FACTORS INFLUENCING CONSUMER RANKINGS OF ALTERNATIVE RETAIL BEEF PACKAGING

Pierre M. L. Pelzer
Dale J. Menkhaus
Glen D. Whipple
Ray A. Field
Elizabeth Hoffman *

Selected Paper Session
1990 AAEA Meetings
August 4-8, 1990
Vancouver, British Columbia, Canada

Topic Areas: Domestic and International Agribusiness
Marketing and Price Analysis

AAEA 1990

FACTORS INFLUENCING CONSUMER RANKINGS OF ALTERNATIVE RETAIL BEEF PACKAGING

ABSTRACT

Ordered probit models were used to identify factors which influenced consumer rankings of vacuum skin packaged steaks and roasts. Variables included selected demographics and concerns regarding retail beef packaging. Information regarding color and the benefits of the vacuum package were found to be among the most important factors.

FACTOR INFLUENCING CONSUMER RANKINGS OF ALTERNATIVE
RETAIL BEEF PACKAGING

Per capita consumption of food has changed little over the past ten years. Future growth in total food demand likely will also be limited. However, the mix of food purchased by consumers has changed substantially ,i.e., consumption has shifted among products (Buse, 1986). Specific to beef, there is clear evidence that the demand for beef has trended downward over the past ten years (Purcell, 1989). This phenomenon can be attributed to changes in relative prices between beef and white meats and changes in the life style of consumers, including health related factors (Chavas, 1986). These changes have contributed to the relative success of marketing efforts of competing proteins and to a reduction in the market share for beef (Allen and Pierson, 1987).

Demand can be positively influenced by increasing the value that the consumer attributes to the product. Packaging, with its technical and marketing characteristics, is an important way to improve consumer value perception of a product. For beef, most retail packaging is currently performed by supermarkets using an overwrapped styrofoam tray (OST). Although most common, this technique is lacking in both product presentation and protection. The main problems include: product quality control (consistency); easily damaged; drips juices; inadequate for freezing; product is not entirely visible; and conveys little information on nutritional content, preparation and serving (Allen and Pierson, 1987).

As the beef industry began to react to the challenge from competing meats, a new concept for retail meat packaging, the centrally prepacked or case ready meat, was introduced (Allen, 1989). This method tends to concentrate the packaging function at the packer level, while the function of merchandizing is

performed by the supermarkets. For this concept to be effective, longer conservation of fresh meat under its retail packaging is required to ensure sufficient time after packaging the product for shipment from packers to retailers. Vacuum skin packaging (VSP) is an alternative which has potential because of its conservation properties and its adaptability to large scale utilization in the packaging industry. The main attributes of the VSP include: extended shelf life; juiciness and freshness of meat; visibility of the meat; and longer and more convenient storage at home. From a marketing point of view, the VSP presents several advantages: homogeneity in quality due to the centralization of the packaging process; provides better oportunities for branded products allowing each firm to develop their own image and marketing strategy; facilitates the use of information on the package; and allows retailers to emphasize consumer services (Linsen, 1988).

The main limitation of VSP is the unusual appearance of the meat. The beef is not the familiar bright red color but has a natural purplish color. When the meat is reexposed to the oxygen contained in the air the color returns to the familiar bright red color in about fifteen minutes. The unusual color seems to prevent consumers from trying the meat. Thus, information about this phenomenon (and its cause) appears to be important to induce initial purchase (Lynch, Kastner and Kropf; 1986).

Although case ready meat has a potential to be a major benefit to the beef industry, its adoption has been slow. For the VSP to be adopted by the industry requires: involvement by packers for a sufficient critical mass; processors and supermarkets to work together and pool resources in research and development; an analysis of retail operating economics; training sessions to help retail meat cutters become better customer service specialists; and an analysis of consumer attitudes toward the vacuum package (Allen, 1989). The

2

objective of this paper is to identify factors which influence consumer rankings of steaks and roasts in alternative package types. This information should be useful in developing marketing strategies for vacuum packaged retail beef.

