ASSESSING EFFECTS OF PRICES AND ADVERTISING ON PURCHASES OF FINFISH AND SHELLFISH IN A LOCAL MARKET IN TEXAS

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Abstract

Estimates of demand parameters for disaggregate finfish and shellfish products were obtained using scanner data from a retail food firm in Houston. Demand for the various products was elastic (except for oysters); in general, cross-price effects play a statistically significant role in pounds sold per 1000 customers. Own-advertisement effects are important, but cross-advertisement effects are generally marginal. Seasonality is a key factor in purchases of most finfish and shellfish products.

Key words: finfish, shellfish, scanner data, demand analysis

INTRODUCTION

The National Fish and Seafood Promotional Council, by authority of the Fish and Seafood Promotion Act of 1986, is the primary caretaker of advertising and promotion campaigns for finfish and shellfish. Yet, little work has been done to assist industry planners in this area. In fact, little information exists on demand parameters for disaggregate species of finfish and shellfish, particularly at the retail level (Cheng and Capps). This paper attempts to fill this void. This research dealt with analyses of demand for several fresh finfish and shellfish products at the retail grocer level. Specifically, the objectives were twofold: (1) to evaluate various fresh forms of finfish and shellfish sold in a retail food firm in Houston through the use of scanner data; and (2) to estimate retail demand relationships for the various species in question. The time frame was January 1987 to November 1988 (97 weeks). This research should be particularly beneficial to food retailers, especially given the proliferation of seafood delicatessens in recent years.

Previous studies that dealt with factors affecting retail grocery demand for finfish and/or shellfish are few in number. Engle, Hatch, and Swinton conducted a survey to profile prices and quantities sold of the most important seafood products at the retail grocer level in a 13-county area in East-Central Alabama and West-Central Georgia. No attempt, however, was made to estimate retail demand functions for the respective products. Raulerson and Trotter conducted a market experiment in six Atlanta grocery stores to determine the demand for commercially raised catfish during a two-month period in 1972. Cheng and Capps, using the Seafood Consumption Survey conducted in 1981 by the Market Research Corporation of America for the National Marine Fisheries Service, analyzed household expenditures from supermarkets for three species of shellfish (crabs, oysters, and shrimp) and five species of finfish (cod, flounder, haddock, perch, and snapper).

This research builds on this scant previous work. Estimation of price and advertisement elasticities for finfish and shellfish products at the retail grocer level were emphasized. Price elasticities allow retailers to determine the sensitivity of purchases to price changes, while advertisement elasticities reveal the sensitivity of purchases to advertisement efforts. The approach in this research is similar to the work of Capps as well as Funk, Meilke, and Huff.

DATA

This research was based on the use of scanner data from a retail food firm in Houston. Scanner data constitute a readily available source of product-specific information. Such data not only permit analysis of demand for disaggregate commodities but also represent *current* market conditions. To quote Tomek, "existing secondary data seem especially inadequate for studying product demand in retail markets, and fundamental work needs to be done to obtain relevant data" (pp. 913-914). The authors agree with Tomek that, "the data associated with computerized checkout systems in grocery stores

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Table 1. A List of Finfish and Shellfish Species and Number of Store-Generated Bar Codes (SGBCs)

Species	Number of SGBCs
Finfish	
Catfish	4
Oreodory	1
Tuna	1
Pollock	1
Perch	1
Scrod	1
Salmon	10
Flounder	6
Trout	5
Whitefish	2
Halibut	2
Swordfish	2
Rockfish	2
Shark	2
Shellfish	
Shrimp	11
Crab	14
Lobster	9
Oysters	4
Scallops	2

could become an important source of information for studying retail demand" (p.913).

The data from the firm were available on a daily basis. To make computational matters more manageable, aggregation of daily information into weekly information was essential. This weekly information also allowed for better representation of supermarket operations. To illustrate, price changes are usually initiated once per week, and merchandising activities such as newspaper advertisements and displays are usually done on a weekly basis (Carmen and Figueroa). The weekly observations begin on Wednesday and end on Tuesday to conform to store sales and advertising patterns. Importantly, the retail food firm in this study predominantly caters only to relatively high-income customers. That is, annual incomes of roughly 40 percent of the respective customers are in excess of $60,000.

The scanner data pertain primarily to fresh finfish and shellfish products (Table 1). A list of all store-generated bar codes (SGBCs) for finfish and shellfish species sold in this retail firm is available from the authors. The number of SGBCs indigenous to each finfish and shellfish category varies from 1 to 14 (Table 1).

This study relied on point-of-sale purchases. Pounds of the SGBC, as well as the price of the SGBC, were reported by week for the time period in question. The quantities of the various items correspond to the sum of the respective quantities of the relevant SGBCs. The prices of the products are weighted averages of all individual SGBC prices. The weights are the SGBC shares of the respective total quantities.

Emphasis in this study was on demand relationships at the firm level in lieu of the store level. The prices for each SGBC were the same across the respective supermarkets, and the stores were reasonably similar with respect to sales of finfish and shellfish items. Hence, data from all supermarkets in the firm were aggregated to form 97 weekly time-series observations.

Scanner data from supermarkets in a particular location represent a "controlled" experimental situation. The community-specific results may not permit drawing defensible broad nationwide or regional inferences. Because of this potential limitation, the results of local analyses (such as this study) should not be used on a stand-alone basis. Although this analysis was limited to the Houston area, the methodology can be replicated in other geographic regions.

CONCEPTUAL FRAMEWORK

Holdren (117-123) provides the conceptual framework for this analysis. Attention was centered on multiproduct retail demand functions. According to Holdren (123) "the multiple product retail demand function can be characterized by:

(1) $q_i = f_i (p_1 , p_2 ..., p_n , a_1, a_2 , ..., a_m)$.

where q_i represent quantity variables expressed in appropriate units, p_i represent price variables, and a_i represent attributes of the retailer's non-price offer variation. Advertising, sales promotion activities, hours open, and customer services are concrete examples of non-price offer variation.

