



# The value of line-caught and other attributes: An exploration of price premiums for chilled fish in UK supermarkets

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## ABSTRACT

Within international markets for fish, the past decade has witnessed a significant growth and proliferation of products labelled to be sustainable or responsibly sourced. These terms encapsulate a range of criteria concerning the state of the stocks and, inter alia, how the fish have been captured. Of the different modes of capture 'line-caught' is one of the longer standing and with associations to lesser impacts upon the environment. Yet despite this position, there appears to have been little assessment of any price premiums realised for fish marketed with environmental, responsibly-sourced, line-caught or other such credentials. This paper is the first published study to examine whether such attributes of chilled fish products command any price premium at the supermarket level of the value chain. The study is based on 68 weekly observations of chilled pre-packed cod and haddock in seven different supermarkets in the UK. The study also examines possible price premiums for other observable attributes such as product form, processing and country of origin, in addition to any differences in pricing between the supermarkets. The results show that the 'line-caught' attribute gives cod and haddock a price premium of 18% and 10%, respectively. The MSC ecolabel gives a 10% price premium on haddock products.

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## 1. Introduction

Traditionally, seafood marketing has focused on issues such as product quality, convenience, healthiness and branding. However, increasingly the environmental friendliness and the sustainability of the actual fishery are emphasised. Ecolabels awarded by non-governmental organisations (NGOs) such as the Marine Stewardship Council (MSC) and Friend of the Sea provide reassurance to the consumer regarding the sustainability of a fishery from which the products originate. In addition, marketers increasingly provide information to the consumer regarding the environmental impacts of the fishing method employed. For example, that a certain fishing method is "dolphin-safe" [1] or that long-lining has low by-catch of unwanted species and juvenile fish and lesser impact upon the seabed than other methods such as trawling. Such environmentally friendly products seem to fit well with the increased emphasis on corporate social responsibility of many of the large supermarket chains [2], whilst also appealing to consumer segments demanding 'green' products.

The use of various types of eco-labels can, over time, influence fisheries management and governance [3]. This, however, requires that retailers and consumers continue to demand eco-labels. It is also of paramount importance that the price premiums achieved are sufficient to cover or exceed any additional costs incurred. In this way, the market may help promote the more environmentally friendly fishing methods at the expense of those that are less so. Knowledge of any such price premiums related to fishing method, or other characteristics such as provenance, at the retail level is thus important. Price premiums are also interesting because they indicate further opportunities for product differentiation.

However, surprisingly few studies have examined the existence and extent, if at all, of price premiums for different eco-labels and fishing methods at the retail level, or indeed at any other point in the value chain. Two recent exceptions are noteworthy. First, Roheim and colleagues [4] found that frozen products of MSC-labelled Alaska pollock gained a 13.3% price premium over non-MSC products across different supermarkets in metropolitan London. Second, Asche and Guillen [5] investigated price determinants for hake in a Spanish wholesale market (Mercabarna) and found that hake caught by long-line fetched higher prices than hake caught by trawl and gillnets.

A wider literature search suggests that no published studies exist concerning price premiums for particular fishing methods at the retail level. The present study starts to fill this void in

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knowledge by exploring price premiums for the attribute “line-caught” in selected supermarkets in the UK. The study, which is based on hedonic price analysis of a wide range of chilled pre-packed products of cod and haddock, also explores price premiums for the MSC-label, product form, country of origin and price differences between different product forms and supermarket chains. Thus, the study also contributes new insights regarding the nature and heterogeneity of the UK retail market for seafood.

The paper is organised as follows. The next section explains the rationale underlying the research design and presents the method of data collection. In Section 3, the hedonic model is specified and in Section 4, the results are presented. Finally, Section 5 discusses the results, their implications and possible avenues for further research.

