

COMPARISON OF STATED CHOICE AND IN-STORE EXPERIMENTAL METHODS IN PREDICTING ACTUAL MARKET BEHAVIOR FOR FRESHWATER PRAWN (*Macrobrachium rosenbergii*) CONSUMERS

R. Karina Gallardo, Dept. of Agricultural Economics, Oklahoma State University
Terrill R. Hanson, Dept. of Agricultural Economics, Mississippi State University
M. Darren Hudson, Dept. of Agricultural Economics, Mississippi State University

Selected Paper prepared for presentation at the Southern Agricultural Economics Association
Annual Meetings. Little Rock, Arkansas, February 5-9, 2005

421-A Ag. Hall. Oklahoma State University, OK 74078. karina.gallardo@okstate.edu
Box 5187 Mississippi State, MS 39762. hanson@agecon.msstate.edu;
HUDSON@AGECON.MSSTATE.EDU

Copyright 2005 by R. Karina Gallardo, Terrill R. Hanson, and M. Darren Hudson. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract

The stated choice (SC) and actual revealed pricing/purchase experimental methods were compared for their ability to predict purchasing behavior and willingness-to-pay for freshwater prawns. SC hypothetical bias may be a consequence of difficulties in controlling factors affecting real world situations, small sample sizes and confusion related to the new product.

Key Words: choice experiment, grocery store experiment, new product, purchasing behavior.

COMPARISON OF STATED CHOICE AND IN-STORE EXPERIMENTAL METHODS IN PREDICTING ACTUAL MARKET BEHAVIOR FOR FRESHWATER PRAWN (*Macrobrachium rosenbergii*) CONSUMERS

Stated choice methods, contingent valuation, and experimental auctions are widely used marketing research techniques. These approaches attempt to measure the responsiveness of potential and existing consumers for goods, in special new products or existing products with a value-added attribute. The study was focused on measure the ability of the stated choice (SC) approach to predict the willingness-to-pay for a shellfish product, relatively new to the U.S. market: freshwater prawns (*Macrobrachium rosenbergii*). To measure the predictability power of the SC method, results obtained were compared with the results of a controlled, real-world grocery store experiment. SC advocates state that data collected and applied to stated choice models provide valid and reliable information of actual market behavior. The method is based on random utility theory, and agrees with Lancaster's utility maximization, demonstrating consistency with realistic choices (Hudson). Also, SC permits to handle a set of attributes simultaneously using a controlled, orthogonal experimental design (Lusk and Schroeder). Another advantage is related to the size of observations used, the method is able to generate a large number of observations on choice from a relatively small number of responses, implying lower costs in designing the experiment in comparison to other methodologies (Louviere, Hensher, and Swait).

Critics of SC noted that questions are answered in a hypothetical situation implying that differences relative to actual behavior may exist (Louviere et al.; Loureiro et al.). In addition, there is evidence that of hypothetical bias in SC results (List and Gallet; List and Shogren; Fox et al.), it was found that SC estimates were higher than non-hypothetical results. However, Lusk

and Schroeder found that the marginal differences of the hypothetical and non-hypothetical experiment were the same, giving more reliability to the SC results.

Methods

A grocery pricing experiment, and a mail survey measuring willingness-to-pay were conducted in two different settings, a rural, low-income, low-population, college town in Mississippi (Starkville) and in a contrasting metropolitan, affluent, densely populated Memphis suburb area of Germantown, Tennessee. These two contrasting locations were chosen to analyze the different perspectives of demand from the two markets, while using the same procedures of analysis in each.

Grocery Store Experiment

The Mississippi State Experimental Stations located at Stoneville, MS and South Farms, Starkville, MS provided the freshwater prawns used in the study. The product was individually quick frozen at the Pilot Plant of the Food Science Department of Mississippi State University and transported by the researchers to the grocery stores in Starkville, MS and Germantown, TN.

Heads-on prawns and prawn tails were sold in alternate weeks and displayed in the fresh seafood counter section. Prices for freshwater prawn, marine shrimp, and lobster were previously collected in several Starkville grocery stores and used as a reference for the price ranges used in the in-store pricing experiment. A similar scenario (but with different price levels) was conducted at the Germantown, TN. In this locale quantities of fresh and frozen marine shrimp and fresh lobster were also recorded on a weekly basis

Mail Survey Experiment

A survey was mailed to 1,000 residents within the Starkville zip code area during the first week of December 2003. Nine weeks later, a second mail-out was sent to non-respondents. The

same survey was mailed to 2,000 residents within the three zip codes comprising the Germantown area during the first week of February 2004. The mailing lists of residents for the two locales were purchased from a private marketing company.

