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Value of Brands and Other Attributes: Hedonic Analysis of Retail Frozen Fish in the UK

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Abstract *In the frozen processed seafood market, through branding, product forms, and portion sizes, retailers target certain segments of the market, such as families with children, singles, or value-conscious consumers. To investigate how segmented the UK retail frozen seafood market is, this study utilizes a hedonic pricing model applied to scanner data to determine the relative value of attributes such as species, national and private brands, package size, and product and process forms. The results have implications for the seafood supply chain, as retailers influence what products processors produce. They also contribute to the highly diverse demand patterns facing fishermen and aquaculture producers.*

Key words Hedonic analysis, scanner data, seafood.

JEL Classification Codes C23, D21, Q11, Q22.

Introduction

Retailers provide their customers with an array of seafood products—in the fresh fish counters, in the frozen processed food aisle, and in the canned food aisle. The products are widely diverse, covering a range of species and product attributes. In the frozen, processed seafood aisle companies target particular market segments, such as families with children, singles, or value-conscious consumers through use of branding, product forms, and portion sizes. For example, breaded fish formed into animal shapes may appeal to children, large package sizes may appeal to value-conscious consumers, and gourmet brands may appeal to the fashion conscious. The industry trade press seems to indicate that the frozen processed seafood segment is a highly dynamic sector in which the value of product attributes evolves with changing consumer preferences and the retail market environment. However, little, if any, economic research has been conducted to examine this market. While the retail level of the market chain is interesting in itself, the highly diversified demand structure

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generated by this sector can also be hypothesized to have important implications downstream through the supply chain for seafood as it influences what products processors produce, their profitability, and which supply chains will be successful. Finally, the retail level of the market chain may contribute to the highly diverse demand patterns facing fishermen and aquaculture producers for their products at the exvessel level of the supply chain. Yet little research has been conducted to investigate these hypotheses.

It is well known from studies using hypothetical data that seafood attributes have value to consumers (Holland and Wessells 1998; Jaffrey *et al.* 2001; Johnston *et al.* 2001). Moreover, fish attributes also have value for the producer (Gates 1974; Anderson 1989; Larkin and Sylvia 1999; McConnell and Strand 2000; Carroll, Anderson, and Martinez-Garmendia 2001; Asche and Hannesson 2002; Fong and Anderson 2002; Kristofersson and Rickertsen 2004). Some individual attributes may be more highly valued than others, and particular combinations of attributes lead to higher- or lower-valued fish at the producer level. The presence of these attributes typically segment fish into different markets often associated with different fresh or processed product forms.

While a significant amount is known about the relative value of species as fresh fish, once the fish is processed into frozen retail packages, the relative value of species compared to one another as a part of the composite good becomes less clear. Studies of actual market data that analyze the value of seafood product attributes relative to one another at the retail level are few. The closest are demand studies where cross-price elasticities are estimated using aggregated data. Wessells and Wilen (1994) provide results regarding the relative value across species. Wellman (1992) and Burton (1992) assess retail demand across groups of fish, such as frozen or fresh.

In this study we will begin to address the paucity of information about the retail sector of the seafood market by investigating the degree of heterogeneity of frozen processed seafood products. We do so by conducting a hedonic analysis of the frozen processed seafood market in the United Kingdom, using scanner data. This data set contains information on all frozen processed seafood products sold between January 2002 and February 2005.

Few studies of seafood have utilized scanner data from independent market research firms in their analysis, with exceptions including Tiesl, Roe, and Hicks (2002) and Wessells and Wallström (1999).[1] The availability of these commercial scanner data allows significant advances in understanding food marketing because it is possible to estimate firm- and brand-level demand models (Cotterill 1994). The data allow us to address issues such as the value of processed product form within the frozen seafood segment, including the price differential between fillets, steaks, fish nuggets, and fish cakes for the same species, for different species, and for different producers (brands). The United Kingdom is a particularly interesting market in this respect because it is one in which there is a large diversity of species offered in the frozen processed fish segment. It is also a market where the retail structure has changed substantially during the last decade, from small, specialized outlets to large supermarket chains. The supermarket chains grew to 66% of the UK retail sales of seafood in 2001, up from 16% in 1988 (Murray and Fofana 2002). With this changing marketing environment, product attributes are increasingly important in the competition for shelf space. Finally, the UK market is also interesting because

[1] Some studies have used scanner data in which the authors have had special arrangements with supermarkets in particular locations (Capps and Lambregts 1991). We are referring instead to scanner data available from market research firms which are collected on branded products.

