

Analysis of the Price Transmission along the Spanish Market Chain for different Seafood Products

Guillen, Jordi & Franquesa, Ramon

GEM-University of Barcelona

jordi@gemub.com

Abstract

Spain is one of the main seafood markets in Europe and the world. Seafood consumption has traditionally been very important in Spain (in 2005 were consumed about 36.7 kg per capita) (MAPA, several years). However, little attention has been paid to the market and how the different levels of the market chain interact. Hence this paper, using weekly data, analyses the Price Transmission Elasticity for twelve seafood products along the Spanish market chain (Ex-vessel, Wholesale and Retail levels). Moreover, then it is investigated the Price transmission asymmetry along these market levels. The results obtained show important implications when examining demand analysis and margins along the seafood value chain. By ignoring them, estimations would be biased.

Introduction

Spain is one of the most important seafood markets in Europe, due to its high consumption levels based on its high volume of landings and imports. Seafood consumption is very important in Spain (about 36.7 kg per capita in 2005).

While there are studies focusing on the species, fleets and their production; little attention has been paid to the Spanish market and how the different levels of the market chain interact.

The 12 fresh seafood species (Hake, Small Hake, Sardine, Anchovy, Mackerel, Blue Whiting, Horse Mackerel, Megrim, Salmon, Trout, Stripped Venus and Mussels) analysed in this study are the main fish species consumed in Spain. They account for the 60% of the fresh seafood commercialised in all the wholesale markets in terms of quantity, and 40% in terms of value.

The results obtained show important implications when examining demand analysis and margins along the seafood value chain. By ignoring them, estimations would be biased.

Methodology

The relationships between two stages in the value chain are well developed by the theory of derived demand; where at any point in the chain, the demand equation is derived from the profit maximisation problem of the agent at the highest level; and the supply equation is derived from the profit maximisation problem of the agent at the lower level of the market chain (Hicks, 1956; Gardner 1975).

However, in practice, the high data requirements to estimate such relationships often make it impossible to estimate. Therefore, analysis of just prices at different levels of the market chain is more commonly employed, especially for primary products, as can be seen on recent examples for beef, oil products, cod and hake in Gjørberg & Johnsen (1999), Goodwin & Holt (1999), Asche et al. (2002) and Jaffry (2004).

Following the extensive analysis carried out by George & King (1971) for a significant number of commodities, displayed that linkages between a product's prices (margins) over the market chain often implied a combination of both constant absolute and constant percentage margins. The justification for this specification of pricing up (establishing margins) is mainly empirical, as it early appears on Thomsen (1951), Buse & Brandow (1960), Dalrymple (1961), Shepherd (1962) and Waugh (1964).

Therefore, the price of a certain product at a certain level in the value chain can be expressed in function of the price of the same product at a different level of the value chain as shown on equation 1.

$$P_r = c + b \cdot P_e \quad (\text{eq. 1})$$

The notation used here is P_r as the retail price, and P_e as the ex-vessel price; while c stands for a constant mark-up and b for a proportional mark-up.

Moreover, it is common practice to assume fixed input proportions (Wohlgenant, 2001), or even a single variable input for the model (Asche et al., 2002); which is a reasonable assumption in the case of the fresh seafood marketing chain since the cost of raw

material represents often more than 80% of total cost (Asche et al., 2002; and Guillotreau et al., 2000).

Following this approach, it can be estimated the elasticity of the price transmission, which measures the percentage change in the retail price to the relative change in the ex-vessel price.

Furthermore, the study finishes with an analysis of the Price transmission asymmetries. In the literature, the analysis of Price transmission asymmetries is often related with market power. Market power may be used by retailers not to fully transmit decreases in their supply price, while perfect transmit the price increases.

The Data

For this analysis there are used the 104 weekly price observations for 2005 and 2006 of 12 fresh seafood species at 3 different levels of the Spanish market chain.

The 12 fresh seafood species analysed (Hake, Small Hake, Sardine, Anchovy, Mackerel, Blue Whiting, Horse Mackerel, Megrim, Salmon, Trout, Stripped Venus and Mussels) are the most consumed in Spain.

From these 12 fresh seafood species, 8 of them can be considered wild fish species (Hake, Small Hake, Sardine, Anchovy, Mackerel, Blue Whiting, Horse Mackerel and Megrim). While for the other 4 species, the main production source is aquaculture; 2 of them are fish species (Salmon and Trout), and the other 2 are shellfish (Stripped Venus and Mussels). Moreover, of this 4 farmed species, the national Spanish production is the main source for Trout and Mussels.