## 2. Research design and data

Answering the question whether the attribute ‘line-caught’ gives a price premium at the retail level is not straightforward for several reasons. First, a wide range of products in many different markets and segments are based on fish caught by line of one sort or another (for instance, long line, small line and hand line) but not all will necessarily declare so on the pack. Legal compliance typically demands only declaration of whether the product was caught or farmed [6]. In addition, the method of capture is not always identifiable in the end market because fish landed by different fishing methods can be mixed in primary processing. These factors make it impossible to identify *all* line-caught products in the market. Moreover the willingness to pay for line-caught products (labelled or not) will probably vary considerably between different markets and consumer segments, reflecting a combination of line-caught and other attributes perceived to be important. In order to make some inroads into the line-caught sector, this paper is focussed on markets and segments where the products can readily be identified as such by customers.

A second difficulty in determining any price premium stems from the fact that retail outlets do not always carry a symmetrical range of line-caught products and those captured using other methods. These limitations of product range may thus introduce some variation between products other than their mode of capture such as fish size, quality and freshness. Third, differences may be compounded because different retailers may pursue their own unique promotional strategies at various points in time. For example, some may choose to focus on stable prices throughout the year whilst others may have seasonal promotions to attract customers; others still may opt to have more, or less, dynamic responses to the changes which are encountered within the naturally fluctuating supplies of fish. These considerations necessitate that product and price observations must cover a sufficiently long period so that reliable price averages can be obtained.

The standard and arguably simplest solution to reduce these challenges would be to purchase time series data based on electronic point of sale (EPOS) product bar codes. However, apart from the potentially prohibitive cost [7], especially at the individual store level, some product cues may not be evident from this source. Additional non-price data such as the presence of on-pack promotions, eco-label communications, country of origin, fishing method and so on are typically not readily available but are required for this study. Given the absence of these important qualitative dimensions, with which price levels are intrinsically linked, it was therefore deemed more desirable to conduct personal in-store observations [8].

The study is limited to the following seven British supermarket chains: Asda, Coop, Marks and Spencer, Morrisons, Sainsbury's, Tesco and Waitrose. Collectively these retail chains accounted for over 87% of the UK retail seafood market and over 95% of the chilled sector in 2010 [9]. As might be anticipated given the coverage of the market, these retailers encapsulate large variations in terms of their individual chain positions and associated strategies. The UK market was chosen because ecolabelling and labelling of fish as ‘line-caught’ is established and appears more widespread here than in many other markets [4,10]. To enable coverage across the wide range of retail chains within the same period, and because each chain often carries more or less the same stock, the study was limited to one store per retailer. This efficient use of resource also enabled data collection over a longer period of time and by the same research assistant to promote consistency of the (anonymous) in-store observations in Glasgow. More specifically, the prices for all chilled pre-packed products of cod and haddock were noted during the second half of each week when the product range and sales volumes normally are at their highest.

### 2.1. Sample and data

For each product information was gathered on catch method (line-caught or not), product form (loins, single fillets, or block/butterfly fillets), processing (skinless or skin-on, smoked or natural), promotion (on offer or not), origin (Icelandic, Norwegian, Scottish, or other), ecolabel (MSC-labelled or not) in the seven supermarket chains previously mentioned. Block/butterfly fillets and fillets with skin-on are only available for haddock. Continuous weekly observations from October 29th 2010 to February 10th 2012, some 68 weeks, give potentially 1496 and 3196 observations for the 22 cod products (10 line-caught) and 47 haddock products (21 line-caught), respectively. The data set contains some gaps due to product line deletions and new products added, resulting in 933 cod and 1864 haddock observations. Ten cod products and 18 haddock products were in stock in all 68 weeks. Descriptive statistics for the products are shown in Table 1.

Of the chilled pre-packed cod products, 55% were line-caught, whilst 43% of the haddock products were line-caught. Morrisons and Marks & Spencer have the largest selection of cod and haddock products, while Tesco and Waitrose have the smallest selection. There are no chilled pre-packed cod products from the Coop. Sainsbury's is the only supermarket with MSC certified cod products, while Sainsbury's, Asda, and Marks & Spencer have MSC certified haddock products. It should be noted that the presence of brands was too limited to give meaningful results, although this in itself reflects upon the dominance of supermarkets' labels within this category.