New Zealand hoki was recently introduced into this market as a sustainable alternative whitefish to cod and haddock, the traditional favorites.

Data

Retail scanner data was purchased from Information Resources, Inc. (or IRI). Scanner data became widely available in the 1980s and are based on Universal Product Code (UPC) or bar code scanning at the supermarket check out counters. The data include weekly sales information for 687 frozen processed seafood products from January 19, 2002 to February 19, 2005. The sales data include quantities sold and prices by brand, package size, and product promotions.

The data were provided for two regions of the United Kingdom—Lancashire, which includes the Manchester metropolitan area, and the London metropolitan area. Lancashire lies in the northwestern region and on the west coast, while London is in the southeast region. Data from these diverse regions were collected to test whether pricing and determinants of prices differ in distinct regions of the country. This could come about, for example, due to differences in the cost of living between the two regions or differences in supermarket pricing strategies in the two regions. There exist other examples of tests for cross-sectional differences across markets in the literature (Wessells and Wilen 1994; Salvanes and DeVoretz 1997; Jaffry *et al.* 2001; Johnston *et al.* 2001).

Supermarkets surveyed by IRI in collection of this data include Asda, Boots, Iceland, Morrisons, Safeway, Sainsburys, Somerfield (including Kwik Save), Superdrug, Tesco, Waitrose, and Woolworths. The data provide a description of the product, including species, price, brand (whether private label and national brands such as Bird's Eye and Young's), coating (such as breaded or battered) or no coating (such as smoked or natural), product form (such as steaks, fillets, fishcakes, bites), and package size. Thus, five major attribute groupings were created—species, brand, product form, package size, and process form—encompassing a total of 37 product attributes.

Private label brands require more explanation. They include supermarket, or retail, brands such as Sainsburys, Waitrose, *etc.* IRI has established a differential pricing policy for its data, in part to protect its primary clients, which are the brand owners. Thus, the dataset used in this analysis identifies a product as 'own-label,' not specifically attributed to a particular supermarket private label and so distinguishes the product from the national brands. To identify exactly which supermarket brand that product actually was affiliated with would have cost the research project an order of magnitude more.[2] The implications of this are not significant for the purposes of this paper.

Of the 687 total products in the data provided by IRI, 201 distinct products are evaluated in this analysis. The final products were determined based on a number of criteria. Initially the data set was culled to eliminate non-finfish products. Other products were also excluded, in particular those in which substantial amounts of additional ingredients were included in the package, such as vegetables. Together, these accounted for over 200 products. Using the data from the London metropolitan area, each remaining product was examined to see for how many weeks the product was actually sold. Those products for sale for less than one third of the time period

[2] The cost of 130 weeks of InfoScan data was £3,000, which identified private label brands as simply 'own-label.' To have purchased 130 weeks of data in which private label brands were specifically identified according to supermarket chains was quoted to cost £50,000.

of our study were eliminated. Next, the finfish species were scrutinized to eliminate those for which very few products were sold, such as halibut or tilapia. This process was repeated to assess product offerings from certain national brands. Again, some had a severely limited number of viable products. Additionally, a few products were removed because the weekly quantities sold were negligible.

Once the final set of products was determined for the London metropolitan area, the same product set was chosen for analysis for the Lancashire area for consistency. Even within the final set of products, not all products remain in the market for the entire time period, as new products are introduced or products are withdrawn by processors. Each of the final 201 products was then coded based on the 37 possible product attributes. The resulting means and standard deviations for the 37 product attributes are shown in table 1 along with the average weekly market share and its standard deviation for each region.

Model Specification

The hedonic model can be written in its general form as:

$$P_{it} = f(s_1,\ldots,s_n), \tag{1}$$

where P_{it} is the price of good i at time t, and $\boldsymbol{S} = (s_1,\ldots,s_n)$ is a vector of attributes that determines the price of the good. Each attribute j can be measured on a continuous scale or by a dummy variable depending on its type.

A number of functional forms have been used in the literature, including Box-Cox functional forms. In this analysis, the attributes are all expressed as dummy variables (see table 1), as there are no continuous variables. Dummy variable coding is used instead of alternative coding, such as effects coding, as it is easily interpretable given the large number of attributes included in the model specification. This follows established methodology of previous hedonic literature including McConnell and Strand (2000); Carroll, Anderson, and Martinez-Garmendia (2001); and Kristofersson and Rickertsen (2004).