These species account for the 60% of the fresh seafood commercialised in all the wholesale markets in terms of quantity, and 40% in terms of value. While the three different market levels chain (Ex-vessel, Wholesale and Retail) are the most significant ones.

This wide range of species allows studying the Spanish seafood market in detail.

Next, there can be seen the figures showing the price evolution for the 12 seafood species at the three different market levels.

Figure 1: Hake prices evolution

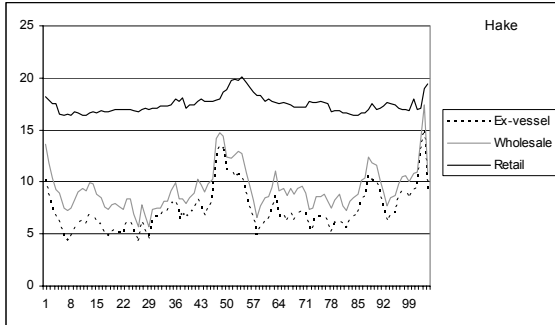


Figure 2: Small hake prices evolution

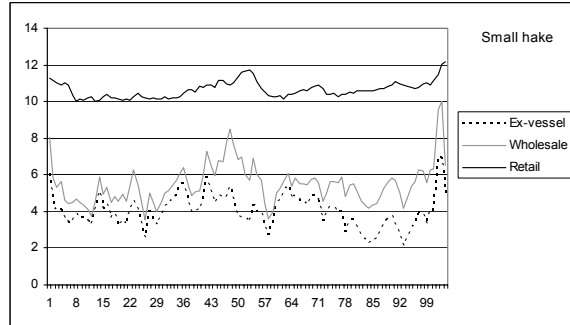


Figure 3: Sardine prices evolution

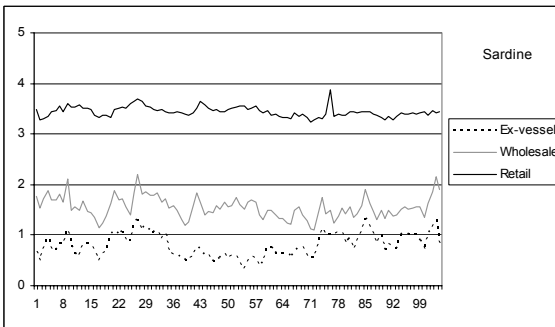


Figure 4: Anchovy prices evolution

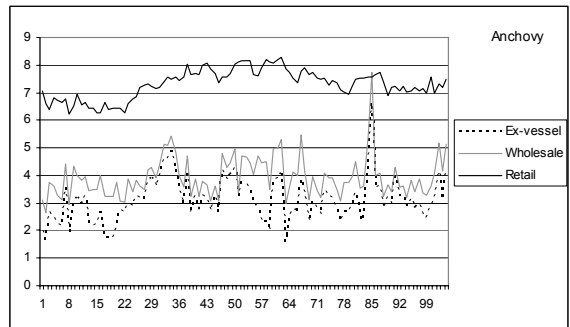