DATA

The study was conducted in two areas, Denver and Los Angeles, during May and August 1989, respectively. Study participants were primary purchasers of meat in the household and must have purchased beef steaks from a supermarket in the month prior to the study. Approximately one-quarter of the participants were men. In Denver, 185 people participated in the study, and 384 in Los Angeles.

Study participants were asked to rank steaks (one choice boneless lip-off rib-eye steak) and roasts (one choice boneless chuck roast) in three different package types. One package was the overwrapped styrofoam tray (OST), the package most used in retail outlets. Another was the vacuum skin package (VSP) which contain meat which is a natural purplish color. The third package type was a VSP with carbon monoxide added (VSP+CO). Beef in this latter package type has a red carboxymyoglobin color similar to the myoglobin color of beef in the OST. In practice, the latter product is not approved for sale. As a result, consumers were not given the opportunity to purchase the beef in this study. However, adding carbon monoxide to the VSP provides a means to identify the influence of the meat color on the rankings. Packages were identified with letters (A,B and C) and their order was rotated for each ranking session.

Rankings were conducted without information and with information regarding the vacuum skin package (natural purplish color). One third of the study participants were given no information. One third of the respondents were provided with information pertaining to the advantages and characteristics of

3

the vacuum skin packaging. One third of the study participants were given information and a demonstration of the effects of opening the VSP package and observing the beef "bloom" to its bright red color. No information was provided as to the reason for the bright red color in the VSP+CO (red carboxymyoglobin color).

Before packages were ranked, participants were asked to complete a background questionnaire. This questionaire included four sets of variables: demographics; concerns about beef and packaging (yes/no); changes in purchasing patterns for beef and other meats (less often/no change/more often); and important characteristics of beef and packaging encouraging the buying decision for beef steaks (1 to 9 scale). Data from the background questionnaire were used as explanatory variables to develop the statistical models to explain rankings for steaks and roasts in the VSP and VSP+CO.

STASTISTICAL METHOD

The objective of this study was to identify the influence of selected demographic variables, concerns regarding beef and packaging, meat consumption patterns, and important characteristics in steak buying decisions on the rankings of steaks and roasts in alternative package types. The rankings of a particular package type serves as the dependent variable: 1, 1st ranking, highest preference; 2, 2nd ranking, middle preference; and 3, 3rd ranking, lowest preference. Thus, the dependent variable is discrete and there is an obvious preference scale between each ranking. A convenient statistical framework, given the characteristics of the dependent variable, is the ordered probit model (McKelvey and Zavoina, 1975).

Although the dependent variable is discrete, it can be assumed that there is an underlying continuous scale which represents preferences of consumers, and that the discrete choice represents a bracket on the underlying continuous

4

scale. In this case, if Y is the underlying continuous parameter and Z is the discrete choice, and if Y1 and Y2 are threshold values:

Z = 1 is equivalent to $Y > Y1$;

Z = 2 is equivalent to $Y1 \geq Y > Y2$; and

Z = 3 is equivalent to $Y2 \geq Y$.

Assuming that Y is a linear combination of explanatory variables (X's), Y can be expressed as $Y = XB + e$, where e is distributed $N(0,\sigma^2)$. This model serves as the framework for identifying significant factors influencing the rankings of the VSP (natural purplish color) for both steaks and roasts and the VSP+CO (red carboxymyoglobin color) for steaks.