The only attribute which would lend itself to being expressed in continuous form is package size. We elected to present package sizes as categorical variables to better capture the differences, if any, in relative values of different package types—*e.g.*, single portions versus family packs. Treating package size as a continuous variable would obscure those marginal value differences. Alternatively, price per average package size was not used, as each species is not marketed across the entire range of package sizes. Per-package prices are used as the dependent variable, with categorical variables capturing effects of various package sizes on price. This is identical to the approach used by Kristofersson and Rickertsen (2004) in their hedonic analysis of cod prices, and similar to the approach of property value analysis where the value of homes are estimated as a function of number of bedrooms.

A simple linear form was chosen:

$$P_{it} = a_0 + \sum_{j=1}^{k} b_j s_j + e_{it}, \tag{2}$$

where e_{it} is a random error. The short time period covered is also a period of low inflation (average rate of 1.3% per year); hence, nominal prices are used.

Table 1
Descriptive Statistics for Variables Included in the Regression Model, by Geographical Area

Variable	Description	London Mean	London Stand. Dev.	Lancashire Mean	Lancashire Stand. Dev.
Price	£ per unit	2.59	1.10	2.45	1.03
Species					
Cod	1 if cod, 0 otherwise	0.284	0.451	0.288	0.453
Haddock	1 if haddock, 0 otherwise	0.194	0.396	0.195	0.397
Hoki	1 if hoki, 0 otherwise	0.034	0.182	0.036	0.187
Lemon sole	1 if lemon sole, 0 otherwise	0.034	0.180	0.020	0.141
Coley	1 if coley, 0 otherwise	0.053	0.223	0.057	0.232
Hake	1 if hake, 0 otherwise	0.013	0.112	0.013	0.115
Plaice	1 if plaice, 0 otherwise	0.055	0.228	0.058	0.234
Sardine	1 if sardine, 0 otherwise	0.009	0.092	0.007	0.082
Tuna	1 if tuna, 0 otherwise	0.047	0.213	0.042	0.201
Mackerel	1 if mackerel, 0 otherwise	0.019	0.137	0.019	0.137
Kippers	1 if kippers, 0 otherwise	0.021	0.142	0.022	0.145
Rainbow trout	1 if rainbow trout, 0 otherwise	0.008	0.091	0.008	0.090
Salmon	1 if salmon, 0 otherwise	0.100	0.300	0.093	0.291
Other whitefish	1 if whitefish not already categorized, 0 otherwise	0.130	0.336	0.140	0.347
Brand					
Bird's Eye	1 if Bird's Eye, 0 otherwise	0.095	0.293	0.098	0.297
Young's/Bluecrest	1 if Young's or Young's Bluecrest, 0 otherwise	0.154	0.361	0.154	0.361
Ross	1 if Ross, 0 otherwise	0.047	0.211	0.051	0.221
The Natural Choice	1 if The Natural Choice, 0 otherwise	0.023	0.151	0.024	0.154
Swankies	1 if Swankies, 0 otherwise	0.015	0.120	0.019	0.135
Marr	1 if Marr, 0 otherwise	0.037	0.190	0.039	0.193
Macrae	1 if Macrae, 0 otherwise	0.009	0.096	0.010	0.098
Own label	1 if produced by a retailer, 0 otherwise	0.620	0.485	0.605	0.489
Product Form					
Steak	1 if steak, 0 otherwise	0.271	0.444	0.283	0.450
Fillet	1 if fillet, 0 otherwise	0.529	0.499	0.538	0.499
Fish cake	1 if fishcake, 0 otherwise	0.138	0.344	0.127	0.333
Goujons	1 if goujons, 0 otherwise	0.013	0.191	0.003	0.056
Kidsfish	1 if kidsfish or fish bites, 0 otherwise	0.038	0.191	0.039	0.193
Other forms	1 if not specified, 0 otherwise	0.013	0.112	0.011	0.103
Package Size (gr)					
140–279	1 if between 140–279, 0 otherwise	0.193	0.394	0.182	0.386
280–399	1 if between 280–399, 0 otherwise	0.176	0.380	0.184	0.388
400–524	1 if between 400–524, 0 otherwise	0.187	0.390	0.193	0.394
525–699	1 if between 525–699, 0 otherwise	0.417	0.493	0.414	0.493
700+	1 if greater than 699, 0 otherwise	0.028	0.164	0.027	0.162
Process Form					
Battered	1 if battered, 0 otherwise	0.227	0.419	0.234	0.423
Breaded	1 if breaded, 0 otherwise	0.449	0.497	0.441	0.497
Natural	1 if no coating, 0 otherwise	0.092	0.289	0.095	0.294
Smoked	1 if smoked, 0 otherwise	0.233	0.423	0.230	0.421

By including a constant term, the parameters b_j are interpreted as deviations from a basic product with a given set of attributes for each region. For each attribute category listed in table 1, other whitefish, own-label, steak, other forms, 400–524 gram package size, and the natural coating are the attributes which are not included in the regression and against whose values the other attributes are interpreted. In each dimension one can investigate whether the different attributes have different marginal values by testing whether the associated parameters are zero.

