An Empirical Application of Laboratory Experimental Auctions in Marketing Research

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Introduction

Agricultural economists are becoming increasingly involved in marketing research (e.g., Branson et al.; Skaggs et al.; Menkhaus et al.). This is due in part to the increased emphasis on marketing by commodity groups and to the keen competition among participants in the food industry. Moreover, changes in consumer attitudes and lifestyles have prompted researchers in food science and related disciplines to develop new products to meet these changing needs. This has provided an opportunity for agricultural economists to collaborate with their colleagues in food science and marketing to develop merchandising strategies that are consistent with consumer choice patterns.

Marketing studies using traditional marketing research techniques (e.g., surveys, focus groups, test markets, and laboratory test markets) have focused on the collection of primary data to assess the consumer appeal of both new and existing products. While such data are useful in identifying consumer choice patterns and product quality attributes, the important issue of value has not been addressed. The economic value consumers place on new products and new product characteristics is important not only for deciding whether or not to produce a product for general sale and pricing, but also for determining if new products and product characteristics enhance consumers' perceptions of value.

The overall purpose of this article is to demonstrate the empirical applicability of experimental economics techniques (specifically, laboratory experimental auctions) as an approach to eliciting value information in marketing research. The specific objective was to determine factors influencing the value consumers place on retail beef steaks in a vacuum skin package (new product) relative to the value of steaks in the traditional overwrapped styrofoam tray. Results from this analysis can be useful in developing viable marketing strategies for new retail beef packaging. However, the focus of the article is directed more toward the application of laboratory experimental auctions rather than the specific results of the problem investigated.

The Methodology

In a laboratory experimental auction (Coppinger, Smith, and Titus; Coursey and Smith; Cox, Roberson, and Smith; Cox, Smith, and Walker; Forsythe and Isaac; Kagel, Harstad, and Levin), participants submit
bids for a product and the winners of the auction purchase the product at a price determined by the auction rules. This procedure allows participants to reveal to the researcher how much they are willing to pay for the product. A laboratory experimental auction, used in conjunction with survey instruments, has specific advantages over traditional marketing research techniques, particularly if determining economic value is important. The researcher can control variables under investigation, obtain data which are useful in analyzing demand, and obtain information pertaining to the economic value of a test product relative to a control product. For example, while a laboratory test market (LTM) procedure (Yankelovich, Skelly, and White) allows for control of variables in a laboratory setting, this method is less effective in eliciting the value consumers are willing to pay for a new product or product characteristic. Essentially, the LTM procedure employs list or posted pricing which, in the LTM setting, not only limits the number of price scenarios which can be examined, but also results only in a purchase or no-purchase decision at a particular price on the part of the test participant. The researcher learns that a participant will buy the test product at a price less than or equal to the list price, but does not learn the maximum amount the participant is willing to pay for the test product (the participant's demand price or reservation value).

The use of laboratory experimental methods has become increasingly popular in microeconomic analyses (Hoffman and Spitzer; Smith 1982; Wilde). Growth in the application of these techniques can be attributed to at least two properties of the experimental approach (Wilde): (a) control over the factors influencing the microeconomic system or the economic environment under investigation and (b) accurate measurement of relevant variables. This approach can be an equally effective and efficient method of obtaining data for an, as yet unobserved, economic phenomenon, such as a benchmark price for a new product.

**Auction Types**

The selection of the auction type to be used in an experiment is essential to the success of the experiment. In most economic experiments, the auction type selected should yield (or converge to) a stable market price and provide an incentive for the subject (consumer) to bid a price consistent with a true reservation value. An auction which satisfies the second property is referred to as a demand-revealing (or incentive-compatible) auction. However, in some applied research, meeting the stringent demand-revealing property may not be necessary. For example, if the objective is to compare values bid for test and control products, then all that may be required is that the auction mechanism provide an incentive to reveal the rank order of true reservation values, particularly if differences in bids from the true reservation value are similar for the two products. This might be referred to as a “rank-order revealing” property of an auction. Revenue generation is not a consideration for auction type selection in this study.

In general, auctions have been used since ancient times (perhaps as early as 500 B.C.) as a mechanism to set price (Mester). A broad categorization includes oral and sealed-bid auctions. In a marketing research setting, sealed-bid auctions may be preferred to oral auctions because they facilitate data collection.

Two common types of oral auctions are the English and the Dutch auctions. The former is characterized by the auctioneer raising prices until only one bidder remains, who wins the good at the price he/she bid. In the Dutch auction, the auctioneer continually lowers the price until stopped by a bidder, who then purchases the product at that price. In the Dutch tulip auction, for example, there is an automated clock which ticks down the price. Each bidder has a button which is used to stop the clock. The first bidder to push the button gets the object at the current clock price.