EXPLANATORY VARIABLES

The selection of variables to enter the ordered probit model was based on a chisquare test using a crosstabulation of the rankings of VSP steaks with the explanatory variables from the background questionaire. Variables which significantly ($\alpha = 0.50$) influenced the rankings were initially introduced into the ordered probit model. In general, variables included: specific concerns or dissatisfactions with beef steaks (1 = concern, 0 = no concern); manner in which selected meat usage has changed in the past three years (1 = less often, 0 = otherwise or 1 = more often, 0 = otherwise); overall opinion of fresh beef and overall opinion of how beef is packaged (1 = excellent, very good, and good, 0 = fair and poor); home storage of fresh beef steaks (1 = prepare the same or next day, 0 = otherwise or 1 = refrigerate and prepare within 2 or 3 days, 0 = otherwise or 1 = refrigerate and prepare within a week, 0 = otherwise or 1 = freeze for later preparation, 0 = otherwise); and importance of selected steak and package characteristics in the buying decision for steaks based on a scale where 1 = strongly discourages buying, ..., 9 = strongly encourages buying (1 = 7, 8 and 9, 0 = otherwise).

5

Demographic variables also were introduced and included: age (continuous); total family income where 01 = 0-10000 bracket, 02 = 10000-20000 bracket,...,over 100000 (continuous); sex (1 = female, 0 = male); marital status (1 = married, 0 = otherwise); employment status (1 = full time, 0 = otherwise); education where 1 = 8th grade or less, 2 = 1-3 years of H.S., 3 = 4 years of H.S., 4 = 1-3 years of college or technical school, 5 = 4 years of college and 6 = graduate work (continuous); and number of people in the household (continuous). A location variable was also introduced, 0 = Denver, 1 = Los Angeles. After non respondents were omitted from the sample, 537 observations remained for the analysis (179 for Denver and 358 for Los Angeles).

Due to a limitation of the statistical package (LIMDEP), the number of independent variables which could be incorporated into the initial model was constrained to forty. As a result, variables were entered and eliminated in the following manner. The criterion to eliminate variables was a likelihood ratio test, minimizing type II error where H_0: B's = 0, i.e., minimize β, the probability of accepting H_0 when H_0 is false. Specifically, α = 0.80, so $0 < \beta < 0.20$. Using this test, the problem of eliminating relevant variables and potentialy biasing estimated coefficients is minimized. The criterion to introduce new variables into the model was a likelihood ratio test minimizing type I error, α = 0.20. As a result, there is a high probability that variables which were not introduced in the model have a coefficient (B) equal to zero. Thus the problem of introducing irrelevant variables into the model and increasing the variance of the estimates should be minimized. Variables which were rejected from the model are presented in the Appendix Table 1.

The selection of variables using the procedure described above was based only on the rankings of the vacuum skin packaged steaks. In order to better

study the effect of beef color in the VSP and the impact of a beef cut other than steaks on rankings, additional ordered probit models using the same independent variables as identifed in the model for VSP steaks rankings were estimated. In these models, the rankings of vacuum skin packaged steaks with carbon monoxide (VSP+CO) and the rankings of vacuum skin package roasts were used as dependent variables. A shortcoming of the analysis of the rankings for roasts is that the independent variables (from the background questionaire) refer only to steaks. The underlying assumption is that concerns and buying decisions for steaks, as reported by study participants, also apply to roasts.

IMPLICATIONS OF THE RESULTS

The estimated parameters and summary statistics for the three ordered probit models are presented in Table 1. The levels of significance (likelihood ratio test) for the VSP steaks, VSP roasts and VSP+CO steaks models are respectively, $0.79*10^{-13}$, $0.10*10^{-7}$ and $0.54*10^{-2}$.

As expected, the level of information pertaining to the VSP which was provided to the study participants was significant and positive in explaining the rankings of the VSP. The change in the probability of ranking the VSP first for the respondents receiving information $(0.142)^{1}$ was not significantly different from the change in the probability of ranking the VSP first for participants who received information plus the demonstration (0.128). Thus, a demonstration of the effects of opening the VSP is not warranted. The information variables were not significant in the VSP+CO model. In this package type, beef has the familiar bright red color. Hence, the effect of

---

[1] $dP/dX_i = f(M\hat{u}1-XB)*B_i$, where dP/dX is the change in the probability (P) of ranking the VSP first given a change in the variable (X_i), f is the normal distribution function $N(0,1)$, XB is the sum of the products of the mean of the variables and the respective coefficients, B_i is the estimated coefficient associated with X_i, and $M\hat{u}1$ is the threshold value between the first and second rankings, Capps (1983).