Seasonal factors and holidays may also affect the quantity variables, *ceteris paribus* (Carmen and Figueroa). Finally, the influence of socio-demographic factors in retail demand functions may be important. Such factors are proxies for tastes and preferences of the collection of consumers who frequent retail stores.

In light of the previous discussion, the specification of the respective demand models in this study is as follows:

(2) $Q_{it} = f(P_{it} , P_{jt} , SEASON, ADV_{it} , ADV_{jt} , H)$.

where Q_{it} corresponds to purchases per 1,000 customers (in pounds) of finfish or shellfish item i in week t, t = 1, . . ., 97; P_{it} denotes nominal price of finfish or shellfish product i in week t (cent/pound); P_{jt} corresponds to nominal prices of competing products (j refers to the set of competing products) in week t (cent/pound); SEASON corresponds to a set of monthly binary variables to measure seasonality; ADV_{it} corresponds to the amount of print space given for finfish or shellfish product i in the weekly advertisement flier (square centimeters); ADV_{jt} corresponds to the amount of print space given for the set of competing products in the weekly advertisement flier (square centimeters); and H corresponds to a binary variable for holidays (1 if holiday, 0 otherwise). Due to unavailability of information, the model specification excludes competitors' prices and advertising as well as socio-demographic factors.

Since data originate from a single firm only, some may argue that price elasticities are not estimable. The rationale for this proposition is as follows: (1) consumers can respond to price changes by shopping at different stores within a market, and (2) no information in this study is available on prices charged at other food stores. However, according to the Food Marketing Institute, only 27 percent of shoppers compare prices from store to store (Cox and Foster). Additionally, collinearity between competitors' prices and in-store prices may be too strong to allow for measurement of the separate effects of the variables (Funk, Meilke, Huff). Therefore, in this study, the omission of competitors' prices may not be a limiting factor in estimating in-store price elasticities.

The variables P_{it} and P_{jt} capture own-price and cross-price effects. Own-price effects were hypothesized to be negative. Cross-price effects may be negative or positive to reflect substitutable or complementary relationships among the commodities in question. For disaggregate analyses, the identification of appropriate substitutes or complements *a priori* is a difficult task. To circumvent potential collinearity problems, cross-price effects correspond to weighted-average prices for other finfish and shellfish. As well, Cheng and Capps suggest that the demand for finfish and shellfish is dependent upon poultry, pork, and beef prices. In this study, these prices correspond to weighted-average prices of poultry, pork, and beef sold by the retail firm. Cross-price effects are of two types — cross-cut effects (finfish, shellfish) and cross-product effects (poultry, pork, and beef). Cross-cut elasticities correspond to cross-species group elasticities, not to different product forms or cuts of a particular species.

Local newspaper advertising was the only mode of advertising considered. Although television, radio, and in-store displays are used by the chain, these forms are primarily oriented toward creating a favorable corporate image. Newspaper advertising, on the other hand, is geared primarily to promoting specific products. The basic format and design of the newspaper advertisements used by the chain were the same throughout the period. Therefore, no measure of "creative aspects" of advertising was necessary. In this study, advertising data refer to the amount of print space devoted to each item, measured in square centimeters. Advertising on the part of competitors was excluded because of resource constraints. *Ceteris paribus,* own-advertisement effects were hypothesized to be positive, while cross-advertisement effects were hypothesized to be negative. The respective sets of advertisement variables used in the retail demand relationships correspond precisely to the set of price variables previously discussed.

DESCRIPTIVE STATISTICS

Descriptive statistics of purchases and prices for the finfish and shellfish products are exhibited in Tables 2 and 3. In terms of purchases per 1,000 customers, the key shellfish product was shrimp, and the key finfish product was catfish. The least important shellfish product in terms of movement was lobster and the least important finfish product was perch. The most expensive shellfish products were crab and lobster ($9.08 and $8.56 per pound respectively on average), and the most expensive finfish products were swordfish and tuna ($8.88 and $8.75 per pound respectively on average). The least expensive shellfish product was oysters ($3.95 per pound on average), and the least expensive finfish product was trout ($3.33 per pound on average). Shellfish products were generally more costly on a per-pound basis than finfish products. Finfish, as a group, and shellfish, as a group, accounted almost equally for the sales of seafood products in this retail firm. On the basis of coefficient of variation, purchases per 1,000 customers exhibited much more variation than prices per pound.

Importantly, the price and quantity information of the individual SGBCs must be *augmented* to provide information on customer counts and advertisement space. That is, data pertaining to advertisement space and customer counts are not automatically part of the scanner data pertaining to the individual Universal Product Codes (UPCs) collected at the point of sale. Customer counts per week for the retail firm in question ranged from 577,428 to 861,844 over the

Table 2. Descriptive Statistics of Weekly Purchases per 1000 Customers (in pounds) of Shellfish and Finfish Products

Species	Mean	Median	Std Dev	Coefficient of Variation (%)	Minimum	Maximum
Shellfish						
Shrimp	6.85	4.42	6.16	89.90	0.88	27.68
Crab	0.89	0.75	0.64	72.05	0.20	4.58
Lobster	0.33	0.29	0.18	55.70	0.11	1.35
Oysters	0.94	0.75	0.83	88.55	0.34	6.47
Scallops	0.77	0.66	0.37	48.33	0.28	2.05
Finfish						
Catfish	5.07	4.53	1.59	31.38	2.03	9.52
Oreodory	0.51	0.34	0.52	102.76	0.04	3.79
Tuna	0.27	0.17	0.43	156.53	0.01	3.90
Pollock	0.37	0.20	0.42	113.28	0.01	2.23
Perch	0.12	0.06	0.18	152.24	0.00	1.18
Scrod	0.29	0.20	0.25	85.30	0.02	1.27
Salmon	0.46	0.36	0.33	72.47	0.16	2.81
Flounder	0.93	0.82	0.41	44.24	0.32	2.43
Trout	1.21	1.17	0.55	45.88	0.41	3.40
Whitefish	0.72	0.46	0.72	99.13	0.11	5.00
Halibut	0.44	0.37	0.20	47.23	0.14	1.16
Swordfish	0.33	0.28	0.25	77.57	0.06	2.38
Rockfish	0.68	0.61	0.31	46.55	0.16	1.70
Shark	0.54	0.42	0.31	57.58	0.11	1.57

time frame. The average customer count (mean or median) for this firm per week was on the order of 724,000.