Figure 5: Mackerel prices evolution

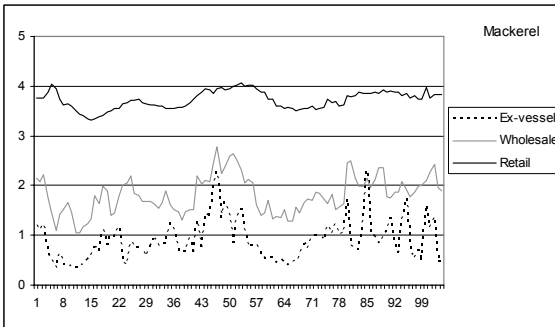


Figure 6: Blue whiting prices evolution

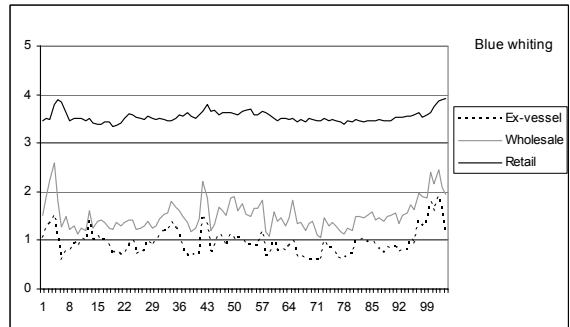


Figure 7: Horse mackerel prices evolution

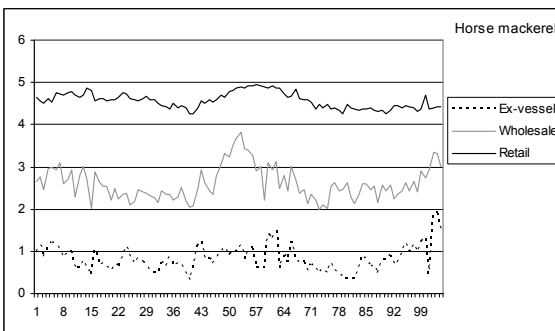


Figure 8: Megrim prices evolution

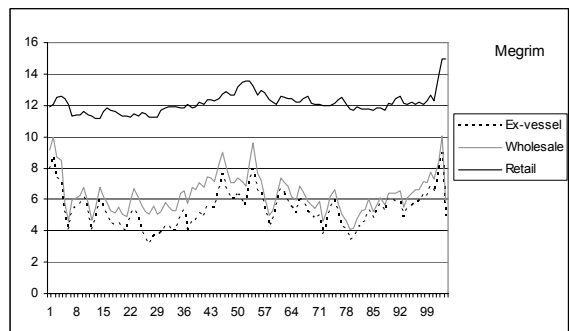


Figure 9: Salmon prices evolution

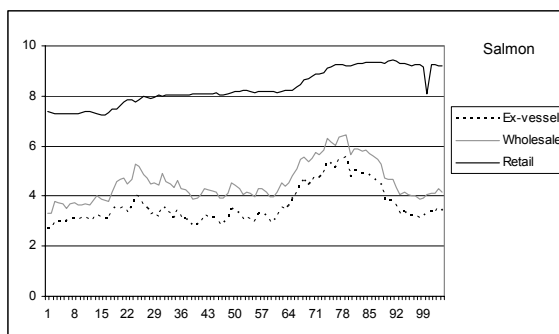


Figure 10: Trout prices evolution

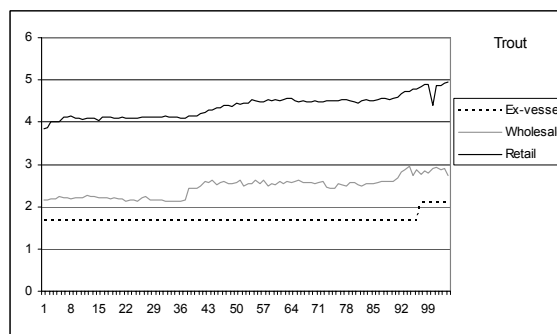


Figure 11: Stripped venus prices evolution

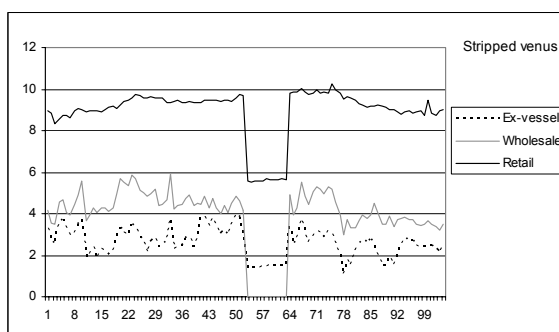
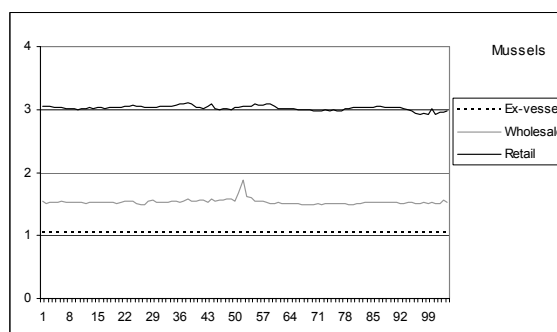


Figure 12: Mussels prices evolution



From the previous figures it can be seen that the different fresh seafood species' prices follow different evolution patterns.