Table 1. Estimated coefficients and summary statistics for the VSP steaks, VSP roasts and VSP+CO steaks models.

Variables	VSP steaks		VSP roasts		VSP+CO steaks	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Constant	-0.66	0.15	-0.82	0.06	+0.85	0.04*
DEMOGRAPHICS						
Age	+0.02	0.00*	+0.01	0.01*	-0.00	0.20
Total family income	+0.03	0.41	-0.00	0.93	-0.03	0.39
Sex	-0.16	0.26	-0.17	0.21	+0.24	0.06
Employment status	+0.19	0.12	-0.05	0.67*	+0.05	0.64
Number of persons in the household	+0.07	0.12	+0.13	0.00	+0.04	0.32
STORAGE						
Storage: freeze for later preparation	+0.11	0.37*	-0.00	0.99	+0.20	0.86
Storage: refrigerate, use within a week	+0.41	0.04	+0.24	0.23	-0.25	0.19
CONCERNS						
Do not like taste	-0.57	0.13*	-0.57	0.11	+0.07	0.86
High fat content	+0.23	0.05	+0.13	0.26	-0.17	0.14
Cuts and package are too large	-0.28	0.10	-0.10	0.56	+0.32	0.06
Cannot see entire product in package	+0.16	0.16*	+0.11	0.34*	+0.06	0.76
Too much gristle	-0.32	0.00	-0.32	0.00*	+0.05	0.63
Beef displayed in store looks unappetizing	+0.28	0.11	+0.34	0.04*	-0.12	0.45
Package wrapping does not protect meat	+0.19	0.14	+0.31	0.01	-0.02	0.86
Not easily prepared	+0.43	0.13	+0.24	0.44	-0.16	0.64
PURCHASING PATTERNS						
Eating fresh beef in general less often	+0.15	0.25*	+0.28	0.04*	-0.01	0.93
Serving small portion at home more often	+0.23	0.05	+0.20	0.10	-0.10	0.39
Buy beef at specialty meat store more often	+0.24	0.12	+0.26	0.09	-0.11	0.49
Having steaks more often	-0.20	0.25	-0.01	0.93	-0.00	0.97
Serving low-fat beef more often	+0.20	0.09*	+0.16	0.17*	+0.09	0.45
Serving poultry more often	-0.33	0.02	-0.38	0.01	-0.13	0.36
OVERALL OPINION						
Good overall opinion of fresh beef	-0.33	0.05*	-0.26	0.10	+0.30	0.05*
IMPORTANCE IN PURCHASING DECISION						
Greater amount of marbling	+0.29	0.02*	+0.11	0.38	-0.15	0.21
Cholesterol content	+0.16	0.19*	+0.14	0.24	-0.18	0.14
Well trimmed of outside fat	-0.39	0.01	-0.01	0.95	-0.02	0.90
Speed and ease of preparation	+0.13	0.30	+0.21	0.09	+0.11	0.37
Appropriate for special occasions	-0.20	0.11*	-0.01	0.92	+0.08	0.52*
Labelled "all natural"	+0.31	0.01*	+0.18	0.15*	-0.33	0.01*
Familiar bright red color	-0.32	0.01	-0.35	0.01	+0.39	0.00
Overall shape	-0.20	0.09	-0.16	0.16	+0.18	0.12
INFORMATION						
Information	+0.48	0.00*	+0.41	0.00*	+0.17	0.19
Information plus demonstration	+0.44	0.00	+0.46	0.00	+0.21	0.10
LOCATION						
Location	-0.10	0.38	-0.16	0.16	-0.04	0.74
THRESHOLD VALUE						
Mû1	+0.86	0.00	+0.93	0.00	+1.15	0.00

* Significance level $\alpha = 0.05$.

information seems to be primarily related to the purplish color of the VSP beef.