There are two types of sealed-bid auctions which apply when there is a single seller of several units of a homogeneous commodity, without specification of a reservation price: a discriminatory (first-price) sealed-bid auction and a uniform-price (second-price or Vickrey) auction. In a discriminatory sealed-bid auction, the highest bidders win and pay what they bid. If a single unit is offered for sale, the highest bidder wins and pays the highest bid price. In the case of multiple units, each unit offered for sale would sell at each winner’s bid price. Thus, each unit could sell at a different price. For example, if four units were offered for sale, they would sell at the four highest bids. In a uniform-price auction, on the other hand, the units all are sold at the same price (market price), which is equal to the highest rejected bid. In the case of a single unit, the highest bidder wins and pays the second-highest price. If four units of a commodity were offered for sale, the four highest bidders would win and pay the fifth-highest submitted bid.

Economists have developed propositions from theory and experimental analyses to aid in predicting the ways bidders behave under different auction types (Coppinger, Smith, and Titus; Cox, Roberson, and Smith; Smith 1982). Theoretically, the expected utility-maximizing bid in the first-price sealed-bid auction and the Dutch auction is less than the bidder’s true value for the auctioned object. Therefore, these auctions are not demand-revealing allocation mechanisms (Cox, Roberson, and Smith). In addition, the amount by which the object’s value exceeds the optimal bid depends on the bidder's risk preferences and expen-
tations of rival bids. Since it is unlikely that risk preferences and expectations will be the same for each bidder, the highest bid will not necessarily be submitted by the subject who places the highest value on the auctioned good. Thus, the first-price sealed-bid and Dutch auctions may not be rank-order revealing.

In an English auction, what the winning bidder pays is determined by the reservation value of the second-highest bidder. The individual with the highest reservation value should always be the highest bidder, since that person need only bid marginally more than the second-highest bidder to win the auction. Thus, the English auction is incentive-compatible and reveals the reservation value of each bidder who drops out of the auction. Only the reservation value of the highest bidder is not revealed.

The second-price sealed-bid auction is isomorphic to the English auction and thus is also incentive-compatible (Vickrey). In the case of the second-price sealed-bid auction, the expected utility-maximizing bid is always equal to the bidder's true value for the auctioned good and is independent of the bidder's risk preferences and expectations. Bidding one's true value is a dominant strategy against any bidding strategy used by other bidders (Cox, Roberson, and Smith; Vickrey). In this sense, a second-price auction is theoretically a demand-revealing allocation or price setting mechanism. Moreover, it has been found by some researchers that subjects in experimental second-price auctions learn to bid their true values after a number of trial auctions (Coppinger, Smith, and Titus; Cox, Roberson, and Smith). This suggests that trial auctions are important so that participants can learn both the auction procedure and the optimal bidding strategy.

Multiple-unit, uniform-price, first-rejected-bid auctions are also theoretically incentive-compatible or demand-revealing. These include third-price (two units sold at the third-highest price), fourth-price (three units sold at the fourth-highest price), and fifth-price (four units sold at the fifth-highest price) auctions. The important ingredients are that the winning bidders do not pay the prices they bid and that each winner purchases only one unit.

The conclusion that bidders generally learn to bid their true values in incentive-compatible auctions has been challenged by subsequent research. Coursey and Smith tested an auction in which four units of a fictitious commodity were sold to four different bidders at the fifth-highest bid price. They found that subjects consistently underbid relative to their true reservation values. This result suggests that the bids in such an auction should not be interpreted as true representations of subjects' maximum willingness to pay. However, differences in bids (or relative bids) across subjects and for different objects very well might represent real differences in value (Coursey and Smith). Coursey and Smith found that subjects tended to underbid by approximately the same amount, thus preserving the rank order of subject valuations. Thus, this auction type is rank-order revealing.

The original second-price auctions were replicated by Cox, Smith, and Walker, and by Kagel, Harstad, and Levin. Cox, Smith, and Walker also replicated the fifth-price auctions. In both sets of replications, some subjects with relatively high reservation values bid more than their reservation values, while participants with low reservation values tended to bid less. In the fifth-price auctions, some high-value participants also bid less than their reservation values. These results lend further credence to the suggestion that bids in such auctions are rank-order revealing, rather than strictly demand revealing. Moreover, there is a need for additional study of the behavioral properties of theoretically incentive-compatible auctions and their use in applied research.