Results

The model was estimated for each of the two metropolitan areas separately and combined. There was a total of 25,263 observations for the London metropolitan area and 23,799 for the Lancashire area. Overall, each of the equations is highly significant with a p-value <0.0001. A Chow test rejects the null hypothesis that the areas can be viewed as a single area (F=26.73), thus table 2 presents the results of each area's regression results. This is of interest as it indicates that within a country, the seafood markets in different regions may have different valuations of different attributes for each seafood product, and accordingly further contribute to the segmented nature of the seafood market.

Each category of product attributes creates segmentations, and allowing these differences adds significantly to the goodness-of-fit of the equations. This is shown in table 3, where partial F-tests are reported for the null hypothesis that there are no differences in the value of a product due to the different attributes in any of the five main attribute categories. Specifications of the model to include interactive terms were estimated; however, a number of difficulties were encountered due to a significant amount of multicollinearity within these models. Largely on a species-specific basis, product form and process form tend to be highly correlated. Addressing this issue would essentially create separate hedonic models, by species. Given that the purpose of this paper is to look more globally at the overall frozen processed seafood market, a more detailed analysis of these interactions on a species basis is left for subsequent research.

To analyze the implications of the regression results, each attribute category is discussed in turn below.

Species

Most demand and market integration analysis conducted at different levels in the supply chain indicates that the seafood market is segmented, including Burton (1992); Wessells and Wilen (1994); Johnson, Durham, and Wessells (1998); Eales and Wessells (1999); Jaffry, Pascoe, and Robinson (1999); Asche, Bjørndal, and Young (2001); and Asche, Gordon, and Hannesson (2002). Hence, one might expect species to be an attribute that contributes to the segmentation of the retail supply. As noted above, this is confirmed by the F-test reported in table 3, rejecting the null hypothesis that prices do not vary for different species.

In our analysis, the species left out of the regression equation is 'other whitefish,' which includes those products simply described as 'whfs', 'whi', 'whit' and thus could be either a generic 'whitefish' or 'whiting,' although this is not clear from the product description. This is a common labeling approach in Germany, where the specific species in the product is typically listed in the ingredients portion of the package, as opposed to the prominent label on the package. It is a less common practice in the United Kingdom, but products are sometimes promoted as '100% fillet' on the front with a listing of species or just 'whitefish' in the ingredients list.

Table 2
Coefficient Estimates for Hedonic Regressions by Area

Variable	London Parameter Estimates	*t*-ratio	Lancashire Parameter Estimates	*t*-ratio
Intercept	2.330	95.46	2.312	90.23
Species				
Cod	0.779	50.93	0.680	43.04
Haddock	0.773	46.28	0.727	42.25
Hoki	0.580	21.47	0.447	16.12
Lemon sole	2.179	72.16	1.402	39.71
Coley	–0.281	11.43	–0.223	8.80
Hake	–0.015	–0.37	–0.011	–0.27
Plaice	1.170	49.27	1.047	42.91
Sardine	–0.037	0.48	–1.032	11.79
Tuna	0.652	25.20	0.490	16.99
Mackerel	–0.003	0.08	0.157	4.36
Kippers	–0.554	14.74	–0.619	15.76
Rainbow Trout	0.070	1.40	–0.015	0.27
Salmon	0.744	37.50	0.703	33.44
Brand				
Bird's Eye	0.257	16.13	0.272	16.21
Young's/Bluecrest	0.221	16.06	0.283	19.83
Ross	–0.295	14.71	–0.260	12.77
The Natural Choice	–0.405	14.02	–0.378	12.61
Swankies	–0.560	15.07	–0.224	6.26
Marr	–0.161	7.15	0.010	0.41
Macrae	–0.606	12.58	–0.618	12.31
Product Form				
Fillet	0.344	25.58	0.330	23.56
Fish cake	–0.439	26.66	–0.588	33.25
Goujons	0.082	1.86	0.090	1.17
Kidsfish	–0.155	6.12	–0.301	11.85
Other forms	0.385	5.99	0.481	6.92
Package Size (gr)				
140–279	–0.859	59.23	–0.784	51.19
280–399	–0.200	13.30	–0.102	6.62
525–699	0.459	38.67	0.401	32.36
700 +	0.975	33.00	1.119	34.76
Processed Form				
Battered	–0.836	36.70	–0.801	33.47
Breaded	–0.779	35.95	–0.709	31.28
Smoked	–0.025	1.05	–0.131	5.31
R^2	0.67		0.61	
F–stat	1,642.91		1,185.87	
p–value	<0.0001		<0.0001	
No. observations	25,263		23,799	