Advertisement space (in terms of square centimeters) for the respective products varies considerably from week to week. Descriptive statistics of advertisement variables are exhibited in Table 4. On the basis of print space, finfish as a group receives two times more advertisement space than shellfish as a group. The most important shellfish item either in terms of print space or advertisement frequency was shrimp. The least important shellfish items by these criteria were crab and lobster. The principal finfish items were catfish, tuna, and salmon. Scrod and trout were least important in terms of average print space. Perch, trout, and swordfish were the least frequently advertised finfish items. Finally, beef, pork, and poultry received between 300 and 350 square centimeters of print space per week. At least one of these products was advertised every week.

Pairwise correlation coefficients between own-price and own-advertisement effects were negative. Simply put, increases in advertisement space were accompanied by decreases in product price. For the finfish and shellfish products, in general, the association between product price and advertisement space, although generally statistically significant, is not large in magnitude.

EMPIRICAL ANALYSIS

The functional form chosen for the respective demand relationships is open to empiricism. This study was based on the use of the linear functional form. The interpretation of parameter estimates as elasticities is convenient with the double logarithmic functional form. However, because of potential zero observations, for the advertisement variables, this form was not employed. Price and advertisement elasticities were emphasized in the empirical results.

Under the assumption that supply is perfectly elastic for this local market, a seemingly unrelated regression (SUR) or joint generalized least squares (JGLS) procedure is attractive. Random exogenous factors such as general level of economic activity, competitors' actions, prices of nonmeat items within the retail firm or other omitted factors may affect purchases of the respective finfish and shellfish products apart from the specified predetermined variables. Consequently, the disturbance terms of the respective equations may be contemporaneously

Table 3. Descriptive Statistics of Weekly Prices (cents/pound) of Shellfish and Finfish Products

Species	Mean	Median	Std Dev	Coefficient of Variation (%)	Minimum	Maximum
Shellfish						
Shrimp	611.37	579.67	138.88	22.71	388.86	860.03
Crab	908.25	859.25	159.37	17.54	502.73	1346.02
Lobster	856.36	846.39	99.81	11.65	628.40	1116.72
Oysters	395.06	378.95	69.01	17.46	306.37	653.93
Scallops	704.54	675.61	119.00	16.89	453.61	994.43
Finfish						
Catfish	382.41	395.11	38.30	10.01	295.56	440.66
Oreodory	398.00	399.00	22.14	5.56	297.00	429.00
Tuna	875.46	899.00	168.53	19.25	399.00	1299.00
Pollock	455.12	449.00	56.91	12.50	299.00	549.00
Perch	649.61	649.00	104.61	16.10	399.00	899.00
Scrod	640.07	649.00	96.86	15.13	469.00	849.00
Salmon	452.20	450.10	53.28	11.78	285.30	611.31
Flounder	582.63	581.65	68.67	11.78	388.73	733.18
Trout	333.93	344.36	26.70	7.99	259.17	378.72
Whitefish	518.12	519.48	72.99	14.08	250.51	676.86
Halibut	624.84	605.05	56.62	9.06	502.79	717.31
Swordfish	888.32	890.71	79.39	8.93	616.12	1046.83
Rockfish	478.32	485.22	42.13	8.80	390.08	553.00
Shark	402.10	399.00	44.03	10.95	299.00	469.00
Pork	290.84	293.19	27.43	9.43	204.09	363.60
Poultry	169.50	172.75	27.74	16.36	91.68	218.76
Beef	146.70	253.61	24.36	16.60	196.37	282.55

correlated. Given that the right-hand side variables are not the same in each relationship, gains in estimation efficiency can be expected with the JGLS procedure relative to the use of ordinary least squares (Fomby, Hill, and Johnson).

The JGLS regression results for the model are exhibited in the Appendix (Tables A.1 and A.2). The weighted R^2 for the system of equations is .8270. The adjusted coefficients of determination for the shellfish products range from .2936 (oysters) to .7439 (scallops); for finfish products, the adjusted coefficients of determination range from .4572 (salmon) to .8936 (swordfish). The 0.10 level of significance was chosen for the statistical tests.

Importantly, on the basis of Durbin-Watson (DW) tests, no serial correlation problems were evident. The CW test statistics range from 1.51 to 2.47. On the basis of condition indices and variance decomposition proportions (Belsley et al.), no degrading collinearity problems were evident. In sum, the econometric analyses are free from serial correlation and collinearity problems. As well, the model captures significant amounts of variation in purchases per 1,000 customers. Consequently, the econometric analyses appear to be satisfactory, especially with the relatively large amount of variation to be explained on a week-to-week basis.

OWN-PRICE ELASTICITIES

Consistent with prior expectations, all own-price elasticities are negative, and except for oysters, they are statistically significant. Except for oysters, the respective own-price elasticities are in the elastic range. This result may be due to the fact that the analysis rests on *weekly* observations rather than monthly or quarterly observations. As exhibited in Table 5, the own-price elasticities for shellfish range from -1.10 (lobster) to -2.84 (shrimp), and for finfish the range is -1.63 (flounder) to -9.60 (oreodory). The price elasticity for fresh catfish, -2.15, lies within the range of previous work by Raulerson and Trotter (-1.23 to -8.93). The own-price elasticities for finfish

Table 4. Descriptive Statistics of Weekly Advertisement Space[a] for Finfish and Shellfish Products