In the study summarized below, a fifth-price auction was used to sell four packages of beef to four different consumers in each auction. A fifth-price auction (as compared to, e.g., a second-price auction) was chosen for several reasons. First, the intent was to sell enough packages of beef to maintain consumer interest in the auctions. Second, it was deemed necessary that the market prices (highest rejected bid) be low enough for high-value consumers to actually purchase several packages of steak at the same price. It was hypothesized that in a series of second-price auctions the market price would decline over time as consumers purchased each unit at close to the maximum price they were willing to pay.

This point about the second-price auction as compared to the fifth-price auction is illustrated in table 1, which presents the hypothetical demand schedules of packages of beef for five consumers. If the beef were sold in a series of second-price auctions and all consumers truthfully revealed their reservation values, the first unit would be purchased by consumer 2 for $7, the second unit would be purchased by consumer 1 for $6.95, the third unit would be purchased by consumer 3 for $6.50, the fourth unit would be purchased by consumer 1 for $6.45, and so on. In contrast, if the beef were sold in a series of fifth-price auctions and all consumers truthfully revealed, consumers 1–4 would win each of the first four auctions and pay $4 per package in each auction. This results in a tendency for convergence to a relatively stable market price after only a few such auctions.

In summary, the first-price sealed-bid and Dutch auctions theoretically are not demand-revealing and may not even be rank-order revealing. The English auction is demand-revealing (at least for participants other than the highest bidder) and is rank-order revealing. The second-price auction theoretically is demand-revealing, but behaviorally, this property has been challenged. However, this auction has been
Table 1. Hypothetical Consumer Demand Schedules for Packages of Beef

<table>
<thead>
<tr>
<th>Number of Packages Purchased</th>
<th>Consumer 1</th>
<th>Consumer 2</th>
<th>Consumer 3</th>
<th>Consumer 4</th>
<th>Consumer 5</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>$7.00</td>
<td>$7.25</td>
<td>$6.95</td>
<td>$6.25</td>
<td>$4.00</td>
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<td>6.50</td>
<td>6.25</td>
<td>6.45</td>
<td>6.00</td>
<td>3.50</td>
</tr>
<tr>
<td>3</td>
<td>6.00</td>
<td>5.25</td>
<td>5.95</td>
<td>5.75</td>
<td>3.00</td>
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<tr>
<td>4</td>
<td>5.50</td>
<td>4.25</td>
<td>5.45</td>
<td>5.50</td>
<td>2.50</td>
</tr>
<tr>
<td>5</td>
<td>5.00</td>
<td>3.25</td>
<td>4.95</td>
<td>5.25</td>
<td>2.00</td>
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<tr>
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<td>4.50</td>
<td>2.25</td>
<td>4.45</td>
<td>5.00</td>
<td>1.50</td>
</tr>
<tr>
<td>7</td>
<td>4.00</td>
<td>1.25</td>
<td>3.95</td>
<td>4.75</td>
<td>1.00</td>
</tr>
</tbody>
</table>

shown to be rank-order revealing. Multiple-unit variants of this auction type (e.g., a fifth-price auction) have a tendency for convergence to a relatively stable market price after only a few auctions. Moreover, in a marketing research setting with real consumers, this auction type is more administratively appealing than the English auction. Thus, the fifth-price auction is a suitable auction mechanism for use in this study.

While the retail meat market can be characterized as a posted-price market, the Vickrey auction was chosen over a posted-price mechanism. Given that the primary objective of this study was to elicit how much study participants were willing to pay for one unit of the test or control product in each bidding session, the Vickrey auction was deemed to be better suited to fulfilling this objective. Specifically, the Vickrey auction yields price or value information while a posted-price market provides quantity data at a finite number of potential prices. Moreover, the Vickrey auction is more operationally appealing as compared to the posted-price mechanism in that the researcher knows with certainty how much product will be sold, thus facilitating product procurement and preparation for the study. References detailing the posted-price market include: Buccola; Hoffman and Plott; Plott and Smith; Plott (1982, 1986); Smith (1964); and Williams.

Empirical Application

Economists have been studying changing meat consumption patterns for the last decade. The beef industry is most interested in identifying the factors responsible for the recent decline in demand for beef (Purcell). The industry has been affected greatly by this decline and is presented with the challenge of winning back market share. The marketing success of competing proteins—chicken, turkey, and seafood—has contributed to the beef industry directing increased efforts towards marketing-related activities. These include advertising, promotional schemes, and new merchandising techniques.

Beef packaging is an area which has received attention in the literature but has changed little at the retail level. Vacuum skin packaging is an alternative retail beef package being considered by the industry. According to Seidman, the advantages of the vacuum skin package include: (a) reduction in weight loss from evaporation and trimming, (b) preservation of meat color, (c) increased hygienic control, and (d) enhanced palatability due to controlled aging. Additional benefits for consumers are: (a) extended refrigerator shelf life, (b) elimination of leakage of juices, (c) a clear view of entire piece of beef, and (d) better protection from freezer burn (Fielding). A disadvantage is that the meat in the vacuum skin package has an unusual purplish color rather than the familiar bright red color. However, when the package is opened and the meat reexposed to oxygen in the air, the color of the meat changes to bright red in about 15 minutes.