Table 3
Partial F-Tests for Significance of Product Category in each Area*

	Lancashire	London
Species	411.42 (<0.001)	577.80 (<0.001)
Brand	156.80 (<0.001)	181.12 (<0.001)
Product Form	424.88 (<0.001)	360.92 (<0.001)
Package Size	1,174.51 (<0.001)	1,460.64 (<0.001)
Process Form	548.55 (<0.001)	834.19 (<0.001)

* *p*-values in parentheses.

Figure 1 shows the relative value of each species by metropolitan area relative to "other whitefish." Lemon sole is the highest-valued species in both regions, although there is a £0.77 differential between the areas, with the value at £2.17 in London and only £1.40 in Lancashire. It is also worthwhile to notice that there seems to be two distinct groups of whitefish, where cod, haddock, and hoki are relatively higher valued, while hake and coley are in the same value range as the generic whitefish, although slightly lower priced. The most prevalent salmon species used in processed frozen salmon is chum, which is of lower value than other wild salmon species, such as sockeye, and farmed salmon is generally not used in this market segment. Thus, the relatively low value of salmon implied from these results is expected.

Hoki, as a recently introduced species to the UK market, is relatively valuable, closely following cod and haddock with a slightly larger differential in Lancashire than London. Unilever, owner of the Bird's Eye brand, introduced hoki into the UK market as a sustainable alternative to cod and haddock in 2002 (Porritt 2005). The product was marketed as "New Zealand hoki" to make the product exotic sounding, and also attached to a location with a reputation for producing high-quality food. Unilever pressured retailers to keep prices for Bird's Eye hoki products low relative to Bird's Eye cod products in an effort to attract customers to the product (Porritt 2005). However, the stronger, oilier taste of hoki relative to cod and haddock, as well as strong price competition among supermarkets, is partly attributed with the difficulty of moving customers away from cod toward hoki. As a result, by mid-2005 Bird's Eye was no longer selling any hoki products in the UK market, although other brands, including Young's, Tesco, and Marks and Spencers, continued to do so (Porritt 2005).

Brands

While species is a source for segmentation that is of relevance throughout the supply chain, brand name is an attribute that is relevant only at the consumer level. In this data set there are seven national brands in addition to the supermarkets' own brands. As reported in table 3, the *F*-test clearly rejects the hypothesis that a product price is independent of brand, indicating that brand is an attribute that contributes to the segmentation of the seafood market. The own-label was removed from the product category, so the coefficients on the national brands are to be interpreted as values relative to the own-label.

From the parameter estimates reported in table 2, one can see that Bird's Eye and the combination of Young's and Young's Bluecrest brands command a premium