Species	Mean	Std Dev	Maximum	Frequency[b]
Shellfish				
Shrimp	46.33	72.47	412.02	64
Crab	1.63	7.99	54.37	6
Lobster	1.71	10.50	94.20	5
Oysters	1.93	5.05	30.60	15
Scallops	3.83	8.46	45.00	24
Finfish				
Catfish	26.69	53.85	291.58	48
Oreodory	4.94	23.16	193.60	11
Tuna	22.01	49.98	247.86	24
Pollock	4.57	12.13	94.40	25
Perch	3.99	21.72	198.38	8
Scrod	1.54	5.52	44.40	11
Salmon	20.83	55.16	291.20	24
Flounder	2.07	6.43	39.00	13
Trout	1.88	7.28	45.60	8
Whitefish	5.27	14.01	96.60	21
Halibut	2.59	11.30	105.00	14
Swordfish	2.53	16.82	164.00	9
Rockfish	2.90	9.33	77.76	17
Shark	6.61	18.39	95.55	25
Beef	349.23	307.12	1343.72	87
Pork	312.70	276.50	1283.64	91
Poultry	329.36	219.23	1051.64	89

[a]In square centimeters.
[b]Maximum of 97 weeks.

typically exceed those for shellfish. This result may be attributed to the number of substitutes available for finfish in comparison to shellfish; alternatively, this result may be attributable to the fact that the clientele of this retail firm corresponds to high-income customers. Nevertheless, there exists sample evidence to indicate that own-price exerts a notable influence on purchases, holding all other factors constant.

Own-Advertisement Elasticities

In accord with prior expectations, as exhibited in Table 5, all own-advertisement elasticities are positive. Among these, only the own-advertisement elasticity for shrimp is not significantly different from zero. The own-advertisement elasticities for shellfish range from 0.002 (shrimp) to 0.069 (crab). The own-advertisement elasticities for finfish range from 0.029 (shark) to 0.270 (tuna). Own-advertisement elasticities are unequivocally smaller in magnitude than the corresponding own-price elasticities.

Seasonality and Holidays

Seasonality is a key factor in purchases of most finfish and shellfish products. Exceptions are crab, oysters, tuna, and swordfish. In addition, purchases of most fresh finfish and shellfish products during the holidays are not significantly different from those purchases during non-holidays, *ceteris paribus* . Exceptions are swordfish and rockfish.

Cross-Price Elasticities

Cross-cut and cross-product elasticities for finfish and shellfish are exhibited in Table 6. For shellfish, 5 of the 10 cross-cut price elasticities are significantly different from zero. Notably *all* the cross-price effects for other shellfish are not only statistically significant but also positive. Consequently, sample evidence supports the notion that the shellfish species in question are substitutes. The cross-price elasticities for shellfish products range from 0.44 to 1.21. The price of finfish is not a statistically significant determinant of purchases of shellfish.

On the other hand, 17 of the 28 cross-cut price elasticities for finfish are significantly different from zero. Other finfish are substitutes for catfish, whitefish, halibut, swordfish, and rockfish. The magnitudes of these cross-elasticities range from 0.61 to 1.59. Scrod and other finfish are complements; the cross-price elasticity in this case is -1.48. The price of shellfish influences purchases of the respective finfish species except for catfish, tuna, and rockfish. Shellfish is a complement to halibut and swordfish, but shellfish is a substitute for oreodory, pollock, perch, scrod, salmon, flounder, trout, whitefish, and shark.

For shellfish, only 4 of the 15 cross-product price elasticities are significantly different from zero. Cross-product prices are not statistically significant factors in purchases of crab, oysters, and scallops for this retail firm. Poultry and beef are complements to shrimp and lobster. For finfish, only 7 of the 42 cross-product price elasticities are statistically significant. Pork is a substitute (complement) for rockfish (tuna). Poultry is a substitute (complement) for tuna (trout). Beef is a substitute for pollock, swordfish, and rockfish. At any rate, as with the situation for shellfish, cross-product prices play a relatively minor role in purchases of finfish for this retail firm.

Table 5. Own-Price Elasticities and Own-Advertisement Elasticities for Finfish and Shellfish Products

Species	$\bar{R}^2$	Own-Price Elasticity[a]	Own-Advertisement Elasticity[a]	Seasonality[b]	Holiday[c]	DW[d]
Shellfish						
Shrimp	.5937	-2.84*	X	1.77*	0.24	2.40
Crab	.6794	-1.84*	0.069*	1.04*	0.19	2.24
Lobster	.6320	-1.10*	0.046*	2.44*	0.90	2.36
Oysters	.2936	X[e]	0.059*	1.27*	0.98	2.43
Scallops	.7439	-1.84*	0.068*	2.76*	-1.54	1.87
Finfish						
Catfish	.6316	-2.15*	0.060*	1.80*	-0.23	2.47
Oreodory	.7951	-9.60*	0.114*	2.77*	-1.59	1.80
Tuna	.4854	-4.28*	0.270*	0.53	-0.23	2.18
Pollock	.6558	-6.15*	0.099*	2.30*	-0.55	1.68
Perch	.5566	-3.09*	0.173*	2.18*	0.16	1.79
Scrod	.6100	-2.71*	0.114*	3.25*	-1.95*	1.95
Salmon	.4572	-2.86*	0.161*	2.05*	-0.15	2.16
Flounder	.6659	-1.63*	0.073*	3.05*	-1.15	2.40
Trout	.7618	-2.01*	0.051*	5.72*	-0.28	2.16
Whitefish	.6269	-5.24*	0.092*	2.23*	-0.83	1.75
Halibut	.5435	-3.88*	0.033*	2.00*	-0.91	1.91
Swordfish	.8936	-4.08*	0.087*	0.78	-0.53	1.72
Rockfish	.5734	-3.55*	0.042*	4.74*	-2.03*	1.51
Shark	.6185	-4.36*	0.029*	2.40*	0.78	2.20

*Statistically significant at the 0.10 level.
[a]At the sample means.
[b]F-statistic.
[c]t-statistic.
[d]DW test statistic for serial correlation.
[e]X denotes regression coefficient not statistically different from zero.