Moreover, prices for wild species at the Ex-vessel and Wholesale levels show high variability and similar trends. While prices at the retail level present lower variations. This can be explained by the existence of more substitutes and sources available, as well as, the presence of larger other costs than raw fish, at the downstream (retail) level.

Furthermore, it can also be seen that aquaculture species farmed at the national level show lower volatility levels, which can be explained by the more regular seafood supply and the lower risks. Moreover, variations increase down in the market chain (retail).

For a more formal and further analysis, some descriptive statistics (mean, standard deviation and the coefficient of variation) for the prices of the 12 seafood species at the 3 different market levels are presented on table 1.

Table 1: Descriptive statistics for the 12 fresh seafood species analysed

Ex-vessel	Wholesale	Retail
-----------	-----------	--------

	Mean	Std. Dev.	CV	Mean	Std. Dev.	CV	Mean	Std. Dev.	CV
Hake	7.34	2.10	28.61	9.35	2.03	21.74	17.43	0.82	4.71
Small Hake	4.02	0.90	22.50	5.50	1.11	20.24	10.64	0.45	4.22
Sardine	0.80	0.23	28.38	1.55	0.21	13.73	3.44	0.10	2.91
Anchovy	3.11	0.79	25.39	3.94	0.75	18.99	7.30	0.53	7.25
Mackerel	0.90	0.41	45.57	1.82	0.37	20.57	3.72	0.18	4.78
Blue Whiting	0.96	0.27	27.66	1.51	0.30	20.09	3.54	0.12	3.30
Horse Mackerel	0.83	0.30	36.64	2.61	0.39	15.01	4.57	0.18	4.03
Megrim	5.36	1.15	21.37	6.34	1.21	19.15	12.14	0.68	5.61
Salmon	3.63	0.74	20.30	4.55	0.77	16.94	8.33	0.71	8.49
Trout	1.68	0.12	7.15	2.46	0.23	9.39	4.37	0.26	5.90
Stripped Venus	2.60	0.71	27.16	4.35	0.68	15.55	8.92	1.20	13.46
Mussels	1.05	0.00	0.00	1.53	0.05	2.97	3.03	0.04	1.22

From table 1, previous conclusions can be complemented. For wild species, the Price variability (Coefficient of Variation) decreases as it goes down in the market chain (from ex-vessel to retail levels). Moreover, the standard deviation also decreases. This leads us to think that it is due to the existence of more substitutes and sources available, and not due to the presence of larger other costs than raw fish, at the downstream (retail) level (which may lead to lower coefficient of variations, but similar standard deviation coefficients). While farmed species do not show a clear group trend.

Analysis

On table 2, it can be seen the degree of correlation between the log of the price series for the 12 seafood species at the 3 different market levels analysed.

On table 2, the 3 market levels, Ex-vessel, Wholesale and Retail, are coded as E, W and R, respectively. While 1 stands for Hake, 2 for Small Hake, 3 for Sardine, 4 for Anchovy, 5 for Mackerel, 6 for Blue Whiting, 7 for Horse Mackerel, 8 for Megrim, 9 for Salmon, 10 for Trout, 11 for Stripped Venus and 12 for Mussels.

It should be noted that the analysis is going to be performed considering all prices in cents, but not in euros, so prices were multiplied by 100, in order to avoid that the log of prices have a negative value.

Table 2: Correlation matrix of the log prices for the 12 seafood species at the 3 different market levels analysed