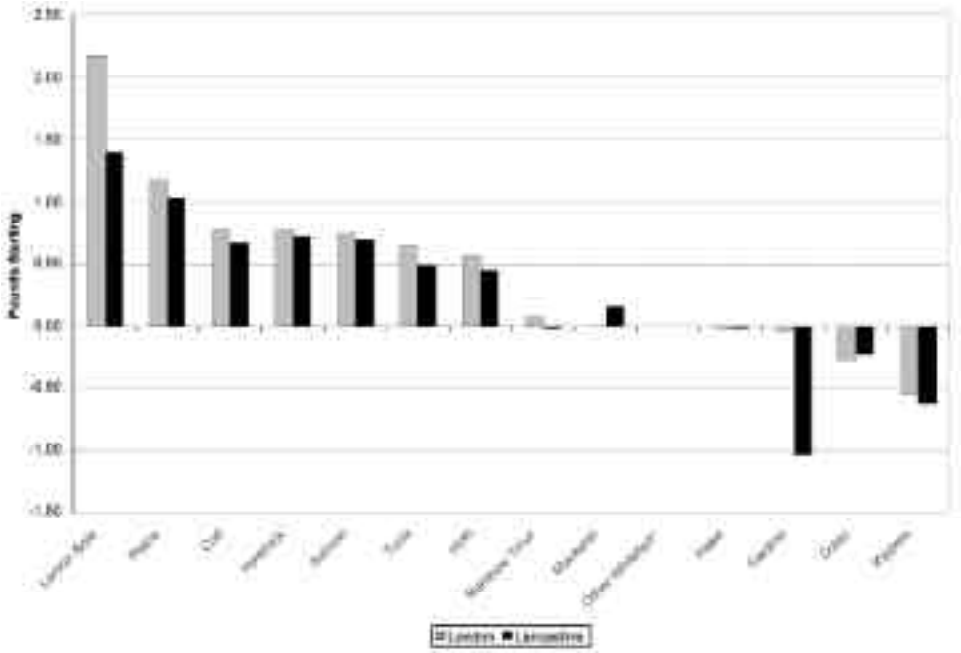

Figure 1. Relative Value of Species (£/package)

* Base species.

over the own-label brands by approximately £0.22–£0.28 in the two areas, while the other national brands sell at a discount. Given that the average product prices in London and Lancashire are £2.59 and £2.45, respectively (table 1), this represents an approximately 10% premium over own-label brands. In the US market, own-label brands generally sell at a 10–40% discount to national brands (Halstead and Ward 1995). This larger price differential in the US between national and own-label brands may be due to at least two factors. First, British grocery retailers have taken a different approach to private brands than their US counterparts. Rather than compete as lower-priced generic products, UK retailers are creating brand alternatives that have a higher value addition and are higher priced, competing directly with leading brand manufacturers (Burt 2000). Additionally, Richardson, Jain, and Dick (1996) argue that European retailers, more so that US retailers, have been successful in increasing store brand market share through dramatic improvements in package design, labeling, advertising, and branding strategies. Second, the own-label data we use are aggregated across all supermarkets, and are not attributed to particular supermarkets. In the United Kingdom, supermarkets range from value-conscious Asda to "up-market" chains such as Sainsburys. Given that the regression results seem to indicate a relatively high value for own-label products, one might expect that the dataset over-represents higher-valued, own-label products. Without the ability to attribute particular own-label products to particular supermarkets, it is impossible to determine with certainty the answer to this.

Some light can be shed by Burt (2000). He shows that different supermarkets in the United Kingdom, depending upon product categories, produce different numbers of own-brand products relative to national brand products. For example, among fro-

zen foods, in 1997 Sainsburys had a 57.9% retail brand value share compared to 52.1% for Tesco, 55.8% for Asda, 40.5% for Waitrose, 45.5% for Safeway, and 24.1% for Co-op. Thus, to the extent these percentages reflect frozen seafood products, Sainsburys and Asda, for example, may be comparable in the number of own-label products they offer their customers. Hence, the bias induced by aggregating own-label products with different values is not likely to be substantial.

The value of brands such as Bird's Eye and Young's have implications for downstream suppliers. Both Unilever's Bird's Eye brand and Young's Bluecrest are major buyers of fish, although Unilever is by far the larger.[3] In both cases, quality and image control is a major concern. Recently, Unilever came under scrutiny for possibly sourcing illegal cod from a Hong Kong-based firm of Russian fishing vessels, Ocean Trawlers, alleged to have engaged in illegal fishing in the Barents Sea (Leigh and Evans 2006). Related to this same issue, Young's Bluecrest announced it would require tighter audits of its suppliers and refuse to purchase products from transshipment vessels flying flags of convenience in an effort to combat the problem of sourcing illegal Barents Sea cod (Cherry 2006d). At other levels in the supply chain, this will translate to a different demand structure, as the focus on different attributes of the seafood supplied changes.

The value of own-labels also has implications for downstream suppliers. Recently, environmental groups have increasingly put pressure on UK retailers to stop selling what they categorize as unsustainable species by using the media and various other highly visible tactics. For example, Greenpeace recently ranked UK retailers on their sustainable seafood buying practices, in which Asda ranked last (Greenpeace 2005). After picketing Asda stores and a rooftop demonstration at Asda headquarters, Asda released a detailed seafood sourcing policy which specifically removes several species from its shelves that have been determined by Greenpeace and other environmental non-governmental organizations to be 'unsustainable.' These include skate, Dover sole, ling, and dogfish (Cherry 2006a). Morrison's recently announced it would be removing unsustainable fish by dropping skate from its shelves and implementing a sustainable seafood policy (Cherry 2006c). The Marine Conservation Society of the United Kingdom released a full ranking of UK supermarkets' seafood sustainability, ranking Marks and Spencer at the top of the list, followed by Waitrose and Sainsburys (Cherry 2006b). This development restricts the ability of suppliers of branded products to source fish globally with a primary focus on price.

