreases demand from about 6,000 head to about 2,100 head per year, while a 30% premium reduces demand to about 1,200 head per year. Bootstrapping was used to generate “confidence intervals” for this demand curve.

Conclusions

Based on Givry’s (1998) survey of the industry, more than 30 producer-owned cooperatives or private firms were marketing organic or natural beef in the United States in 1998. Growing consciousness about what animals are fed, how they are medicated, and how they are confined has led some consumers to demand and pay premiums for natural beef or range poultry. At the same time, natural food stores are a growing presence in urban areas. In the late 1990s, Wild Oats had a significant presence, and both Whole Foods and Vitamin Cottage were expanding in Colorado. While much has been made of the growth of natural food stores, this study suggests that “direct from producer” and specialty shop sales may have greater potential for producers than if producers attempted to secure space in natural food stores.

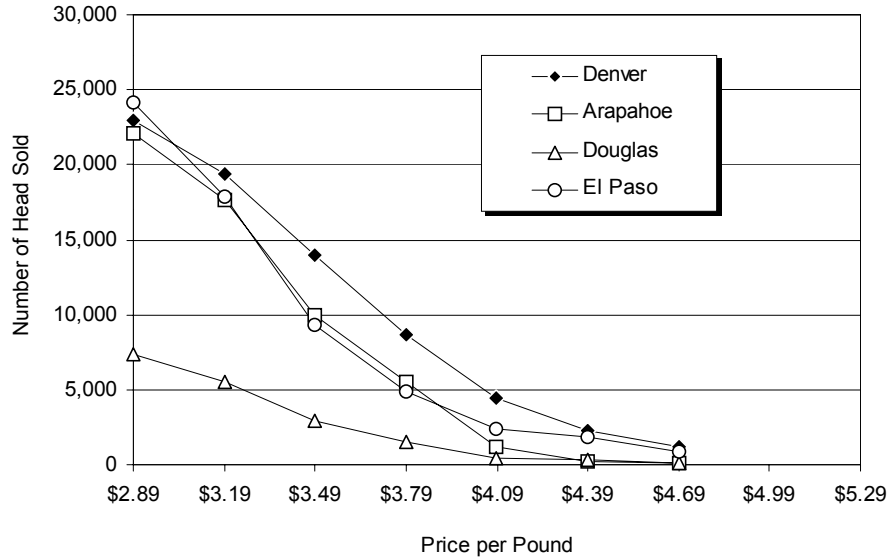


Figure 7. Estimated demand for natural freezer beef, Front Range (Denver, Arapahoe, Douglas, and El Paso counties) (Conventional Price = \$2.89/lb.)

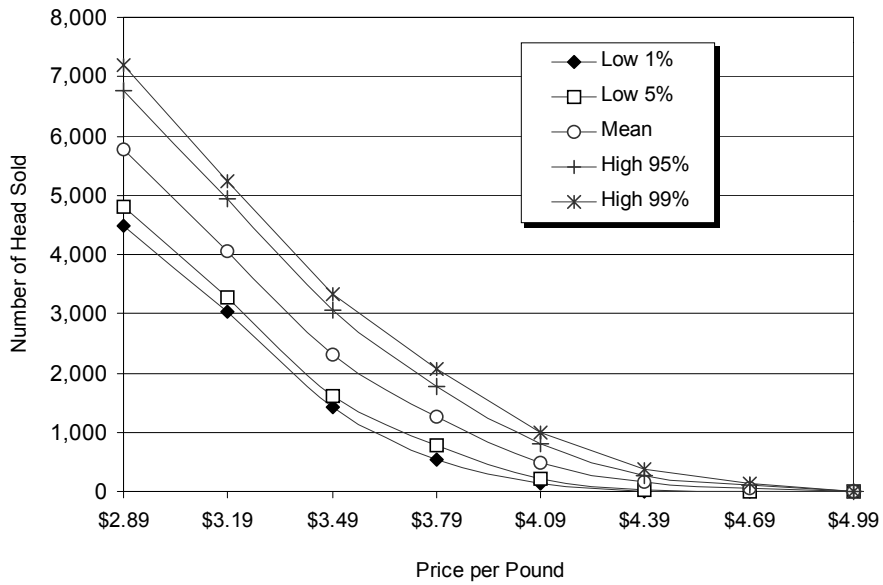


Figure 8. Estimated demand for natural freezer beef, Western Slope (Montrose and Delta counties) (Sample N = 78, Bootstrap N = 500; Conventional Price = \$2.89/lb.)