Research by Lynch, Kastner, and Kropf addressed the issue of consumer acceptance of the vacuum skin packaged beef. Results of this study suggest that informed consumers are more likely to indicate positive purchase intentions, while uninformed consumers are more apprehensive about purchasing the product.

Since consumer acceptance is essential to the development of any new product, further consumer studies involving vacuum skin packaged retail cuts of beef are necessary to determine the marketing potential of this product. Past studies have considered purchase intentions by consumers as the basis for acceptance.
of vacuum skin packaged retail cuts of beef. However, an issue yet unaddressed is the value consumers place on the vacuum skin package relative to the value they place on the traditional overwrapped styrofoam tray.

**Experiment Design and Procedures**

The experimental design used in the empirical application is presented below. The overwrapped styrofoam tray package is the control and the test is the vacuum skin package.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>w/o info</td>
<td>Control Test (8 replications)</td>
</tr>
<tr>
<td></td>
<td>Test Control (8 replications)</td>
</tr>
<tr>
<td>w/info</td>
<td>Control Test (8 replications)</td>
</tr>
<tr>
<td></td>
<td>Test Control (8 replications)</td>
</tr>
<tr>
<td>w/info + demo</td>
<td>Control Test (8 replications)</td>
</tr>
<tr>
<td></td>
<td>Test Control (8 replications)</td>
</tr>
</tbody>
</table>

The study was conducted in Denver, Colorado (May 1989) and Los Angeles, California (August 1989). Approximately 384 individuals participated in the auction at each study site. Four monitors conducted simultaneous auction sessions (identical treatment and package order) four times per day for three days at each location.

A branch of the same market research firm was commissioned to handle local arrangements and to recruit study participants in each location. The market research firm was instructed to provide a sample consistent with the population demographic characteristics of the area regarding age and income.

Approximately three weeks prior to the study, the market research firm telephoned a sample of households in either the Denver or Los Angeles area and administered a telephone screener survey. The screener was used to eliminate individuals working for a company involved in the sale or distribution of fresh meat and to get a representative sample by income and age for each session. One important criterion in the sample selection was to choose among those individuals who had purchased beef steak from a supermarket in the past month. This assured that the study participants were familiar with the value of beef steaks and that each had an underlying preference for steak. Moreover, the study participants were chosen such that each auction session had two males and six females. This allowed for an analysis of price differences across sexes. This mix was selected to ensure that every time slot had the same proportion of males and females since a higher percentage of women than men are the primary shoppers in their households and it is difficult to recruit men during the day.

Respondents who passed the screening tests then were asked if they would be willing to participate in a market study in which they would be given $35 for participating and might have the opportunity actually to purchase steaks. Those who agreed to participate were sent a thank-you note and a reminder notice a few days prior to the study. Extra individuals were recruited for each session in case some people who had agreed to participate did not show up.

The experiment was designed such that, to the extent possible, it duplicated the environment of the marketplace for retail beef. Study participants were provided the opportunity to inspect a display of Choice boneless, lip-off rib-eye steaks in overwrapped styrofoam trays and vacuum skin packages before participating in the auction. Each package contained two eight-ounce steaks and weighed one pound. Rib-eye steaks were used because they can be made relatively uniform with regard to seam fat, can be cut to provide for uniform package weight, and are highly valued. To assure that consumers were bidding for a homogeneous product and to maintain the incentive properties of the auction, representative steaks in each package type were chosen from the display case and used in the auctions. Study participants were given several opportunities during the auctions to closely examine the steaks and the two package types. Participants, in groups of eight, actually bid for the right to select steaks packaged in the overwrapped styrofoam tray and vacuum skin from the display case after the auctions were completed. For the purpose of control, and to assure that the prices bid for the steaks in the two package types could be compared, the steaks in the two package types were similar in size, amount of marbling, and distribution of seam fat. The lean color was different due to the packaging methods.