Product Form

Product form is an important attribute in most processed food industries, as there are a number of product introductions and withdrawals in efforts to reach the consumer. As shown by the standard deviations in table 1, there are tremendous variations in the market share for the different product forms between different weeks, taken over the entire data set. The *F*-test in table 3 also indicates that there are significant differences in product prices due to product form. Relative to steaks, our base category, fillets are the most valuable product form—approximately £0.34 more than steaks. Goujons is a French word for small, fried strips from fillets of fish. The goujon products are breaded, and the species include lemon sole, cod, and salmon. The results show that the relative value of goujons is significantly higher than even a steak.

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[3] Unilever announced in February 2006 that it is divesting itself of a majority of its frozen seafood business in Europe, including its Bird's Eye and Iglo brands.

Kidsfish is a product form that includes fish nuggets, or fish bites, and shaped fish bites. These shapes might include the shapes of 'fish' or other forms, and the target market segment is families with children. In the London market these products have a relative discounted value to steaks of £0.15, while in the Lancashire area they have a relative discounted value of £0.33. The difference between the two areas is quite large, and may have to do with a difference in affluence between the areas, size of the market, or a number of other factors.

The "other" product form category is an aggregate of 'bites,' which is a product form sometimes used for appetizers, and whole fish—generally associated with such fish as sardines. There were few observations on these product forms, so they were pooled together to form this group.

Package Size

Package size is also an important attribute in the positioning of a product. Our base attribute is packages of 400–524 grams, and as indicated in table 3, the prices vary by package size. As expected, the larger the package size, the larger the relative value; however, this is not a linear function of size. Figure 2 shows the value distribution. From table 1, the majority of products in both geographical areas fall into the 525–699 gram package size, thus the producers are primarily targeting households providing 2–3 servings of product at a meal. Only 3% of the packages are of 700 grams or above, or 'family size,' thus the number of choices presented to consumers is relatively low, although the overall value sales in that category may be proportionately higher than the number of products would indicate.

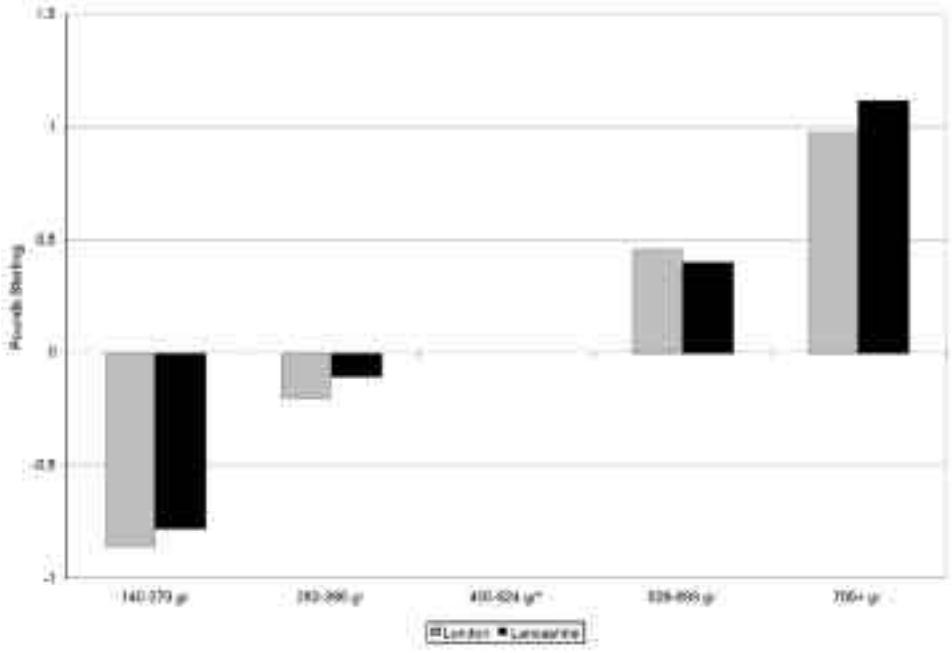

Figure 2. Relative Value of Package Size (£/package)

* Base package size.