Two of the most important findings regarding the potential for alternative meat market strategies are repeated here to stress their significance:

1. Approximately 25% of Western Slope respondents purchased at least some beef from producers, while only 7% of Front Range, urban respondents bought directly. This may be due to a higher availability (and choice) of alternative shopping choices for urban respondents, including natural food stores (8%) and specialty stores (18%).
2. Among all respondents who buy from producers, household members were more likely to hunt, and among those interested in buying from producers, households are more likely to have children and own a freezer.

Although the contingent valuation method used in this analysis limits the validity of the willingness-to-pay findings, the market shares inferred from stated preferences at various premia are worth noting. At a premium of \$0.40 over prevailing market prices (a premium of about 24%), the market share of natural ground round would be between 50% and 70%. Meanwhile, at a 20% premium (\$1.00), the market share of natural steak would be between 20% and 40%. For freezer beef, thousands of head would still be demanded on the Front Range and Western Slope if producers charge a 30% premium. The larger market share for ground round at higher relative price levels is consistent across regions, but the demand for natural ground beef is more pronounced on the Front Range. Regardless of region, we believe the difference in market shares across the two beef products is partly due to the fact that steak is a higher priced item, and therefore the relative premium seems lower. This is welcome news to producers because the demand for ground meats must be higher to help them move the large share of ground beef coming from the average beef carcass.

Study Limitations and Future Research Directions

This study represents an important starting point to guide Intermountain producers in developing workable marketing plans directed at niche markets. Still, there are limitations to the approach and findings of this study. First, hypothetical willingness-to-pay estimates are not likely to be fully accurate assessments of real marketplace behavior, as discussed in the literature review. Future studies may wish to use more reliable contingent valuation methods or develop experimental auction markets, or draw from pricing changes implemented by producers who are already marketing such products, to estimate more reliable pricing strategies. Also, now that organic standards have been put into place, and new labeling programs are being introduced, a follow-up study on consumers' acceptance and valuation of such standards would be quite informative.

It is important to conclude by highlighting a few points on what issues will drive the likely success of future ventures by cattle producers such as those who funded this study. First, although "grass-fed" did not rate high as an attribute in this project

(Grannis and Thilmany, 2001), recent publicity on grass-fed beef may change consumer priorities. Findings of recent studies suggest grass-fed beef may offer an attractive protein source to health-conscious consumers because it is lower in calories and fats, and concentrated in important omega-three fatty acids (Burros, 2002; O'Neil, 2002). Citing discussions with researchers from Colorado State University, the University of Guelph, and the *European Journal of Clinical Nutrition*, both Burros and O'Neil argue that some of the downturn in beef demand due to health concerns may be reversed with a healthier, grass-fed product. In addition to nutritional value, there is some evidence to indicate antibiotic usage, E. coli and mad-cow occurrences, and incentives for hormone implants may be lessened with grass-fed production.

Similar to organic vegetables in past decades, recent research points to a likelihood that grass-fed beef will move into mainstream consumer markets (Burros, 2002). Even producers who do not believe some of the scientific claims may be drawn to the consumer niche if it offers higher operating margins (Bell, 2002). Still, there are great challenges to managing a niche marketing venture, whether it be for grass-fed, natural, or freezer beef with any differentiated attributes—including lack of specific marketing skills, a complex regulatory environment, and significant marketing costs for direct sales ventures (Wilson, 2002). Based on the findings from this study, future research and planning should focus on the growing interest in grass-fed beef, operational models that would allow producers to take advantage of freezer beef sales, and market research on the costs of direct marketing.

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