The multiple-unit Vickrey auction (previously discussed) was used to auction off four packages of each type during each of six purchase auctions (three auctions for each package type). The order of the packages auctioned was varied to control for sequencing effects. After the instructions explaining the specifics of the auction were read to the participants, four trial auctions (two for each package) were conducted prior to the purchase auctions. These were designed to acquaint participants with the auction procedures. The
The model focuses on factors influencing the difference in bids for steaks between the two package types and demonstrates the potential use of data generated from laboratory experimental auctions in marketing and economic analyses. From a marketing perspective, it is useful to identify factors influencing the bids for beef in the alternative package types. Such information can be important in developing specific marketing strategies for the test product, vacuum skin (VS) packaging. Given that the bids obtained from the Vickrey auction cannot be viewed as behaviorally true reservation values, but are rank-order revealing, the analysis of bids obtained for each package type was conducted using relative (rather than absolute) bids. Accordingly, the dependent variable was defined as each study participant's average bid for beef in the VS package minus the average bid for beef in the overwrapped styrofoam tray (OST) package over a series of three auctions for each package type.

Explanatory variables in the model were hypothesized to be classified into five categories: experimental variables, demographic characteristics, meat usage patterns, packaging, and related beef characteristics. With the exception of the experimental variables, which related to the specific manner in which the laboratory experiment was conducted, the remaining categories of variables were hypothesized to potentially influence consumer attitudes toward beef and retail beef packaging. This provided the motivation for including these variables in the background questionnaire administered before the auction, as well as in the model to explain the difference in bids for the steaks in the alternative package types. A discussion of the variables in each of the five categories identified above follows.

The experimental variables were hypothesized to account for variation in the relative bids for beef in the two package types which might be due to the specific characteristics of the experiment. The experiment was designed to test the effects of information regarding the VS package on bids; order was varied to control for any sequencing effects. Moreover, there was interest in identifying the effects of location on relative bids for the package types. To some extent, this variable might pick up influences associated with differences in relative appeal of the package types in two different geographic regions. Finally, differences associated with the time of day the auction was conducted and the monitor were incorporated into the model. Time of day could be hypothesized to impact relative bids due to proximity to meal time (perhaps affecting the relative attractiveness of the two products) and the general temperament of participants during the course of the day. The experience of the monitors in conducting auction experiments, as well as their age and sex, also might be expected to have an influence on relative bids and thus merits testing. As compared to the no-information treatment, information treatments were expected to significantly increase the bids for the VS package relative to the OST package. If consumers move down their demand schedule as additional steaks are offered for sale in the auction, the order of presentation would be expected to increase the difference in bids for steaks in the VS package relative to steaks in the OST (since VS package first is coded 1). The specific experimental variables include: \( INF1 = \) no information treatment
Variables chosen from the background questionnaire to reflect possible differences in bids between the VS and OST packages due to these characteristics include: $OBP = \text{opinion of beef packaging (1 if good, 0 otherwise)}$; $FR = \text{freeze fresh beef (1 if freeze for longer than one week after purchase, 0 otherwise)}$; $FT = \text{fat trim (1 if not well trimmed/too much fat left on a concern, 0 if no concern)}$; $MAR = \text{marbling (1 if greater amount of marbling encourages buying decision, 0 if discourages buying)}$; $PS = \text{packaging sturdiness (1 if packages are not sturdy or strong is a concern, 0 if no concern)}$; $JUC = \text{juiciness (1 if juicy/not dried out encourages buying decision, 0 if discourages buying)}$; $NAT = \text{natural (relates to environmental advantage of VS package—1 if labeled “all natural” encourages buying decision, 0 if discourages buying)}$; $BAA = \text{beef appetizing and attractive (1 if beef looks appetizing and attractive encourages buying decision, 0 if discourages buying)}$; and $SHA = \text{shape of beef in package (1 if overall shape encourages buying decision, 0 if discourages buying)}$.

Those characteristics which were expected to contribute to increased bids for steaks in the VS package relative to bids for steaks in the OST include: freeze fresh beef, marbling, package sturdiness, juiciness, and naturalness. Other characteristics were hypothesized to reduce the bids for steaks in the VS package as compared to bids for the OST steaks, including: fat trim and shape of the beef. Fat trim, due to the visibility of the meat in the VS package and the contrast in color, may be detrimental to this package type. Finally, if consumers indicate a good overall opinion of the traditional beef package type, and if the bright red color of beef (beef appetizing and attractive) encourages the buying decision, each of these characteristics could be expected to be inversely related to the dependent variable.

The model was estimated using ordinary least squares. The data for the dependent variable, average
bid for beef in the VS package minus the average bid for steaks in the OST package over a series of three purchase auctions for each package type, were obtained from the auction. The average difference in bids between steaks in the two package types was $2.96. The data for the explanatory variables (other than the experimental variables) were obtained from the background questionnaire administered prior to the auction. Incomplete questionnaires and bid data from nonparticipating respondents were excluded, leaving a sample of 725 for model estimation.