Cross-Advertisement Elasticities

Cross-cut and cross-product advertisement elasticities are exhibited in Table 7. In accord with *a priori* considerations, cross-cut advertisement elasticities, in cases of statistical significance, are, with a single exception, negative. For shellfish, 4 of the 10 cross-cut advertisement elasticities are statistically significant. Advertisement space for finfish and other shellfish influences purchases of shrimp, advertisement space for other shellfish influences purchases of lobster, and advertisement space for finfish influences purchases of oysters. For finfish, only 5 of 28 cross-cut advertisement elasticities are statistically significant. Advertisement space for other finfish affects purchases of tuna, perch, whitefish, and salmon. Advertisement space for shellfish only influences purchases of whitefish.

Contrary to prior expectations, where significance occurs, most cross-product advertisement elasticities are positive rather than negative. Only 4 of the 15 cross-product advertisement elasticities are significant for the shellfish species, and 14 of the 42 elasticities are significant for the finfish species. Advertisement space for pork influences purchases of shrimp, catfish, scrod, flounder, halibut, swordfish, and rockfish; advertisement space for poultry influences purchases of crab, oysters, flounder, whitefish, halibut, rockfish, and shark. Finally, advertisement space for beef influences purchases of lobster, whitefish, swordfish, and shark.

CONCLUSIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Though much empirical and theoretical work exists with respect to demand and market analyses in recent years, reliable estimates of demand parameters for finfish and shellfish products are few in number. This analysis, which employed scanner data, fills this void.

Table 6. Cross-Price Elasticities for Finfish and Shellfish

Species	Cross-cut Elasticities[a]		Cross-Product Elasticities[a]		
Shellfish	Finfish	Other Shellfish	Pork	Poultry	Beef
Shrimp	X[b]	1.21	X	-1.21	-1.75
Crab	X	0.73	X	X	X
Lobster	X	0.61	X	-0.51	-1.07
Oysters	X	1.21	X	X	X
Scallops	X	0.44	X	X	X
Finfish	Other Finfish	Shellfish	Pork	Poultry	Beef
Catfish	0.61	X	X	X	X
Oreodory	X	0.97	X	X	X
Tuna	X	X	-4.20	1.86	X
Pollock	X	0.58	X	X	1.62
Perch	X	1.02	X	X	X
Scrod	-1.48	0.83	X	X	X
Salmon	X	0.69	X	X	X
Flounder	X	0.48	X	X	X
Trout	X	0.42	X	-0.35	X
Whitefish	1.59	1.20	X	X	X
Halibut	0.87	-0.82	X	X	X
Swordfish	0.88	-0.37	X	X	0.69
Rockfish	0.76	X	0.79	X	0.71
Shark	X	0.46	X	X	X

[a]At the sample means.
[b]X denotes regression coefficient not significantly different from zero.

Demand for finfish and shellfish products in this retail firm was elastic (except for oysters); therefore, there exists incentive to lower prices for selected items since such a strategy results in increases in total revenue. Own-advertisement effects are important in purchases of finfish and shellfish for this retail firm. Own-advertisement elasticities are positive but very inelastic. Nevertheless, a strategy to increase advertisement exposure may be worthwhile to boost demand, subject to the costs of advertising. However, it was not possible to discern whether a strategy to reduce own-price was preferable to a strategy to increase exposure. Such a determination is dependent upon the costs of the respective strategies.

The community-specific results may not allow defensible broad nationwide or regional interferences to be drawn. However, it can be assumed that the own-price elasticities (predominantly in the elastic range) from this research are representative at least for the South; then percentage changes in the supply of finfish or shellfish, due to changes in aquacultural production (of importance to the South) or imports, lead to less dramatic percentage changes in the prices of the products. That is, the percentage changes in price in absolute value are less than the percentage changes in quantity. Thus, public policies designed to stimulate aquacultural production may give rise to lower prices for consumers and to increases in total revenue for producers (provided the derived demand elasticities remain elastic).

In addition, with growing support and likely passage of mandatory seafood inspection legislation, information about the demand for disaggregate finfish and shellfish products will be valuable in the assessment of the economic effects of inspection programs. The own-price elasticities from this research can assist in determining the consequences to producers and consumers as a result of public announcements of contaminated aquatic environments or finfish and shellfish disease epidemics. At any rate, the results from this study may assist not only food retailers, but also policy analysts, if indeed the community-specific results are representative.

Table 7. Cross-Advertisement Elasticities for Finfish and Shellfish

Species	Cross-Cut Elasticities[a]		Cross-Product Elasticities[a]		
Shellfish	Finfish	Other Shellfish	Pork	Poultry	Beef
Shrimp	-0.219	-0.208	0.217	X	X
Crab	X[b]	X	X	0.121	X
Lobster	X	-0.042	X	X	0.031
Oysters	-0.224	X	X	0.473	X
Scallops	X	X	X	X	X
Finfish	Other Finfish	Shellfish	Pork	Poultry	Beef
Catfish	X	X	0.055	X	X
Oreodory	X	X	X	X	X
Tuna	-0.447	X	X	X	X
Pollock	X	X	X	X	X
Perch	-0.231	X	X	X	X
Scrod	X	X	0.136	X	X
Salmon	0.116	X	X	X	X
Flounder	X	X	0.073	0.080	X
Trout	X	X	X	X	X
Whitefish	-0.203	-0.090	X	0.258	0.146
Halibut	X	X	0.085	-0.106	X
Swordfish	X	X	-0.090	X	0.062
Rockfish	X	X	0.086	-0.132	X
Shark	X	X	X	0.147	0.106

[a]At the sample means.
[b]X denotes regression coefficient not significantly different from zero.

REFERENCES

Belsley, D.A., E. Kuh, and R.E. Welsch. *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity.* New York: John Wiley and Sons, 1980.

Branson, R.E., *et al.* "Data Sources of Demand Analysis." *Food Demand Analysis: Problem, Issues and Empirical Evidence.* Robert Rauniker and Chung L. Huang, ed., Des Moines: Iowa State Press, 1987.

Capps, O., Jr. "Utilizing Scanner Data to Estimate Retail Demand Functions for Meat Products." *Am. J. Agr. Econ.*, 71(1989):750-760.

Carmen, H.F. and E.F. Figueroa. "An Analysis of Factors Associated with Weekly Food Store Sales Variation." *Agribusiness,* 2(1986):375-390.