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	
E1	1	0.38	-0.14	0.35	0.34	0.46	0.38	0.65	-0.14	0.43	-0.04	na	0.94	0.79	0.09	0.24	0.52	0.60	0.43	0.63	-0.13	0.57	-0.36	0.37	0.59	0.72	-0.14	0.44	0.53	0.42	-0.19	0.69	0.37	0.49	-0.10	-0.24	
E2	0.38	1	-0.25	0.03	-0.03	0.29	0.28	0.34	-0.27	0.23	0.23	na	0.43	0.74	0.09	0.06	-0.05	0.29	0.18	0.47	-0.21	-0.07	0.17	0.11	0.42	0.19	0.01	0.15	-0.18	0.35	0.19	0.39	-0.26	-0.11	0.21	-0.12	
E3	-0.14	-0.25	1	0.24	-0.03	0.17	0.00	-0.22	0.32	0.21	-0.24	na	-0.23	-0.16	0.61	0.22	0.06	0.06	-0.12	-0.27	0.32	-0.03	-0.06	-0.26	-0.34	-0.27	0.27	-0.23	0.04	-0.05	-0.22	-0.19	0.31	0.20	-0.10	-0.16	
E4	0.35	0.03	0.24	1	0.29	0.19	0.08	-0.04	0.08	0.05	0.08	na	0.16	0.17	0.38	0.85	0.25	0.19	0.06	0.03	0.19	0.13	0.05	0.21	0.25	0.17	0.23	0.55	0.30	0.19	-0.14	0.23	0.31	0.21	0.18	0.11	
E5	0.34	-0.03	-0.03	0.29	1	0.07	-0.11	0.14	0.18	-0.06	-0.06	na	0.24	0.33	-0.06	0.17	0.63	0.18	-0.03	0.16	0.25	0.26	-0.15	0.18	0.27	0.25	-0.11	0.30	0.40	-0.06	-0.34	0.21	0.34	0.19	0.16	0.07	
E6	0.46	0.29	0.17	0.19	0.07	1	0.41	0.46	-0.41	0.54	0.04	na	0.42	0.40	0.43	0.27	0.28	0.83	0.35	0.51	-0.42	0.07	-0.31	0.18	0.18	0.27	0.12	-0.03	0.19	0.41	0.01	0.30	-0.10	0.06	-0.42	-0.16	
E7	0.38	0.28	0.00	0.08	-0.11	0.41	1	0.53	-0.40	0.41	0.31	na	0.45	0.41	0.35	0.08	0.17	0.54	0.67	0.54	-0.46	0.22	-0.08	0.19	0.33	0.46	0.14	0.00	0.37	0.60	0.24	0.47	-0.12	0.16	-0.32	-0.24	
E8	0.65	0.34	-0.22	-0.04	0.14	0.46	0.53	1	-0.28	0.37	0.16	na	0.74	0.61	0.03	-0.02	0.32	0.58	0.41	0.91	-0.37	0.42	-0.30	0.20	0.37	0.59	-0.21	0.05	0.37	0.38	0.06	0.54	0.06	0.29	-0.34	-0.33	
E9	-0.14	-0.27	0.32	0.08	0.18	-0.41	-0.40	-0.28	1	-0.15	-0.29	na	-0.17	-0.13	-0.25	0.13	0.10	-0.34	-0.29	-0.47	0.96	0.24	-0.01	-0.37	-0.16	-0.12	-0.21	0.23	-0.04	-0.41	-0.33	-0.06	0.63	0.41	0.52	-0.15	
E10	0.43	0.23	0.21	0.05	-0.06	0.54	0.41	0.37	-0.15	1	-0.13	na	0.40	0.42	0.19	0.09	0.21	0.55	0.31	0.34	-0.21	0.49	-0.43	-0.05	0.16	0.47	-0.05	0.01	0.20	0.48	-0.21	0.48	0.30	0.54	-0.31	-0.58	
E11	-0.04	0.23	-0.24	0.08	-0.06	0.04	0.31	0.16	-0.29	-0.13	1	na	-0.03	0.12	0.20	0.04	0.05	0.13	0.12	0.30	-0.22	-0.15	0.68	0.21	0.28	0.08	0.20	0.23	0.13	0.30	0.38	0.10	-0.36	-0.25	0.19	0.03	
E12	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
W1	0.94	0.43	-0.23	0.16	0.24	0.42	0.45	0.74	-0.17	0.40	-0.03	na	1	0.78	0.07	0.14	0.42	0.57	0.55	0.66	-0.22	0.52	-0.38	0.35	0.54	0.71	-0.16	0.26	0.45	0.43	-0.04	0.67	0.21	0.41	-0.19	-0.29	