**Results and Discussion**

Before estimating the model, correlation coefficients were calculated to determine whether any variables were pair-wise correlated. Given the cross-sectional nature of the data, pair-wise correlations were found to be quite small. The highest pair-wise correlations occurred between the following variables: INF2, INF3 = -.52; NPH, MS = .44; EBL, EPM = .40; EBL, CHOLES = .26; CHOLES, CAL = .32; and EBL, CAL = .21. The magnitudes of these coefficients suggest the precision of the ordinary least squares estimator should not be impacted by close linear associations between independent variables. However, they do suggest interesting relationships. For example, as expected, individuals indicating that they have been eating beef less often have to some extent substituted poultry for beef. Finally, among the consumer segment that is eating beef less often, the health aspects of beef (CHOLES and CAL) may be an issue for consideration by the beef industry.

The estimated model is presented in table 2. Several experimental factors significantly affected the difference between average bids for the VS package of beef rib-eye steaks and the average bids for beef in the OST package. As expected, the level of information regarding the VS package significantly influenced the difference in average bids for steaks in the two package types [$0.41 higher when information was provided (INF2) and $.48 higher when information and demonstration were provided (INF3), compared to the no-information treatment]. Relative bids with information alone were not significantly different from average relative bids in the information plus demonstration treatment. This suggests that information regarding the VS package enhances the value perception of beef in the VS package, but a demonstration of how the meat blooms to the familiar bright red color upon opening might not be warranted. However, this latter result should be considered cautiously, since consumers might not view information from a manufacturer to be as reliable as information given by university personnel.

The order (ORD) in which the different package types were offered during the purchase auctions significantly influenced the difference in average bids for steaks between the VS and OST packages. When the VS package was offered first, the relative bid increased by nearly $.44 for the VS package. This result may have two possible interpretations: (a) subjects submitting winning bids when the VS package is offered first may adjust their bids downward as they become familiar with the market price, and (b) subjects may initially move down their demand curves as additional steaks are offered in the auctions. If explanation (a) is correct, subjects may be truthfully revealing their willingness to pay more than the market price but not their actual maximum willingness to pay. As the study participants willing to pay substantially more than the market price observe that they do not necessarily need to bid their true value in order to obtain steaks, they may shade their bids. Such behavior might stem from a psychological need to guard against bidding too much, even though the winning bids were not revealed and participants generally did not pay what they bid.

Despite efforts to account for differences in the model due to demographics, meat purchase behavior, and general appeal of beef which might exist among consumers in the two study locations, location (LOC) had a significant effect on the relative bids. Los Angeles participants submitted, on average, bids which were about $.09 higher for the VS package relative to the OST package than Denver participants. Los Angeles participants may have been somewhat more acquainted with the VS package than Denver participants, since the VS packaged meat had been introduced into a few Los Angeles club merchandising outlets just prior to the study. In addition, differences in the general price level between the two locations may have contributed to differences in average relative bids for the two package types.

The time of day the auction was conducted did not significantly influence the bids for the VS package relative to the OST package. As compared to the morning session, differences in average bids between the two package types during the early afternoon, late afternoon, and evening sessions were not significant, nor were they significant among sessions 2, 3, and 4 (TD2, TD3, and TD4, respectively). Relative bids for monitors 1, 3, and 4 (M1, M3, and M4) were not significantly different from relative bids received by monitor 2. There also was no significant difference in relative bids obtained by monitors 1, 3, and 4.

Demographic characteristics of participants were not particularly important explanators of relative average bids. Income, number of people in the household, and employment status were the only demographic factors which significantly influenced relative bids for the two package types; age, sex, education,
Table 2. Regression Results with Average Bid for the VS Package Minus the Average Bid for the OST Package as the Dependent Variable