The survey had three sections. The first section inquired about the participant's knowledge, preferences, and opinions about freshwater prawns and seafood species. The second section of survey questions consisted of presenting the respondents with twelve or thirteen different product pricing scenarios for freshwater prawn, marine shrimp, and lobster products. Each scenario presented the individual with four alternatives of purchasing three seafood products: (1) a price was given for a 23-45 count farm-raised freshwater prawn, (2) a price was given for a 23-45 count wild-caught marine shrimp, and (3) a price for a one pound wild caught marine lobster. The fourth alternative was to select none; i.e., none of the products would be purchased at the proposed prices. The respondent was asked to mark the alternative he/she would choose given the stated prices for each product. Prices were stated in dollars per pound and all products were described as being de-headed and in the shell.

A full factorial design was used to create product-pricing scenarios. Prices for the three seafood species were combined in such a way that the first price assigned to freshwater prawns was combined with every level of marine shrimp prices arranged in ascending order and with every level of lobster prices arranged in descending order. The product of such an exercise was a set of 25 different pricing combinations. Because 25 conjoint scenarios would be an inconvenience for the respondents, the scenarios were divided into two groups, the first 12 scenarios were included in version 1 of the survey and the next 13 scenarios were included in version 2. This was the only difference between versions 1 and 2 of the survey.

The third section of the survey questionnaire inquired about socio-demographic information of the respondent. Because some consumers may not be aware of freshwater prawns, a brochure containing photographs of the freshwater prawn product, dietary and production information, and recipes were included with the survey.

Data Analysis

Grocery Store Experimental Data Analysis

Data from the grocery store experiment were used to estimate the weighted average price paid for the freshwater prawn, marine shrimp, and lobster products. The weighted average price provides an estimate of the price consumers are most likely to pay for a pound of shellfish product and was compared with the average willingness-to-pay obtained from the conjoint analysis product pricing scenarios included in the mail survey.

Additionally, sales data from the grocery store experiments were used to calculate the market share for each product and was the quotient of the total sales of a shellfish product divided by the total sales of the three shellfish products considered in the study. The market share gave the percentage of the sales of freshwater prawn in comparison with marine shrimp and lobster, two shellfish products already well-established in the market; and was compared with the predicted market share calculated from the conjoint analysis included in the mail survey.

Mail Survey Experimental Data Analysis

Data from the mail survey related to the willingness-to-pay was analyzed using Limdep® V8 (Econometric Software, Inc.). The conjoint model was used to determine the probability of the freshwater prawn (or marine shrimp or lobster) product being chosen for different pricing levels. A willingness-to-pay amount estimated from this model and associated confidence intervals were constructed around the willingness-to-pay mean using the Krinsky-Robb

procedure (Krinsky and Robb). These confidence intervals were used to test for statistical differences between WTP values for each product.

Market Share Estimation

The market share for prawns was estimated by dividing the probability of choosing prawns by the sum of probabilities for all three alternatives, at a determined price level. An identical procedure was followed to calculate the market share for marine shrimp as well as for lobster, at different price levels.

Comparison of Revealed Preference and Stated Choice Methods

The primary objective of the study was to analyze individuals' willingness-to-pay for freshwater prawns using two alternative methodologies. To test the null hypothesis that the two methodologies would yield the same results ($p < 0.05$), a comparison of the weighted average price confidence interval for the grocery store experiment (revealed preference method) and the confidence interval of the mean willingness-to-pay amount obtained from the conjoint experiment (stated choice method) was conducted. If the confidence intervals from each approach overlap, then there would be no significant difference ($p < 0.05$) between the two means and the two methodological approaches in this study.

Results

Results from the two methodologies described in the previous section are presented in this section. For the purposes of the present paper, only the data related to the tail (heads-off) form will be presented so the comparison with the results of the stated choice (SC) experiment can be done.

Grocery Store Experiment Results

Weighted Average Price

As summarized in Table 1, the volume of all freshwater prawn sales in Starkville was less than that in Germantown; but the weighted average price was greater. The differences in sales volumes are likely due to demographic differences. The weighted average price paid in Starkville was greater than the Germantown-price for both jumbo and large sizes. However, the lower quantity sold in Starkville cause difficulty in any comparison of the two weighted average prices. Table 1. The inconsistency in these results is attributed to the little sales that took place in the Starkville grocery store during the period of the experiment.