W2	0.79	0.74	-0.16	0.17	0.33	0.40	0.41	0.61	-0.13	0.42	0.12	na	0.78	1	0.10	0.12	0.45	0.55	0.38	0.65	-0.09	0.43	-0.18	0.27	0.63	0.62	-0.10	0.34	0.34	0.49	-0.06	0.71	0.20	0.36	0.09	-0.29	
W3	0.09	0.09	0.61	0.38	-0.06	0.43	0.35	0.03	-0.25	0.19	0.20	na	0.07	0.10	1	0.34	0.10	0.36	0.26	0.12	-0.21	-0.23	0.06	0.17	0.05	0.04	0.50	-0.12	0.23	0.39	0.14	0.08	-0.17	-0.13	-0.25	0.02	
W4	0.24	0.06	0.22	0.85	0.17	0.27	0.08	-0.02	0.13	0.09	0.04	na	0.14	0.12	0.34	1	0.13	0.24	0.17	-0.02	0.17	0.03	0.00	0.11	0.12	0.08	0.11	0.38	0.08	0.10	-0.02	0.20	0.18	0.15	0.08	0.05	
W5	0.52	-0.05	0.06	0.25	0.63	0.28	0.17	0.32	0.10	0.21	0.05	na	0.42	0.45	0.10	0.13	1	0.39	0.19	0.34	0.15	0.41	-0.21	0.29	0.38	0.51	-0.01	0.34	0.62	0.19	-0.22	0.41	0.40	0.38	0.06	-0.07	
W6	0.60	0.29	0.06	0.19	0.18	0.83	0.54	0.58	-0.34	0.55	0.13	na	0.57	0.55	0.36	0.24	0.39	1	0.42	0.60	-0.35	0.31	-0.37	0.19	0.38	0.56	-0.08	0.14	0.45	0.58	-0.10	0.54	0.08	0.26	-0.40	-0.21	
W7	0.43	0.18	-0.12	0.06	-0.03	0.35	0.67	0.41	-0.29	0.31	0.12	na	0.55	0.38	0.26	0.17	0.19	0.42	1	0.35	-0.38	0.24	-0.25	0.39	0.37	0.47	0.14	0.04	0.35	0.50	0.35	0.49	-0.13	0.17	-0.29	-0.21	
W8	0.63	0.47	-0.27	0.03	0.16	0.51	0.54	0.91	-0.47	0.34	0.30	na	0.66	0.65	0.12	-0.02	0.34	0.60	0.35	1	-0.47	0.29	-0.15	0.31	0.48	0.57	-0.05	0.16	0.38	0.48	0.09	0.54	-0.09	0.10	-0.25	-0.16	
W9	-0.13	-0.21	0.32	0.19	0.25	-0.42	-0.46	-0.37	0.96	-0.21	-0.22	na	-0.22	-0.09	-0.21	0.17	0.15	-0.35	-0.38	-0.47	1	0.16	0.12	-0.30	-0.08	-0.16	-0.14	0.34	-0.05	-0.42	-0.34	-0.08	0.61	0.34	0.66	-0.02	
W10	0.57	-0.07	-0.03	0.13	0.26	0.07	0.22	0.42	0.24	0.49	-0.15	na	0.52	0.43	-0.23	0.03	0.41	0.31	0.24	0.29	0.16	1	-0.51	0.00	0.33	0.66	-0.29	0.46	0.50	0.28	-0.39	0.59	0.76	0.91	-0.02	-0.57	
W11	-0.36	0.17	-0.06	0.05	-0.15	-0.31	-0.08	-0.30	-0.01	-0.43	0.68	na	-0.38	-0.18	0.06	0.00	-0.21	-0.37	-0.25	-0.15	0.12	-0.51	1	0.02	0.02	-0.43	0.22	0.06	-0.34	-0.17	0.40	-0.33	-0.41	-0.50	0.51	0.27	
W12	0.37	0.11	-0.26	0.21	0.18	0.18	0.19	0.20	-0.37	-0.05	0.21	na	0.35	0.27	0.17	0.11	0.29	0.19	0.39	0.31	-0.30	0.00	0.02	1	0.56	0.38	0.21	0.28	0.35	0.28	0.25	0.33	-0.15	-0.08	0.02	0.26	
R1	0.59	0.42	-0.34	0.25	0.27	0.18	0.33	0.37	-0.16	0.16	0.28	na	0.54	0.63	0.05	0.12	0.38	0.38	0.37	0.48	-0.08	0.33	0.02	0.56	1	0.66	-0.04	0.53	0.36	0.41	0.09	0.75	0.12	0.24	0.28	-0.03	
R2	0.72	0.19	-0.27	0.17	0.25	0.27	0.46	0.59	-0.12	0.47	0.08	na	0.71	0.62	0.04	0.08	0.51	0.56	0.47	0.57	-0.16	0.66	-0.43	0.38	0.66	1	-0.23	0.43	0.68	0.66	-0.20	0.88	0.39	0.56	-0.18	-0.28	