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Regression Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Variables:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INF2—Trt 2 (Information)</td>
<td>.410*</td>
<td>.078</td>
</tr>
<tr>
<td>INF3—Trt 3 (Info + Demo)</td>
<td>.479*</td>
<td>.078</td>
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<tr>
<td>ORD—Order</td>
<td>.442*</td>
<td>.067</td>
</tr>
<tr>
<td>LOC—Location</td>
<td>.090*</td>
<td>.067</td>
</tr>
<tr>
<td>TD2—Time of day 2</td>
<td>-.048*</td>
<td>.093</td>
</tr>
<tr>
<td>TD3—Time of day 3</td>
<td>-.016*</td>
<td>.093</td>
</tr>
<tr>
<td>TD4—Time of day 4</td>
<td>.075*</td>
<td>.098</td>
</tr>
<tr>
<td>M1—Monitor 1</td>
<td>-.056*</td>
<td>.089</td>
</tr>
<tr>
<td>M3—Monitor 3</td>
<td>-.075*</td>
<td>.089</td>
</tr>
<tr>
<td>M4—Monitor 4</td>
<td>-.099*</td>
<td>.089</td>
</tr>
<tr>
<td><strong>Demographic Characteristics:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE—Age</td>
<td>.001</td>
<td>.003</td>
</tr>
<tr>
<td>INC—Income</td>
<td>.060*</td>
<td>.021</td>
</tr>
<tr>
<td>SEX—Sex</td>
<td>.029</td>
<td>.079</td>
</tr>
<tr>
<td>ED—Education</td>
<td>.008</td>
<td>.033</td>
</tr>
<tr>
<td>NPH—Number of persons in household</td>
<td>-.040*</td>
<td>.026</td>
</tr>
<tr>
<td>MS—Marital status</td>
<td>-.048</td>
<td>.091</td>
</tr>
<tr>
<td>ES—Employment status</td>
<td>-.016*</td>
<td>.076</td>
</tr>
<tr>
<td><strong>Meat Purchasing Patterns:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBL—Eating fresh beef less</td>
<td>.068</td>
<td>.072</td>
</tr>
<tr>
<td>EPM—Eating poultry more</td>
<td>-.112*</td>
<td>.079</td>
</tr>
<tr>
<td><strong>Package and Related Beef Characteristics:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBP—Opinion of fresh beef packaging</td>
<td>-.035</td>
<td>.067</td>
</tr>
<tr>
<td>FR—Freeze for later preparation</td>
<td>.091*</td>
<td>.066</td>
</tr>
<tr>
<td>FT—Not well trimmed/too much fat</td>
<td>-.138*</td>
<td>.069</td>
</tr>
<tr>
<td>MAR—Greater amount of marbling</td>
<td>-.084</td>
<td>.072</td>
</tr>
<tr>
<td>PS—Packages are not sturdy or strong</td>
<td>.091</td>
<td>.085</td>
</tr>
<tr>
<td>JUC—Juicy/not dried out</td>
<td>.104</td>
<td>.109</td>
</tr>
<tr>
<td>NAT—Labeled “all natural”</td>
<td>.116*</td>
<td>.073</td>
</tr>
<tr>
<td>BAA—Beef looks appetizing and attractive</td>
<td>.042</td>
<td>.108</td>
</tr>
<tr>
<td>SHA—Overall shape</td>
<td>-.127*</td>
<td>.068</td>
</tr>
<tr>
<td>Constant</td>
<td>-.340</td>
<td>.294</td>
</tr>
</tbody>
</table>

* Indicates significance at $\alpha = .10$.
* Indicates no significant difference between pairs of coefficients in each category—information, time of day, and monitor, respectively.

$R^2 = .155$

and marital status were not significant influences. As income increased by $10,000, the difference in average bids for beef in the VS package relative to average bids for beef in the OST package increased by $0.06. For participants employed full-time, the difference in average bids between the two package types was $0.11 lower, as compared to part-time and unemployed participants; as the number of people in the household increased by one member, the difference in bids decreased $0.04. From a marketing perspective, these results suggest that a reasonable target market for the VS package is consumers with higher incomes. Specialty meat and upscale stores might attract such a clientele.

An examination of the influences of meat usage patterns (beef, poultry) indicates that eating poultry more ($EPM$) significantly decreased the difference in average bids for the VS package of beef rib-eye steaks relative to the average bids for the OST package ($0.11$). The vacuum skin package did not prompt significantly higher bids, as compared to the OST, among those individuals reporting eating beef less often. These results suggest that the package alone might not recapture those consumers who have reduced beef consumption in the three years prior to the study. However, a change in packaging might be part of a total product which would help the beef industry regain market share. The package might provide a useful means of changing the image of beef.
Several concerns (characteristics) related to beef and beef packaging expressed by study respondents significantly contributed to explaining relative bids. When not well-trimmed/too much fat left on (FT) was expressed as a concern, the difference in average bids for the VS package relative to the average bids for the OST package decreased by $.14. For consumers identifying shape of beef in the package (SHA) as encouraging the buying decision for steaks, the difference in average bids for the two package types was reduced by about $.13. The full visibility of beef in the VS package and the compressed nature of the product in the package type could explain these relationships. These results also suggest the importance of trim and overall fat content in retail beef merchandising, particularly for the VS package.

When individuals indicated that they typically freeze meat for longer than one week after purchase (FR), the difference in average bids for the VS package of beef rib-eye steaks relative to the average bids for the OST package was significantly higher by $.09. The suitability of the VS package for use in freezing may provide an explanation for this result.