Cheng, H.T. and O. Capps, Jr. "Demand Analysis of Fresh Frozen Finfish and Shellfish in the United States." *Am. J. Agr. Econ.*, 70(1988):533-542.

Cox, C. and R. Foster. "What's Ahead for the U.S. Food Processing Industry? Discussion." *Am. J. Agr. Econ.*, 67(1988):1155-1157.

Cox, T.L. and M. Wohlgenant. "Prices and Quality Effects in Cross-Sectional Demand Analysis." *Am. J. Agr. Econ.*, 68(1986):908-919.

Engle, C.R., U. Hatch, and S.M. Swinton. "Factors Affecting Retail Grocery Demand for Seafood Products in East-Central Alabama and West-Central Georgia." *J. Ala. Acad. Sci.*, 59(1988):1-16.

Fomby, T.B., R.C. Hill, and S.R. Johnson. *Advanced Econometric Methods.* New York: Springer-Verlag, 1984.

Funk, T.F., K.D. Meilke, and H.B. Huff. "Effects of Retail Pricing and Advertising on Fresh Beef Sales." *Am. J. Agr. Econ.*, 59(1977):533-537.

Holdren, B.R. *The Structure of a Retail Market and the Market Behavior of Retail Units.* Prentice-Hall, Inc., 1960.

Raulerson, R.C. and W.K. Trotter. "Demand for Farm-Raised Channel Catfish in Supermarkets." U.S. Department of Agriculture, Marketing Research Report Number 993. Washington, D.C., 1973.

Tomek, W.G. "Limits on Price Analysis." *Am. J. Agr. Econ.*, 67(1985):905-915.

Table A.1. Parameter Estimates and t-Statistics for the Retail Demand Functions for the Shellfish Species

	SHELLFISH				
Exogenous Variables	Shrimp	Crab	Lobster	Oysters	Scallops
Intercept	37.4072[a]	2.5795*	0.8532*	-0.7213	1.2573*
	(2.914)[b]	(2.240)	(2.357)	(-0.321)	(2.130)
Price Variables					
Own-Price	-0.0318*	-0.0018*	-0.0004*	-0.0013	-0.0020*
	(-9.806)	(-4.913)	(-3.430)	(-1.18)	(-9.685)
Finfish	-0.0186	-0.0010	(0.0001	0.0013	-0.0002
	(-1.284)	(-0.751)	(0.421)	(0.508)	(-0.372)
Other Shellfish	0.0136*	0.0010*	0.0003*	0.0018	0.0005*
	(2.170)	(2.752)	(2.803)	(2.737)	(2.590)
Beef	-0.0488*	-0.0017	-0.0014*	0.0009	0.0006
	(-2.018)	-0.749)	(-2.104)	(0.225)	(0.510)
Poultry	-0.0492*	0.00007	-0.0010*	0.0045	0.0007
	(-2.389)	(0.039)	(-1.719)	(1.240)	(0.759)
Pork	0.0157	0.0003	-0.0002	-0.0027	0.0006
	(0.682)	(0.164)	(-0.315)	(-0.654)	(0.562)
Advertisment Variables					
Own-Advertisement	0.0004	0.0379*	0.0090*	0.0291*	0.0138*
	(0.059)	(10.732)	(8.811)	(1.897)	(5.396)
Finfish	-0.0127*	0.0001	-0.0001	-0.0017*	0.0001
	(-2.507)	(0.298)	(-0.742)	(-2.013)	(0.775)
Other Shellfish	-0.0246*	0.0002	-0.0002*	-0.0003	-0.0001
	(-1.377)	(0.495)	(-1.420)	(-0.352)	(-0.488)
Beef	0.0005	0.0001	0.00008*	0.0004	-0.00008
	(0.246)	(0.612)	(1.500)	(1.140)	(-0.852)
Pork	0.0047*	0.0001	0.00003	0.0004	-0.00002
	(1.990)	(0.453)	(0.559)	(0.936)	(-0.173)
Poultry	-0.0016	0.0003*	0.00008	0.0013*	0.00009
	(-0.590)	(1.316)	(1.31)	(2.794)	(0.715)
Seasonality					
M1	3.8919*	-0.0926	0.1346*	0.1328	0.2594*
	(1.803)	(-0.449)	(2.131)	(0.342)	(2.439)
M2	5.9345*	-0.0530	0.619	-0.0846	0.2442*
	(2.705)	(-0.246)	(0.964)	(-0.215)	(2.229)
M3	6.3766*	-0.4202*	0.1263*	-0.1108	0.4927*
	(2.951)	(-2.028)	(2.010)	(-0.287)	(4.591)
M4	4.4113*	-0.1177	0.0480	-0.6270	0.2154*
	(2.010)	(-0.546)	(0.749)	(-1.573)	(2.034)
M5	5.4545*	-0.2002	0.0730	-0.5622	0.2483*
	(2.402)	(-0.940)	(1.066)	(-1.379)	(2.269)
M6	5.1300*	-0.2383	0.2629*	-0.6721*	0.1743
	(2.289)	(-1.123)	(3.814)	(-1.667)	(1.609)
M7	6.5325*	0.0665	0.0722	-0.5468	0.1794
	(2.860)	(0.301)	(1.046)	(-1.329)	(1.609)
M8	4.8136*	-0.2003	0.0947	-0.8047*	.1490
	(1.987)	(-0.856)	(1.347)	(-1.835)	(1.233)
M9	3.8415*	-0.2756	0.0861	-0.7475*	0.1957*
	(1.655)	(-1.255)	(1.203)	(-1.779)	(1.643)
M10	4.0209*	-0.2967	0.0661	-0.5191	0.1883
	(1.623)	(-1.257)	(0.915)	(-1.154)	(1.512)
M11	0.4050	-0.1789	0.0440	-0.0370	0.0824
	(0.175)	(-0.819)	(0.650)	(-0.088)	(0.732)
Holidays					
H	0.2773	0.0211	0.0297	0.2035	-0.0852
	(0.243)	(0.198)	(0.903)	(0.986)	(-1.542)

*Denotes statistical significant at the 0.10 level.
[a]Parameter estimate.
[b]t-statistic.