Information on promotion enables testing of the extent and size of any discount supermarkets give on cod and haddock products. Discounted cod products are found in Sainsbury's and Morrisons, with discounted haddock also found in the Coop. The number of observations showing any discount is small, which suggests that any effects on price are liable to be marginal.

## 3. Model specification

The hedonic pricing model specifies the price of a product as a function of the product attributes. In its general form the model can be written as:

$$P_{it} = f(s_1, \dots, s_n), \quad (1)$$

where  $P_{it}$  is the price of product  $i$  at time  $t$ , and  $s_1, \dots, s_n$  is a vector of attributes that determine the price of the product. In this study, the log-linear function form with estimates evaluated as

**Table 1**  
Variables and their descriptive statistics.

Variable	Description	COD		HADDOCK	
		Mean	Std.dev	Mean	Std.dev
Price	£ per kilogram	14.551	3.656	13.505	3.342
Ln P	Log of Price	2.640	0.288	2.572	0.253
Line	1 if line-caught, 0 otherwise	0.555	–	0.429	–
Loin	1 if loin, 0 fillet	0.400	–	0.170	–
Smoked	1 if smoked, 0 otherwise	0.283	–	0.595	–
On offer	1 if on offer, 0 otherwise	0.050	–	0.058	–
Asda	1 if Asda, 0 otherwise	0.160	–	0.212	–
Marks & Spencer	1 if M&S, 0 otherwise	0.219	–	0.281	–
Morrisons	1 if Morrisons, 0 otherwise	0.259	–	0.216	–
Sainsbury's	1 if Sainsbury's, 0 otherwise	0.152	–	0.101	–
Tesco	1 if Tesco, 0 otherwise	0.118	–	0.045	–
Waitrose	1 if Waitrose, 0 otherwise	0.092	–	0.068	–
Coop	1 if Coop, 0 otherwise	–	–	0.077	–
Icelandic	1 if Icelandic, 0 if otherwise	–	–	0.085	–
Norwegian	1 if Norwegian, 0 if otherwise	–	–	0.046	–
Scottish	1 if Scottish, 0 if otherwise	–	–	0.136	–
Skinless	1 if skinless, 0 otherwise	–	–	0.109	–
Butterfly fillet	1 if butterfly fillet, 0 otherwise	–	–	0.160	–
MSC-labelled	1 if MSC labelled, 0 otherwise	–	–	0.328	–

percentages was applied to two product groups, chilled pre-packed cod and haddock:

$$\ln P_{it} = a + \sum_{j=1}^k b_j s_j + e_{it}. \quad (2)$$

Dummy variable coding was used, as it is easy to interpret and rank the number of attributes represented by the parameters  $b_j$  listed in Table 1. This follows the established methodology of previous hedonic literature [4,7,11,12]. The parameters are interpreted as the percentage deviation from a basic product with a set of attributes not included in the regression. The basic product is a fillet displayed at Morrisons, not line-caught, not on offer, not smoked, not ecolabelled\*, not a block/butterfly fillet\* not Icelandic\*, not Norwegian\*, not Scottish\* and not skinless\*. Eq. (2) was estimated separately for cod and haddock<sup>1</sup> because seven attribute variables were either not available or appropriate for the cod regression. The econometric analysis was conducted using the STATA software, adjusting for heteroskedasticity as White's test on homoscedasticity was rejected [13,14].