Process Form

Process form is potentially an important attribute for the positioning of frozen retail product among consumers, targeting certain market segments. The *F*-test in table 3 indicates that the price of the product is not independent of the process form. The base attribute is "natural," which is no coating other than spices or lemon flavoring. It is of particular interest to note that the process forms of breaded, battered, and smoked are all relatively lower valued than natural in both metropolitan areas, although smoked is insignificantly different from natural in the London area. This is a clear indication that there is a premium on fish of a sufficiently high quality, implying that it need not be covered by breading and batter.

Of the process forms, over 65% of the products are breaded and battered in each area (see table 1). These products involve more use of input factors, but the results show that their final value is lower. Thus, while typically considered 'value-added' products, they are adding value to a product which is of lower value from an initial state, perhaps because of lower quality. In other words, if the product were of sufficiently high quality, one would expect that the fish be marketed as the higher-valued product, natural. Thus, so-called 'value-added' from breading and battering actually is a process form that masks some of the quality control issues generated downstream in the supply chain.

Conclusions

The seafood market is quite diversified and highly segmented in a number of dimensions at the retail level. In this paper, we shed some light on this topic using a hedonic pricing model on retail scanner data for frozen seafood in the UK market. Results show that species, branding, process form, package size, and product form add distinct value to the product and may segment the product in reaching different consumer target markets.

After an extensive review of the published and grey literature, we conclude that this analysis represents a significant contribution to the fisheries economics literature, as no analysis of this kind has been conducted at the retail level to date. The contribution rests at several levels; however, perhaps most heavily on the regression results of the relative value of the brands. Very little analysis has been done within the fisheries economics and seafood marketing literature on industrial organization at the top of the supply chain, yet market structure and branding have significant implications for demand facing the fishing and aquaculture industries. Use of scanner data, and in particular its use in analysis of the relative value of national and private label brands, such as conducted in this study, represents a constructive first step toward better understanding of the retail market. This, in turn, leads to a better understanding of the implications of decision making by retail brands owners by the rest of the seafood supply chain.

The fact that national and retail brands have value confirms that reputations are at stake; thus, seafood buyers will make changes in their purchasing patterns to protect their reputation and maintain quality. Many seafood buyers presently require some level of traceability in the supply chain. However, those requirements are likely to increase as brand owners demand assurances of an increasing amount of information concerning the history and origins of the fish on which they put their brand (Derrick and Dillon 2004; Thompson, Sylvia, and Morrissey 2005). Traceability, in turn, imposes costs on the supply chain, which may or may not be compensated for by the buyer, depending upon several factors, including the level of market power exercised by the buyer. Some level of traceability is required by most

governments for seafood safety regulations. The European Union and United States also require traceability for country-of-origin labeling. However, as in the case of Young's Bluecrest's efforts to avoid purchasing illegal cod, seafood buyers in the future may impose additional audit trails to avoid embarrassing or costly incidents affecting their brands, which will create additional costs for downstream suppliers.

Another interesting result of this analysis worth emphasizing is the lower value of the more processed products relatively to a "natural" product form. The results would appear to indicate that "value adding" is a process that is viable only when the quality of the raw fish is highly variable, and a substantial part is not suitable for the higher-valued product forms—*i.e.*, natural steaks or fillets. Frozen natural products may be close substitutes for the fresh fish counter. The high value of these products relative to the breaded and battered products, or "value-added" products, would indicate that these natural products are of higher quality. Thus, there is a higher return for the raw fish product that is of sufficiently high quality to be put into that market segment. This is an additional source of rent dissipation, if the poor fish quality is the result of management systems that provide incentives for long trips and poor treatment of fish. Moreover, while the "value adding" may create some direct employment in fish processing, it may reduce the overall value of the fishery for coastal communities and the fishermen when the fish is relegated to lower-valued product forms.

The findings of this study would not have been possible without the use of scanner data. While having the disadvantage of high cost, scanner data has the advantage of providing a level of detail in product-level data that government statistics cannot match at any level of the supply chain. Without this, analysis of brand-level prices and sales would be difficult, if not impossible, as would the implications of process form. While consumer demographic information is frequently lacking with scanner data, when utilized across metropolitan areas, it can often be combined with metropolitan area-wide demographic data to form panel datasets of some level of demographic richness as in Cotterill, Putsis, and Dhar (2000). Thus, future use of scanner data for consumer demand analysis is an avenue worth pursuing.

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