When labeled “all natural” was identified as influencing steak buying decisions (NAT), the difference in average bids for the VS package of beef rib-eye steaks relative to the OST package was significantly larger by an average of $.12. Participants receiving information about the VS package (two-thirds of total sample) were told that quality beef has a “natural” burgundy color. Statements such as this may have contributed to a perception that the VS package of beef rib-eye steaks was somehow more “natural.” In addition, environmental issues (such as whether the package is biodegradable) were commonly mentioned by participants concerned about the unsafe production and disposal of the traditional OST package type.

Interestingly, coefficients associated with variables which were incorporated into the model to depict the advantages of the VS package, such as sturdy package (PS) and retains juices (JUC), were not significant. These advantages were specifically identified in the information treatments (INF2, INF3) of the experiment as part of the auction instructions. It may be that the latter variables masked the individual impacts of these product characteristics, even though there were no strong correlations between these product characteristics and the levels of information. Finally, coefficients associated with greater amount of marbling (MAR) and beef looks appetizing and attractive (BAA) exhibited unexpected signs but were not significantly different from zero.

Implications

Study results suggest that information is very important in the marketing of the vacuum skin package. When study participants received information about the VS package, they valued the beef in the VS package significantly higher as compared to the value when no information was provided. A demonstration of opening the VS package did not significantly increase the value of the VS package compared to the information treatment. This finding suggests a potential cost savings to retailers and the beef industry, since consumers only require information about the VS package. This result may have been affected somewhat by university personnel providing information rather than a retailer or processor.

Physical appearance of the beef continues to play a major role in the purchasing decisions of consumers, with fat and shape significantly decreasing the value of beef in the VS package relative to beef in the OST package. These concerns become more important when considering the VS package, because consumers can see both sides of the meat. If the VS package is introduced, packers and retailers are faced with the need for increased quality control related to fat.

Implications from this study regarding the value of the VS package relative to the OST package provide additional information about consumer attitudes pertaining to retail beef packaging. Study results suggest that the introduction of the VS package for retail beef appears to be warranted from the perspective of the consumer. However, the VS package should be introduced in conjunction with an information-oriented advertising campaign designed to encourage consumers to try the product. Whether the recent failure by Excel to introduce this package type in the market was due to the lack of an information-oriented marketing effort or to institutional barriers, such as retail meat cutters feeling threatened, is a subject for further investigation.

Concluding Remarks

An experimental economics procedure was used as the primary methodology in this study. While this procedure is not new, its use in marketing research is. Laboratory experimental auctions can allow researchers to elicit willingness to pay for a test product as well as provide a means to determine if unique characteristics of a test product enhance its value. The results obtained from this study suggest that the experimental economics procedure can provide information useful for marketing decisions and economic analyses, particularly when combined with traditional marketing research techniques. Finally, while a
laboratory experimental auction can provide a rich set of data for economic analyses, additional study is warranted pertaining to the behavioral properties of selected auction types and the use of this technique in applied research. The authors are in the process of studying properties of different auctions and their application to such problems as the effectiveness of alternative advertising campaigns on enhancing demand.

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Notes

1 A bidder's reservation value can be determined in experiments by telling each participant that if he or she purchases a unit of a commodity, i.e., wins the auction, the experimenter will repurchase it for a stated reservation value. To mitigate the dependence of reservation values in a sequence of auctions, each subject may receive a new reservation value from a distribution of values in successive auctions. See Coppinger, Smith, and Titus, and Cox, Roberson, and Smith for details pertaining to this type of experiment.

2 See Forsythe and Isaac for a discussion of why such an auction is not incentive-compatible if bidders can purchase more than one unit.

3 Consistent with the terminology used in the industry, the package types were specifically identified as overwrapped styrofoam tray and vacuum skin package types. Since consumers, to some extent, may have been exposed to the industry terminology, specifically identifying package types facilitated response to questions related to consumer appeal of the packages and alleviated any order bias possibly associated with a generic alphabetic labeling of package types.

4 Participants were asked to evaluate their overall opinion of how beef is packaged. Ratings were based on a five-point scale, where 5 = excellent, 4 = very good, 3 = good, 2 = fair, and 1 = poor. This variable was transformed by combining 3, 4, and 5 to reflect good (1), and 1 and 2 to reflect not good (0).

5 In the background questionnaire, study participants were asked to identify characteristics of beef steaks which they did not like or about which they were concerned. This was a 0 (no concern) or 1 (concern) response.

6 Participants were asked to rate on a nine-point scale (1 = strongly discourages from buying and 9 = strongly encourages buying) characteristics of beef steaks which were important in their buying decision. This variable was transformed by combining responses 7, 8, and 9 = encourages buying (1), and 1, 2, 3, 4, 5, and 6 = discourages buying (0).

References


Menkhaus et al.  Laboratory Experimental Auctions  55


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