#### 4. Results

Table 2 reports the parameter estimates and goodness-of-fit of the models. *F*-tests show that the models are highly significant with *p*-values < 0.0001. The attributes included explain 56% and 76% of variation in the price of cod and haddock products, respectively. Table 2 also shows that line-caught cod is 18% more expensive than cod caught by other gear. Cod loins are shown to be 27% more expensive than cod fillets, and smoked cod fillets are 7% more expensive than natural cod fillets. However, the largest differences occur between supermarkets. For example, the base cod product is 31% more expensive at Waitrose and Marks & Spencer than at Morrisons. The eco-label MSC was not included in the cod model since MSC certified cod was sold only by Sainsbury's and because this store did not carry cod without the MSC label.

<sup>1</sup> Coop supermarket and attributes marked with \* appeared only in the haddock regression.

**Table 2**  
Parameter estimates.

Variable	Cod		Haddock	
	Parameter estimates	Robust SE	Parameter estimates	Robust SE
Intercept	2.310***	0.023	2.282***	0.007
Line	0.180***	0.018	0.104***	0.017
Loin	0.270***	0.021	0.326***	0.007
Smoked	0.074***	0.014	0.031***	0.007
On offer	–0.034	0.030	–0.206***	0.011
Asda	0.033	0.024	–0.039	0.022
Marks & Spencer	0.314***	0.018	0.356***	0.017
Sainsbury's	–0.006	0.022	0.046	0.017
Tesco	0.013	0.022	–0.011***	0.020
Waitrose	0.306***	0.035	0.253***	0.030
Coop	–	–	0.088***	0.012
Icelandic	–	–	–0.064	0.026
Norwegian	–	–	–0.057	0.019
Scottish	–	–	0.120***	0.018
Skinless	–	–	0.017	0.010
Butterfly fillet	–	–	0.128***	0.009
MSC-labelled	–	–	0.101***	0.013
<i>R</i> <sup>2</sup>	0.557		0.764	
No. observations	933		1864	
<i>p</i> -value	< 0.001		< 0.001	

\*\*\* significant at 1%.

Results further indicate that line-caught haddock are 10% more expensive than haddock caught by other gear. Loins are 33% more expensive than fillets, while smoked and natural haddock fillets show only a very small price differential. Promotional activities occurred primarily at the Coop and Sainsbury's who lowered prices on the base haddock product by 21% on average. Analysis of cod showed no significant promotional influence on price. MSC-labelled haddock products are 10% more expensive than products without such labelling and Scottish origin fetches a 10% price premium on haddock.

Haddock block/butterfly fillets, as represented by the Block variable, are 13% more expensive than single fillets. Butterfly fillets have a lower yield (c30%–33%) compared to single fillets

(c47%–50%) and thus require a higher unit price to make up some of the relative losses incurred in filleting. However, in practice, block/butterfly fillets are typically based upon smaller fish, which tend to command a lower unit price; when consideration is given to respective product's costs and yields then the price premium is supported.

## 5. Discussion

The main contribution of this paper is its exploration of price premiums for fishing methods at the retail level of the value chain. The revealed price premium for line-caught cod and haddock within the chilled pre-packed segment is a strong signal that the market prefers line-caught fish compared to fish captured with other methods. The paper also contributes other interesting insights. The revealed 10% price premium for MSC-labelled haddock corroborate the 13.3% price premium found on frozen MSC-labelled Alaska pollock products in UK supermarkets [4]. The paper further contributes by demonstrating price differences between product forms, processing, country of origin and different supermarket chains within the chilled pre-packed segment. It is also noteworthy that brands are almost absent from the investigated products. In sum, these findings imply enhanced understanding of the nature and heterogeneity of the UK retail market for chilled fish. They also indicate opportunities for product differentiation based on sustainability and fishing method.

### 5.1. Limitations and future research

This study is the first to explore price premiums for fishing method at the retail level. It is also the first to explore the valuation of product attributes within the chilled pre-packed category within UK supermarkets. This implies that the results must be interpreted with caution and that further research should be carried out to improve present understanding of the issues under scrutiny here.

