Price linkages in seafood value chains: Methodology and results

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Introduction

- The ex-vessel price of fish defines the profits and welfare of fishermen and their communities and is ultimately set by the end-user/retail demand for the commodity.

- Demand and supply functions are commonly specified for both farm and retail sectors, and the equilibrium is solved under general competitive conditions Gardner (1975).

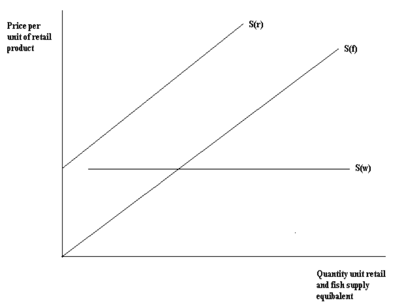
- The assumption of perfect competition seems appropriate when applied to setting the ex-vessel price of fish but inappropriate for setting price at the processing-distribution-retailing (PDR) sector of the fish market.

- In many industrialised countries a few supermarket chains account for a very large share of retail sales and seafood products. Therefore, non-competitive pricing at the PDR sector of the market may have important welfare implications for fishermen and fish farmers.

Theoretical framework: Assumptions

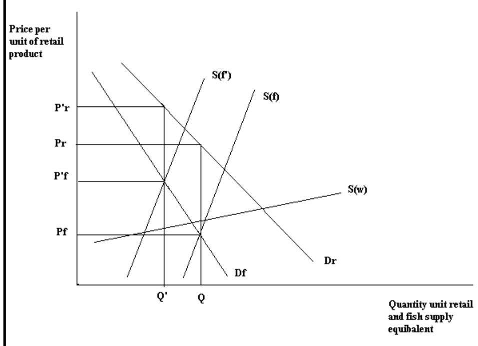
- The demand for fish from the fisherman or fish farmer is derived from demand for the end-user/retail commodity.
- The retail price will reflect the fish price plus the cost of marketing the commodity from the vessel or fish farmer to the retail level. “Marketing” in this context includes transportation, processing and distribution to the point of end use.
- The impact of a shock to fish landings on retail price will depend on the structure of the relationship between the two sectors.
- Let the retail/vessel price margin be the difference between the retail and vessel price…

Theoretical framework: fixed proportions relationship



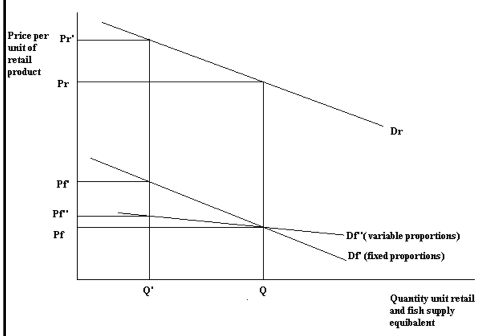
- Perfectly elastic supply of marketing inputs. The cost of using these inputs is constant per unit produced.
- Supply of the fish commodity at the retail level S(r) is the sum of fish supplied S(f) and the fixed supply of marketing inputs S(w).

Theoretical framework: Variable marketing cost



- Non-constant relationship between fish supply and marketing inputs. Increases in fish supply will cause changes in the margin.
- The upward sloping (*Sw)* represents the need to use proportionally larger amounts of marketing inputs to process increased levels of fish supply.
- Decreases in fish supply cause an increase in both ex-vessel and retail price but a decrease in the margin.

Theoretical framework: Substitution between commodity and marketing costs



- Assuming that the initial supply of fish is constant and set at *Q*, a decrease in harvest to *Q'* under fixed proportions will increase the price to *Pf'*.
- If it is possible to substitute marketing inputs for the higher priced fish the derived fish demand curve *(Df'')* is more elastic and the price of fish increases to only *Pf''*, .
- A decrease in fish supply can be associated with an increase in margin. The attributes of products may change over time, or at the same point in time.