Market Share Estimation

Market share estimates were not calculated for a single price level, because in the majority of the cases prawns and marine shrimp were not sold at the same price levels. For both grocery stores, marine shrimp price levels were beyond the control of the study. A global market share including prawn and marine shrimp jumbo and large sizes was calculated to use in comparison with the lobster sales. Results presented for the Starkville grocery store considered prawn and marine shrimp sales coming from the fresh seafood sales counter section only. Information from the Germantown locale considered prawn and marine shrimp (large) sales at the fresh counter section and marine shrimp sold at the fresh counter (jumbo marine shrimp that were sold only at the self-service freezers). This situation made difficult to draw conclusions about the market share because the sales occurred at different places and conditions. To compare both the Starkville and Germantown market share estimations, Germantown results included only the large marine shrimp sold at the fresh counter.

Market share results presented in Table 2 show that prawns have a considerably higher market share than marine shrimp at the Starkville grocery store. This may be attributed to the low marine shrimp sales at the fresh seafood counter. Similarly, in the Germantown store marine shrimp sales at the fresh seafood counter were noticeably less than sales at the self-service freezers. Convenience, and printed information on the package, and more availability may explain that consumers were more likely to buy marine shrimp from the self-service freezers than the fresh seafood counter. Also in Germantown the market share for lobster was the largest and this might be attributed to the repeated sales that occurred during the Valentine's week, a "traditional time to buy lobster". Although, the market share for freshwater prawns was lower than for marine shrimp and lobster, the 23% market share achieved is a good response from consumers toward a new product, especially in relation to two established shellfish species already established in the market place.

Mail Survey Results

Willingness-to-Pay Results

Tables 3 and 4 summarize the willingness-to-pay (WTP) results for Starkville and Germantown respondents, respectively, further separated by prawn non-consumer (people who stated they have never consumed prawns before) and consumer categories (people who stated they consume prawns).

Respondents in Starkville stated that their mean willingness-to-pay (WTP) for freshwater prawns was lower than that for marine shrimp and lobster but not significantly different, which is a positive finding for a relatively new product, Table 3. No differences in WTP results were also obtained for non-consumers and consumers groups in Starkville, except consumers of prawns were willing to pay twice as much as non-consumers.

Respondents in Germantown stated that their WTP for freshwater prawn tails was significantly lower than that for marine shrimp tails, and lobster, Table 4. WTP for lobster was significantly higher than that for marine shrimp tails. Non-consumers in Germantown were willing to pay a significantly lower price for prawn tails in comparison to marine shrimp tails, or lobster. Additionally, non-consumer groups were un-willing to pay a premium price for lobster products. Consumers in Germantown stated that they were willing to pay a lower price for prawn tails than for marine shrimp tails, but the difference was not significant. Consequently freshwater prawn consumers do not differentiate between marine shrimp and prawns, indicating product acceptance. However, prawn consumers in Germantown stated their willingness to pay a premium price for lobster products.

Predicted Market Share

Results from Starkville and Germantown respondents are summarized in Table 5. In general, freshwater prawn tails had a lower market share than marine shrimp tails or lobster. However, being a relatively new product, the prawn market share was nonetheless considerable considering that it was being compared with two established shellfish products. Respondents in Starkville assigned a higher market share to marine shrimp tails while respondents in Germantown assigned a similar market share to lobster and marine shrimp tails (34.87% vs. 34.07%).

Comparison between Revealed Preference (Grocery Store Experiment) and Stated Choice Methods (Conjoint Analysis Questions from the Mail Survey)

Willingness-to-Pay

Comparisons between willingness-to-pay results from both methods are summarized in Table 6. From the revealed preference method, the weighted average price for large freshwater

prawn tails, large marine shrimp tails, and lobster were compared to the willingness-to-pay amounts from the stated-choice method for consumers groups located in Starkville and Germantown.