The results are based on data from seven supermarkets in one city in the UK market. Thus, an important question is whether the results are valid across the UK market. Although UK retail chains tend to carry more or less the same products across their different stores, consumer preferences and demand for different species and attributes may vary across different regions of the country. This may lead to regional price differences for different species and attributes. A recent study of hedonic prices for different frozen seafood products in UK supermarkets found indications that the retail market for frozen seafood in two different regions (London metropolitan area and the Lancashire area) had different valuation of different attributes [7]. Although that study focused on a different product category (frozen seafood) than the present study, it indicates that the valuation of attributes on chilled pre-packed products may also vary across the country. Thus, to improve the confidence in the results of the present study, it should be replicated in different regions of the UK. Such replications should be based on present knowledge regarding any traditional differences in seafood preferences in the UK. It would

also be relevant to conduct follow-up studies to monitor how the line-caught attribute and certified ecolabels are valued over time.

It would also be interesting to explore possible price premiums for fresh and frozen line-caught cod and haddock, as well as other line-caught species. In addition, similar studies should be conducted in other country markets to reveal if price premiums for line-caught fish exist outside the UK.

Based on the observed price premiums for line-caught fish revealed here it would be particularly interesting to explore in more detail exactly why consumers are willing to pay this premium. Given apparent background levels of understanding regarding other more common product cues, such as brands and certified eco-labels, questions might be asked as to what consumers really understand by 'line-caught'. And what might the implications, and appeals, of such a method of capture be? Are line-caught fish products perceived as better quality and/or more environmentally friendly than fish caught using other methods?

From the broader perspective along the supply chain, it would also be of interest to explore the extent to which price premiums for line-caught fish are fed back to processors, fishers and other channel actors—and the extent to which this might alter any future investment decisions in catching fish by line.

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## References

- [1] Brown J. An account of the dolphin-safe tuna issue in the UK. *Mar Policy* 2012;29:39–46.
- [2] Leadbitter D. Market-based mechanisms—improving fisheries management? In: Ward T, Phillips B, editors. *Seafood Ecolabelling: Principles and Practice*. Oxford, UK: Blackwell Publishing; 2008. p. 187–206.
- [3] Smith MD, Roheim AA, Crowder LB, Halpern BS, Turnipseed M, Anderson JL, et al. Sustainability and global seafood. *Science* 2010;327:784–786.
- [4] Roheim CA, Asche F, Santos JI. The elusive price premium for ecolabelled products: evidence from seafood in the UK market. *J Agric Econ* 2011;62:655–668.
- [5] Asche F, Guillen J. The importance of fishing method, gear and origin: the Spanish hake market. *Mar Policy* 2012;36:365–369.
- [6] SFIA (2012) <<http://www.seafish.org/retailers/labelling/legal-requirements>> (accessed 20/2/12).
- [7] Roheim CA, Gardiner L, Asche F. Value of brands and other attributes: hedonic analysis of retail frozen fish in the UK. *Mar Resour Econ* 2007;22:239–253.
- [8] Ward CE, Lusk JL, Dutton JM. Implicit value of retail beef product attributes. *J Agric Resour Econ* 2008;33:364–381.
- [9] SFIA (2011) *Seafood Retail Overview Q4 2010* Sea Fish Industry Authority.
- [10] Parkes G, Young JA, Walmsley SF, Abel R, Harman J, Horvat P, et al. Behind the signs—a global review of fish sustainability information schemes. *Rev Fish Sci* 2010;18:344–356.
- [11] McConnell K, Strand I. Hedonic prices for fish: tuna prices in Hawaii. *Am J Agric Econ* 2000;82:133–144.
- [12] Carroll M, Anderson JL, Martinez-Garmendia J. Pricing U.S. North Atlantic bluefin tuna and implications for management. *Agribusiness* 2001;17:243–254.
- [13] MacKinnon JG, White H. Some heteroskedasticity consistent covariance matrix estimators with improved finite sample properties. *J Econ* 1985;29:305–325.
- [14] Davidson R, MacKinnon JG. *Econometric theory and methods*. New York: Oxford University Press; 2004.