With respect to the demographics, the age of the participants had a significant positive impact on the preferences for the VSP for both steaks and roasts. For the VSP roast model, the number of people in the household had a significant positive impact on the preferences for the VSP.

Consumers who reported refrigerating beef for consumption within a week after purchase seemed to appreciate the conservation properties of the VSP steaks. This consumer segment may be a prime target for the VSP.

Study participants who had a good overall opinion of fresh beef were less likely to prefer the VSP steaks. On the other hand, respondents who had a good overall opinion of fresh beef were more likely to prefer the VSP+CO steaks. Evidently, the color of the beef in the traditional OST contributes to the appeal of fresh beef in general, particularly among those with a good overall opinion of beef. Moreover, a good overall opinion of fresh beef did not influence the rankings of the roasts in the VSP.

Study participants who reported increased poultry consumption over the past three years were less likely to prefer the VSP for both steaks and roasts. This phenomenon may be explained by the fact that these consumers are satisfied with poultry and are not inclined to increase their consumption of beef if the package type is changed. In the VSP roasts model, the variable "eating fresh beef in general less often" is significant and exhibits a positive relationship. Thus, the VSP might have an impact on increasing the preference for beef roasts, particularly among those who are eating beef less. This tendancy also was exhibited for steaks by those who reported serving smaller portions at home more often.

Two variables which are significant in the VSP steaks model relate to the attractiveness of the package. Consumers who rated the importance of the familiar bright red color in buying decision 7,8, or 9 on the 1-9 scale were less likely to prefer the VSP for steaks. Similar results also were obtained in the VSP roasts model. It is not surprising that this variable is significant and has a positive effect in the VSP+CO steaks model, where the vacuum packaged beef has a bright red color. These results, as well as those previously presented, confirm the findings reported by Lynch, Kastner and Kropf (1986) which indicate the importance of color in the buying decision. Consumers evidently associate the bright red color of beef with an image of good quality (Smith, 1981; Taylor, 1982). Conversely, the variable "importance of labelled 'all natural' in buying decision", has a significant positive influence on the preference for the VSP steaks and has a significant negative influence on the rankings of the VSP+CO steaks. This finding could provide an important marketing argument for the use of the VSP technique. As a matter of fact, in the VSP steaks model, the negative impact of the variable "importance of familiar bright red color in the buying decision" is offset by the positive impact of the variable "importance of labelled 'all natural' in the buying decision", with respect to the probability of ranking the VSP first (-0.094 and +0.092).

The variable "too much gristle" has significant negative impact on the rankings of the VSP for the steaks and roasts. The skin properties of this package, as well as the darker color of the meat, evidently makes the gristle in the beef appear more vividly. Moreover, the variable "importance of well trimmed of outside fat in the buying decision" is significant only in the VSP steaks model. A possible explanation is that VSP steaks appear less trimmed than those packaged in the OST, because of the increased visibility of the

product in the VSP and that consumers are more sensitive to external fat for steaks than for roasts. The variable "greater amount of marbling" strongly encouraging purchase of steaks is significant in contributing to a higher preference for VSP steaks. This result may also be attributed to the improved visibility of the beef in the VSP as compared to beef in the OST.

Rankings of the roasts in the VSP seem to be more influenced by package concern variables. The concern variables "beef displayed in store looks unappetizing" and "package wrapping does not protect meat" significantly influenced respondents' preferences for the VSP, as measured by their rankings for roasts in the VSP. This suggests that the VSP, with respect to protection and presentation of the meat, was perceived by the study participants to be more effective for roasts than for steaks.