Results for the willingness to pay amounts for the large freshwater prawn tails in Starkville and Germantown from both methodologies were significantly different. Consequently, the null hypothesis that there were no differences between the willingness-to-pay amounts from the two approaches is rejected. Results for large marine shrimp tails in both locations and lobsters in Germantown were not significantly different ($p < 0.05$). Consequently one can accept null hypothesis. The results suggest that the stated choice (SC) experiment was not sufficient to estimate the willingness-to-pay amount for the new freshwater prawn product. These differences might be attributed to the duration of the grocery store experiment being insufficient for consumers to show a clear price-quantity behavior toward freshwater prawn tails. However, the CE was sufficient to estimate the willingness-to-pay amount for the already known marine shrimp and lobster.

Predicted Market Share

Results from the predicted market share estimated by the revealed preference (grocery store experiment) and CE (mail survey) methods are summarized in Table 7. For the Starkville location, revealed preference results showed that market share for prawns was higher than that for marine shrimp. Results from the stated choice method showed the opposite.

For the Germantown location, results for the market share for prawn tails in the grocery store (23%) were different than the results obtained through the conjoint experiment (31%). The differences in results might be due to factors that were beyond the control of the present study. For example, Valentine's Day weekend and the low range of marine shrimp prices used at the

fresh seafood counter in the Starkville grocery store, a condition that might have influenced consumers to buy prawns rather than marine shrimp.

Conclusions

The primary objective of this research was to compare the willingness-to-pay for freshwater prawns results from two alternative methods that included revealed preference and stated choice (SC) methods. SC results were expected to be sufficient to gather information concerning willingness-to-pay. If correct, then one could avoid conducting revealed preference experiments (grocery store experiment), which require greater costs in terms of product to be sold and implementation time involved. Additionally, revealed preference methods might involve external factors that are beyond the control of the study; i.e. price variations of related products and holidays in which consumption of certain products is greater than in normal conditions. Nonetheless, the major advantage of the revealed preferences methodology is that actual consumer purchasing data in a real buying environment is obtained. The stated choice methodology permits the researcher more control over many factors affecting the purchasing decision, but the major drawback is that it is conducted in a hypothetical context. Willingness-to-pay results from both methodologies were expected to be similar, but were actually statistically different ($p < 0.05$) for freshwater prawns, the new shellfish product, in two locales. However, results were not statistically different for marine shrimp in two locales, and lobster in one locale. Results suggest that the approaches yielded similar willingness-to-pay amounts for the already known products but different willingness-to-pay amounts for the new product. Factors beyond the control of the experiment and the limited study period affected the grocery store experiments and therefore made comparisons to the stated preference results difficult.

References

Fox, J., J. Shogren, D. Hayes, and J. Kliebenstein. "CVM-X: Calibrating Contingent Values with Experimental Auction Markets." *American Journal of Agricultural Economics*, 80(1998): 455-465.

Hudson, D. "Problem Solving and Hypothesis Testing Using Economic Experiments." *Journal of Agricultural and Applied Economics*. 35(2003): 337-347.

Krinsky, I. and A.L. Robb. "On Approximating the Statistical Properties of Elasticities." *Review of Economics and Statistics*. 64(1986):715-719.

Lancaster, K.J. "A New Approach to Consumer Theory." *The Journal of Political Economy*, 74(1966): 132-157.

Loureiro, M.L., J.J. Mc Cluskey, and R.C. Mittelhammer. 2003. "Are Stated Preferences Good Predictors of Market Behavior?" *Land Economics*. 79(2003): 44-45.

Louviere, J., D. Hensher, and J. Swait. Stated Choice Methods: Analysis and Applications. University Press. Cambridge, UK. 2000.

List, J. and C. Gallet. "What Experimental Protocol Influence Disparities Between Actual and Hypothetical Stated Values." *Environmental and Resource Economics*, 20(2001): 241-254.

List, J. and J. Shogren. "Calibration of the Differences Between Actual and Hypothetical Valuations in a Field Experiment." *Journal of Economic Behavior and Organization*, 37(1998): 193-205.

Lusk, J.L. J. Roosen, and J.A. Fox. "Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States." *American Journal of Agriculture Economics*. 85(1) (2003):16-29.

Lusk, J. and T. Schroeder. "Are Choice Experiments Incentive Compatible: A Test With Quality Differentiated Beef Steaks." *American Journal of Agricultural Economics*, 86(2004): 467-482.