Table A.2. Parameter Estimates and t-Statistics for the Retail Demand Functions for the Finfish Species

	FINFISH				
Exogenous Variables	Catfish	Oreodory	Tuna	Pollock	Perch
Intercept	10.6335* (3.398)	4.5951* (5.288)	1.7222* (1.748)	1.7504* (2.222)	0.4558 (1.157)
Price Variables					
Own-Price	-0.0286* (-9.955)	-0.0123* (-10.358)	-0.0013* (-4.843)	-0.0050* (-10.378)	-0.0005* (-3.669)
Other Finfish	0.0071* (2.214)	-0.0003 (-0.476)	-0.0003 (-0.328)	-0.0003 (-0.336)	-0.00001 (-0.041)
Shellfish	-0.0002 (-0.264)	0.0008* (3.108)	-0.0002 (-0.622)	0.0003* (1.290)	0.0002* (1.282)
Beef	0.0012 (0.213)	-0.0002 (-0.180)	0.0021 (1.138)	0.0024* (1.630)	-0.0001 (-0.152)
Poultry	-0.0045 (-0.897)	0.0005 (0.436)	0.0030* (1.837)	0.0011 (0.850)	0.0002 (0.430)
Pork	0.0042 (0.743)	0.0004 (0.349)	-0.0039* (-2.157)	-0.0004 (-0.282)	-0.0005 (-0.678)
Advertisement Variables					
Own-Advertisement	0.0115* (5.808)	0.0118* (10.453)	0.0033* (5.256)	0.0081* (4.158)	0.0053* (9.512)
Other Finfish	-0.0015 (-1.198)	-0.00005 (-0.178)	-0.0010* (-2.197)	-0.0002 (-0.656)	-0.0002* (-1.435)
Shellfish	-0.0009 (-0.614)	-0.0004 (-1.273)	-0.0001 (-0.283)	0.0002 (0.774)	-0.0002 (-1.227)
Beef	-0.0002 (-0.439)	0.00008 (0.696)	0.0001 (0.736)	-0.00001 (-0.090)	-0.00008 (-1.262)
Pork	0.0008* (1.485)	-0.00002 (-0.179)	-0.0002 (-1.260)	-0.00007 (-0.477)	-0.00007 (-0.979)
Poultry	-0.0006 (-0.971)	0.0001 (1.147)	0.0002 (1.138)	0.00001 (0.077)	-0.00003 (-0.401)
Seasonality					
M1	1.4848* (2.820)	0.2885* (2.223)	0.1315 (0.775)	0.3334* (2.420)	0.1048 (1.537)
M2	1.1959* (2.231)	-0.0166 (-0.127)	-0.0542 (-0.315)	0.1578 (1.143)	0.0954 (1.377)
M3	1.6287* (3.060)	0.4327* (3.320)	0.2035 (1.173)	0.3176* (2.307)	0.1807* (2.631)
M4	1.5897* (2.967)	0.4133* (3.123)	0.1521 (0.865)	0.2675* (1.915)	0.1959* (2.837)
M5	0.8416 (1.534)	0.3262* (2.376)	0.1177 (0.637)	0.3847* (2.647)	0.1073 (1.503)
M6	1.0147* (1.860)	0.3283* (2.434)	0.2402 (1.285)	0.0885 (0.623)	0.1744* (2.475)
M7	1.5226* (2.642)	0.1487 (1.069)	0.1072 (0.564)	-0.0714 (-0.490)	0.2817* (3.906)
M8	1.7931* (3.014)	0.2676* (1.840)	0.0559 (0.283)	0.0116 (0.075)	0.1064 (1.393)
M9	1.0231* (1.805)	0.0764 (0.548)	0.2015 (1.086)	0.2340 (1.586)	0.1604* (2.158)
M10	1.0845* (1.783)	0.1528 (1.025)	0.2128 (1.090)	0.0486 (0.309)	0.1147 (1.430)
M11	0.5327 (0.917)	0.2494* (1.783)	0.1341 (0.724)	0.2294 (1.526)	0.0733 (1.002)
Holidays					
H	-0.0653 (-0.230)	-0.1104 (-0.1595)	-0.0219 (-0.236)	-0.0406 (-0.555)	0.0060 (0.165)