SUMMARY

The results obtained from the models developed in this paper reinforce previous findings regarding the attitude of consumers toward the purplish color of beef under vacuum packaging conditions and the importance of information for the acceptance of beef in the vacuum skin packaging. Packers and retailers must provide consumers with information about the natural purplish color of the vacuum skin packaged beef and perhaps emphasize the "all natural" advantage of this packaging technique. A demonstration of how the meat "blooms" to the familiar bright red color after the package is opened, does not significantly improve consumer acceptance of the VSP, as compared to providing only information.

Differences in preferences for the VSP were found between steaks and roasts. Marketing of the VSP roasts should emphasize the advantages of the VSP with respect to protection and presentation of the product. For steaks, marketing efforts should concentrate on consumers who are serving smaller

11

portions at home more often and emphasize the conservation properties of the VSP. Particularly for steaks, because of the visibility of the product in the VSP, quality control of external fat is very important.

Consistent with the previous research, the color of the beef in the VSP is a concern among consumers. However, information pertaining to the VSP enhances the preference for this package type. There also are differences in factors influencing the preferences of the package type between steaks and roasts. This suggests that slightly different marketing strategies for each cut may be required.

Appendix Table 1. Variables which were selected to enter the VSP steaks model which do not have coefficients significantly different from zero in the ordered probit analysis.

DEMOGRAPHICS
  Marital status
  Level of education
CONCERNS
  Too expensive
  Need to prepare shortly after purchase
  Packages are messy and unattractive
  Cholesterol content
  Can't easily store in refrigerator
  Color
  Packages are not sturdy or strong
  Too much waste
  Contains artificial ingredients
  Eating too much not good for health
  Cannot be prepared in a variety of way

PURCHASING PATTERN
  Eating fresh beef away from home more often
  Purchase beef at grocery store less often
  Having roast more often
OVERALL OPINION
  Good overall opinion of packaging
IMPORTANCE IN PURCHASING DECISION
  Value for the money
  Appeal to adults
  Attractiveness of package
  Branded product
  Beef look appetizing and attractive
  Package retain freshness longer
  Uniform size
  Appeal to children

REFERENCES

Allen, J.W. "Centrally Prepacked Fresh Red Meat: Success or Failure?". The National Provisioner August 5 (1989):8-10.

Allen, J.W. and T.R. Pierson. "Packaging Has Rising Role in Red Meat's turnaround". The National Provisioner December 13 (1986):7-25.

Buse, R.C. "What is America Eating and What Is Happening to Meat Consumption?" The Economics of Meat Demand, Proceedings of the Conference on The Economics of Meat Demand, Charleston, South Carolina Oct (1986).

Capps, O. Jr. "Qualitative and Censored Response Model". American Agricultural Economics Association Workshop, Purdue University (1983).

Chavas, J.P. "On the Structure of Meat Demand". The Economics of Meat Demand, Proceedings of the Conference on The Economics of Meat Demand, Charleston, South Carolina Oct (1986).

Linsen, M.A. "Meat-ing the Challenge". Progressive Grocer May (1988):235-244.

Lynch, N.M., C.L. Kastner and D.H. Kropf. "Consumer Acceptance of Vacuum Packaged Ground Beef as Influenced by Product Color and Educational Material". Journal of Food Science 51 (1986):253-255.

McKelvey, R.D. and W. Zavoina "A Statistical Model for the Analysis of Ordinal Level Dependent Variables". Journal of Mathematical Sociology 4 (1975):113-120.

Purcell, W.D. "The Case of Beef Demand". Choices Second Quarter (1989):16-19.

Smith, G.C. "Considerations for Fresh Meat Packaging". National Provisioner January 31 (1981):27.

Taylor, A.A. "Retail Packaging System for Fresh Meat". Meat Science and Techniques, International Symposium Proceedings, Lincoln, Nebraska. National Live Stock and Meat Board, Chicago, Illinois (1982):353.