Structural model

- A competitive equilibrium three equation model to measure variations in the marketing margin (Mi), retail price (Pri) and ex-vessel price (Pei) is due to Holloway (1991).
- Explanatory factors, which are the same for each equation, are defined as:

    a) Marketing costs (MCi).
    b) Retail demand shifter (RDi).
    c) Fish supply (Li)

- The Holloway model can be written as:

$$M_i = \beta_m + \beta_{mmc} MC_i + \beta_{mrd} RD_i + \beta_{mq} L_i + \varepsilon_1$$

$$pr_i = \beta_{pr} + \beta_{prmc} MC_i + \beta_{prrd} RD_i + \beta_{prq} L_i + \varepsilon_2$$

$$pf_i = \beta_{pf} + \beta_{pf} MC_i + \beta_{pfrd} RD_i + \beta_{pfq} L_i + \varepsilon_1$$

- Linear restrictions will test for competitive conditions.

Reduced form model

- Rely on statistical techniques to capture price linkage, where some form of cointegration among the prices defines the market and allows for predicting the consequence of price and random shocks in the price chain (Asche et al, 2007).
- If cointegration is proven, price transmission is confirmed and a shock in ex-vessel price will lead to a shock of similar magnitude in the rest of the chain. Otherwise, non-competitive pricing is in effect.
- This requires time series data on prices at different stages of the supply chain. For estimation, a sufficient number of observations is required.

Structural models: variables & data

- **Ex-vessel, ex-farm (Pf) and retail prices (Pr)**

Spanish National Observatory of Food Prices. The Ministry of Food and Agriculture (MAGRAMA) collects weekly prices at producer, wholesale and retail from 2004. Some fresh fish species included in the data sets are Hake; sardines; anchovy; blue whiting; mackerel and trout.

EUROSTAT external trade database. Used to obtain monthly series of CIF price for Spanish imports of different species.

Structural models: variables & data

- **Marketing costs (MC)**

Yearly Survey of Trade. Conducted by the Spanish Institute of Statistics (INE). Provides yearly estimations of total labor costs and expenses in services and products different that merchandise in the wholesale and retail sectors.

Occupation in the retail sector. Assuming that costs will vary according to the level of activity, occupation is used to decompose yearly marketing costs into monthly series.

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Structural models: variables & data

- **Retail demand shifter (RD)**

  Prices and Income. The National Institute of Statistics (INE) provides monthly and quarterly series for the Consumer Price Index and national disposable income.

  RD index. Main foodstuffs and the general non-food price index and disposable income are reduced, using principal components procedures, into a single factor of the form:

  $RD = 100 + b_1M + b_2S + b_3F + b_4G + b_5I$

  M = Meat cpi; S = Seafood cpi; F = Food & beverages cpi; G = General cpi;
  I = Disposable income

Structural models: variables & data

- **Supply (L)**

  MercaMadrid fish market statistics. Monthly traded quantities in the largest Spanish wholesale market of for each of the selected species were used in an attempt to have a proxy of landings and imports.

  EUROSTAT external trade database. Used to obtain monthly series of cif price for Spanish imports of different species.

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Structural models: GFI & Parameter estimates

GOODNESS OF FIT		Margin	Retail P	Ex-vessel P
Blue whiting	R2	0,537	0,780	0,597
	DW	1,750	1,332	1,689
	F	8,981***	3,562***	8,852***
Anchovy	R2	0,433	0,861	0,579
	DW	1,939	2,293	2,063
	F	5,963***	4,064***	7,835***
Mackerel	R2	0,488	0,683	0,525
	DW	1,817	1,350	1,822
	F	13,283***	7,882***	15,381***
Hake	R2	0,475	0,640	0,533
	DW	2,004	2,514	2,045
	F	2,080*	5,187***	0,475
Sardine	R2	0,555	0,925	0,660
	DW	1,981	1,931	1,924
	F	5,620***	1,448	6,801***
Trout	R2	0,688	0,979	0,816
	DW	1,677	1,291	1,672
	F	0,393	0,750	3,102**