Exogenous Variables	FINFISH Scrod	Salmon	Flounder	Trout	Whitefish
Intercept	0.7445 (1.547)	1.9672* (2.538)	0.3496 (0.466)	3.1628* (3.331)	0.4876 (0.348)
Price Variables					
Own-Price	-0.0012* (-5.873)	-0.0029* (-5.777)	-0.0026* (-5.954)	-0.0073* (-5.878)	-0.0073* (-10.776)
Other Finfish	-0.0009* (-1.704)	-0.0003 (-0.416)	0.0009 (1.011)	-0.0008 (-0.950)	0.0026* (1.674)
Shellfish	0.0004* (2.282)	0.0005* (1.990)	0.0007* (2.810)	0.0008* (2.552)	0.0014* (2.905)
Beef	-0.0002 (-0.211)	-0.0012 (-0.793)	0.0010 (0.744)	0.00003 (0.019)	0.0030 (1.090)
Poultry	0.0002 (0.282)	-0.0013 (-1.040)	0.0003 (0.256)	-0.0025* (-1.751)	0.0020 (0.877)
Pork	0.0010 (1.111)	0.0002 (0.167)	0.0015 (1.073)	0.0016 (1.047)	0.0009 (0.364)
Advertisement Variables					
Own-Advertisement	0.0218* (7.325)	0.0036* (6.998)	0.0331* (8.658)	0.0329* (9.556*)	0.0128* (4.878*)
Other Finfish	0.0001 (0.552)	0.0004* (1.384)	-0.0003 (-1.001)	-0.00002 (-0.063)	-0.0012* (-2.194)
Shellfish	0.0002 (1.171)	0.0002 (0.770)	-0.00008 (-0.226)	0.0001 (0.304)	-0.0011* (-1.696)
Beef	-0.00004 (-0.492)	0.0001 (1.136)	0.0001 (1.264)	0.00004 (0.333)	0.0003* (1.333)
Pork	0.0001* (1.314)	0.0001 (0.859)	0.0002* (1.484)	0.0001 (1.055)	-0.0001 (-0.493)
Poultry	0.00007 (0.642)	0.0001 (0.910)	0.0002* (1.331)	0.00001 (0.071)	0.0005* (1.880)
Seasonality					
M1	0.2609* (3.020)	-0.2102 (-1.455)	0.4876* (3.718)	0.4289* (2.876)	0.2674 (1.079)
M2	0.2724* (3.126)	-0.1705 (-1.199)	0.3559* (2.684)	0.3386* (2.171)	9.6437* (2.540)
M3	0.1397 (1.603)	0.1609 (1.120)	0.5364* (3.831)	0.4499* (2.980)	0.7687* (2.992)
M4	0.2462* (2.817)	-0.0639 (-0.439)	0.2616* (1.872)	0.5613* (3.664)	0.6532* (2.578)
M5	0.2338* (2.538)	-0.1705 (-1.145)	0.3697* (2.607)	0.2380 (1.507)	0.8620* (3.345)
M6	0.1820* (1.998)	-0.3273* (-2.216)	0.2057 (1.506)	0.0186 (0.119)	0.4662* (1.850)
M7	-0.0204 (-0.223)	-0.1777 (-1.192)	0.0996 (0.709)	-0.0283 (0.177)	0.9333* (3.607)
M8	0.0225 (0.234)	-0.2058 (-1.301)	-0.1179 (0.798)	-0.0414 (-0.249)	0.4847* (1.785)
M9	0.1645* (1.787)	-0.1307 (-0.861)	-0.1362 (0.963)	-0.0493 (-0.310)	0.4829* (1.842)
M10	0.1421 (1.440)	-0.1125 (-0.698)	-0.1841 (1.226)	-0.1251 (-0.736)	0.3760 (1.344)
M11	0.0470 (0.511)	-0.1770 (-1.154)	-0.2536* (1.799)	-0.1753 (-1.091)	0.5877* (2.241)
Holidays					
H	-0.0895* (-1.952)	-0.0116 (-0.159)	-0.0805 (-1.155)	-0.0222 (-0.181)	-0.1070 (-0.832)

Exogenous Variables	FINFISH Halibut	Swordfish	Rockfish	Shark
Intercept	1.5913*	1.2317*	1.6363*	2.4757*
	(3.416)	(4.362)	(2.469)	(4.016)
Price Variables				
Own-Price	-0.0027*	-0.0015*	-0.0050*	-0.0059*
	(-8.166)	(-9.984)	(-10.173)	(-11.965)
Other Finfish	0.0008*	0.0006*	0.0011*	0.0006
	(1.602)	(1.998)	(1.596)	(0.974)
Shellfish	-0.0005*	-0.0002*	0.0001	0.0004*
	(-3.687)	(-2.118)	(0.729)	(1.794)
Beef	0.0007	0.0009*	0.0019	-0.0007
	(0.870)	(1.783)	(1.548)	(-0.625)
Poultry	-0.0006	0.00008	-0.0014*	-0.0009
	(-0.879)	(0.198)	(-1.289)	(-0.900)
Pork	0.0010	0.00005	0.0018*	-0.0007
	(1.207)	(0.115)	(1.524)	(-0.619)
Advertisement Variables				
Own-Advertisement	0.0057*	0.0114*	0.0100*	0.0024*
	(4.768)	(21.766)	(5.326)	(2.316)
Other Finfish	0.00008	0.0001	0.0001	-0.00007
	(0.469)	(1.271)	(0.552)	(-0.294)
Shellfish	-0.0001	-0.00002	0.00007	0.000008
	(-0.505)	(-0.210)	(0.231)	(0.029)
Beef	0.00006	0.00005*	0.00001	0.0001*
	(0.814)	(1.360)	(0.154)	(1.629)
Pork	0.0001*	-0.00009*	0.0001*	-0.00003
	(1.377)	(-1.851)	(1.492)	(-0.307)
Poultry	-0.0001*	0.00003	-0.0002*	0.0002*
	(-1.462)	(0.640)	(-1.889)	(1.820)
Seasonality				
M1	0.2145*	-0.0293	0.1170	0.2821*
	(2.765)	(-0.634)	(1.028)	(2.604)
M2	0.0700	-0.0021	0.2766*	0.2173*
	(0.895)	(-0.047)	(2.405)	(1.958)
M3	0.1740*	-0.0225	0.2467*	0.4399*
	(2.223)	(-0.429)	(2.091)	(4.026)
M4	0.2090*	-0.0086	0.3333*	0.3282*
	(2.619)	(-0.165)	(2.844)	(2.959)
M5	0.2488*	-0.0170	0.2160*	0.3441*
	(2.975)	(-0.317)	(1.741)	(2.930)
M6	0.1304	0.0147	0.0243	0.2624*
	(1.590)	(0.292)	(0.199)	(2.304)
M7	0.1776*	0.0259	0.0753	0.2914*
	(2.072)	(0.516)	(0.603)	(2.500)
M8	0.2471*	0.0288	-0.1103	0.2711*
	(2.782)	(0.546)	(-0.836)	(2.238)
M9	0.1912*	-0.0312	-0.0513	0.3442*
	(2.247)	(-0.614)	(-0.402)	(2.884)
M10	0.0888	-0.0658	-0.1955	0.4798*
	(0.945)	(-1.172)	(-1.428)	(3.799)
M11	0.0645	-0.0462	-0.2608*	0.4622*
	(0.771)	(-0.860)	(-2.016)	(3.946)
Holidays				
H	-0.0377	-0.0132	-0.1243*	0.0458
	(-0.912)	(-0.537)	(-2.034)	(0.788)

* Denotes statistically significant at the 0.10 level.
[a] Parameter estimate.
[b] t-statistic.