Table 1. Summary of freshwater prawns sales in two locations

	Jumbo Tail	Large Tail
Quantity Sold (lbs)		
Starkville	8.77	21.43
Germantown	54.15	22.50
Weighted Average Price (\$/lb)		
Starkville	\$12.07	\$9.46
Germantown	\$11.88	\$6.83
Overall Revenue Generated (\$)		
Starkville	\$105.85	\$202.73
Germantown	\$643.30	\$153.68

Table 2. Market share estimation for the three shellfish species considering 5-week sales when prawn tails were offered

	Freshwater prawn	Marine shrimp	Lobster	Total
	Starkville			
Quantities sold (lb)	30.2	18.52	--	48.72
Market share (%)	62%	38%	--	100%
	Germantown			
Quantities sold (lb)	76.65	122.50	132.00	331.15
Market share (%)	23%	37%	40%	100%

Table 3. Comparison of willingness-to-pay for three shellfish products as collected from respondents of the Starkville mail survey

	Willingness to pay		
	Total	Non-consumers	Consumers
Large freshwater prawn tails (23-45 units/lb)	7.02 _a [6.76 - 7.27]	3.84 _a [3.64 - 4.02]	8.11 _a [7.73 - 8.48]
Large marine shrimp (23-45 units/lb)	7.5 _a [7.27 - 7.73]	4.19 _a [4.02 - 4.35]	8.38 _a [8.00 - 8.79]
Lobster (1/lb)	7.48 _a [7.10 - 7.73]	4.19 _a [3.99 - 4.38]	8.34 _a [7.92 - 8.77]

¹ Numbers inside parentheses represent the 95% confidence interval around the mean. Letters (*a*) of values within a column represent significant differences at the $p < 0.05$ level, among shellfish products; same letters represent no significant difference and different letters represent significant differences.

Table 4. Comparison of willingness-to-pay for three shellfish products as collected from respondents of the Germantown mail survey

	Willingness to pay		
	Total	Non-consumers	Consumers
Large freshwater prawn tails (23-45 units/lb)	8.39 _a [8.23-8.54]	4.41 _a [4.32 - 4.50]	9.21 _a [8.98 - 9.45]
Large marine shrimp (23-45 units/lb)	8.99 _b [8.85-9.14]	4.98 _b [4.91 - 5.06]	9.31 _a [9.09 - 9.54]
Lobster (1/lb)	9.29 _c [9.14-9.44]	5.03 _b [4.96 - 5.12]	9.89 _b [9.67 - 10.12]

¹ Numbers inside parentheses represent the 95% confidence interval around the mean. Letters (*a*) for values within a column represent significant differences at the p<0.05 level, among shellfish products; same letters represent no significant difference and different letters represent significant differences.

Table 5. Estimated market share of the three seafood products derived from the conjoint analysis of survey responses

	Starkville			Germantown		
Prawn Tails	Marine Shrimp Tails	Lobster	Prawns Tails	Marine Shrimp Tails	Lobster	
22.28%	42.67%	35.05%	31.06%	34.07%	34.87%	

Table 6. Comparison between revealed preference (grocery store experiment) and stated choice (mail survey) willingness-to-pay results for Starkville and Germantown

Product	Consumer willingness to pay (\$/lb.)			
	Starkville		Germantown	
	Revealed preference	Stated choice	Revealed preference	Stated choice
Large freshwater prawn tails (23-45 units/lb)	9.46 _a [8.76-10.16]	8.11 _b [7.73 - 8.48]	6.83 _x [5.27-8.39]	9.21 _y [8.98 - 9.45]
Large marine shrimp (23-45 units/lb)	10.47 _a [4.82-16.11]	8.38 _a [8.00 - 8.79]	8.15 _x [6.54-9.20]	9.31 _x [9.09 - 9.54]
Lobster (1 pound)	--	8.34 [7.92 - 8.77]	12.68 _y [9.98-15.42]	9.89 _y [9.67 - 10.12]

¹ Confidence intervals at 95% significance. Letters (*a, b*) represent significant differences at the $p < 0.05$ level for Starkville values in a row; letters (*x, y*) represent significant differences at the $p < 0.05$ level for Germantown values in a row. Same letters represent no significant difference and different letters represent significant differences.

Table 7. Comparison between revealed preference (grocery store experiment) and stated choice (mail survey) market share results for Starkville and Germantown locations

Method	Starkville			Germantown		
	Prawns	Shrimp	Lobster	Prawns	Shrimp	Lobster
Revealed preference	62.00%	38.00%	--	23.00%	37.00%	40.00%
Stated choice	22.28%	42.67%	35.05%	31.06%	34.07%	34.87%