PARAMETERS		Margin	Retail P	Ex-vessel P
Blue whiting	MC	-0,202	0,071	0,252
	RD	2,073	3,386**	2,132
	L	0,336***	-0,010	-0,342***
Anchovy	MC	0,639**	-0,114	-0,737**
	RD	-2,655	0,834	6,234
	L	0,163***	-0,029***	-0,198***
Mackerel	MC	-2,232**	0,0128568	2,295**
	RD	4,586	2,991**	-1,333
	L	0,404***	-0,030***	-0,439***
Hake	MC	-0,030	0,065	-0,048
	RD	7,100	5,396*	-4,834
	L	0,136	0,057***	-0,062
Sardine	MC	1,471***	-0,024	-1,519***
	RD	-15,898***	-2,781	21,828***
	L	0,033	-0,014	-0,049
Trout	MC	-0,038	-0,001	0,019
	RD	-1,926	0,537	6,513**
	L	0,006	-0,005	-0,014

Structural models: GFI & parameter estimates

- Different species, different market conditions. Only three of the six fish species selected resulted in significant F values for all the three equations. At least one equation resulted significant in any of the other three species.
- Supply volume (L) is the most influential factor in the majority of species and equations. Excepting for sardines and trout, traded volumes affect prices and/or margins in different ways.
- Demand shifter (RD) influences retail price for blue whiting, mackerel and hake, but it is not relevant in any other species. Margins and ex-vessel prices of sardine, as well as trout's ex-farm price, appear to be also affected by this factor.
- Marketing costs (MC) resulted significant for anchovy, mackerel and sardine in the equations of margin and ex-vessel price. Parameter signs differ between mackerel and the other two species.

Structural models: Testing for perfect competition

- To consider perfect competition verify H_1 and reject H_2.

		Margin	Retail P	Ex-vessel P
Blue whiting	H_1: RD + L = 0	0.161	4.980	0.065
	H_2: MC = 0	0.213	0.810	0.266
Anchovy	H_1: RD + L = 0	0.384	0.116	1.141
	H_2: MC = 0	4.231	2.318	4.563
Mackerel	H_1: RD + L = 0	0.447	3.999	0.054
	H_2: MC = 0	5.854	0.011	5.940
Hake	H_1: RD + L = 0	2.495	3.105	0.569
	H_2: MC = 0	0.005	0.355	0.011
Sardine	H_1: RD + L = 0	11.402	1.937	15.857
	H_2: MC = 0	12.573	0.210	11.537
Trout	H_1: RD + L = 0	0.585	0.320	6.797
	H_2: MC = 0	0.135	0.002	0.035

- Only anchovy somehow satisfies the conditions for all three equations. Mackerel fits restrictions for margins and ex-vessel price. Perfect competitive conditions could be rejected in any other case.

Reduced form models: results

		Domestic prices		Including imports	
	Rank	Trace	Lmax	Trace	Lmax
Blue whiting	0	74,122***	45,006***	128,400***	50,539***
	1	29,116**	22,154**	77,863***	46,679***
	2	6,962	6,962	31,184***	18,703*
Anchovy	0	32,044	15,515	88,730***	49,501***
	1	16,529	13,009	39,229*	25,563**
	2	3,5202	3,5202	13,666	10,854
Mackerel	0	47,610**	31,394***	144,460***	92,603***
	1	16,216	10,369	51,855***	27,828**
	2	5,8474	5,8474	24,027*	18,966*
Hake	0	41,457*	27,474**	123,320***	60,749***
	1	13,983	9,882	62,568***	41,817***
	2	4,101	4,101	20,751	16,484*
Sardine	0	50,675***	25,436*	95,399***	43,871***
	1	25,238*	15,149	51,529***	25,093**
	2	10,090	10,090	26,436**	20,840**
Trout	0	53,856***	27,346**	187,000***	99,741***
	1	26,510**	21,186**	87,259***	53,855***
	2	5,3241	5,3241	33,404***	26,954***

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Reduced form models: results

- Perfect price transmission is harder to achieve when using local series. The number of cointegrating vectors increases when the prices of imports are included in the models.
- Only one of the five wild species (Blue whiting), resulted in cointegration with local prices. Trout, as the only farmed species, also confirm price transmission with local data.
- All successful models link retail price with imports. Local price also affect retail in all cases but hake and trout. Wholesalers' are significant for all species retail price with the exception of hake.

Conclusions

- When considering domestic seafood production and retailing, a perfect competitive framework does not fit with observed data in the majority of the species considered.
- Inclusion of import price series result in significant cointegration across prices of the value chain for almost all wild species. Imports improve price transmission in the value chain.