R3	-0.14	0.01	0.27	0.23	-0.11	0.12	0.14	-0.21	-0.21	-0.05	0.20	na	-0.16	-0.10	0.50	0.11	0.01	-0.08	0.14	-0.05	-0.14	-0.29	0.22	0.21	-0.04	-0.23	1	0.01	0.06	0.19	0.31	-0.17	-0.30	-0.30	0.09	0.18	
R4	0.44	0.15	-0.23	0.55	0.30	-0.03	0.00	0.05	0.23	0.01	0.23	na	0.26	0.34	-0.12	0.38	0.34	0.14	0.04	0.16	0.34	0.46	0.06	0.28	0.53	0.43	0.01	1	0.41	0.21	-0.24	0.46	0.47	0.38	0.51	0.05	
R5	0.53	-0.18	0.04	0.30	0.40	0.19	0.37	0.37	-0.04	0.20	0.13	na	0.45	0.34	0.23	0.08	0.62	0.45	0.35	0.38	-0.05	0.50	-0.34	0.35	0.36	0.68	0.06	0.41	1	0.56	-0.23	0.51	0.39	0.39	-0.16	-0.02	
R6	0.42	0.35	-0.05	0.19	-0.06	0.41	0.60	0.38	-0.41	0.48	0.30	na	0.43	0.49	0.39	0.10	0.19	0.58	0.50	0.48	-0.42	0.28	-0.17	0.28	0.41	0.66	0.19	0.21	0.56	1	0.04	0.62	-0.01	0.19	-0.29	-0.17	
R7	-0.19	0.19	-0.22	-0.14	-0.34	0.01	0.24	0.06	-0.33	-0.21	0.38	na	-0.04	-0.06	0.14	-0.02	-0.22	-0.10	0.35	0.09	-0.34	-0.39	0.40	0.25	0.09	-0.20	0.31	-0.24	-0.23	0.04	1	-0.12	-0.68	-0.45	0.10	0.11	
R8	0.69	0.39	-0.19	0.23	0.21	0.30	0.47	0.54	-0.06	0.48	0.10	na	0.67	0.71	0.08	0.20	0.41	0.54	0.49	0.54	-0.08	0.59	-0.33	0.33	0.75	0.88	-0.17	0.46	0.51	0.62	-0.12	1	0.35	0.55	-0.02	-0.32	
R9	0.37	-0.26	0.31	0.31	0.34	-0.10	-0.12	0.06	0.63	0.30	-0.36	na	0.21	0.20	-0.17	0.18	0.40	0.08	-0.13	-0.09	0.61	0.76	-0.41	-0.15	0.12	0.39	-0.30	0.47	0.39	-0.01	-0.68	0.35	1	0.88	0.19	-0.39	
R10	0.49	-0.11	0.20	0.21	0.19	0.06	0.16	0.29	0.41	0.54	-0.25	na	0.41	0.36	-0.13	0.15	0.38	0.26	0.17	0.10	0.34	0.91	-0.50	-0.08	0.24	0.56	-0.30	0.38	0.39	0.19	-0.45	0.55	0.88	1	0.02	-0.66	
R11	-0.10	0.21	-0.10	0.18	0.16	-0.42	-0.32	-0.34	0.52	-0.31	0.19	na	-0.19	0.09	-0.25	0.08	0.06	-0.40	-0.29	-0.25	0.66	-0.02	0.51	0.02	0.28	-0.18	0.09	0.51	-0.16	-0.29	0.10	-0.02	0.19	0.02	1	0.10	
R12	-0.24	-0.12	-0.16	0.11	0.07	-0.16	-0.24	-0.33	-0.15	-0.58	0.03	na	-0.29	-0.29	0.02	0.05	-0.07	-0.21	-0.21	-0.16	-0.02	-0.57	0.27	0.26	-0.03	-0.28	0.18	0.05	-0.02	-0.17	0.11	-0.32	-0.39	-0.66	0.10	1	

It should be noted that E12, which are mussels at the ex-vessel level, presents a non available (na) result, because prices were constant during all the analysis period.

Some more interesting results can be obtained from the correlation matrix, table 2. It can be seen that:

- The high value species (Hake, Small Hake and Megrim) show more similar trends with other species (a higher sum of the correlation coefficients). While most of the farmed (Salmon, Stripped venus, and Mussels) and the lowest value species (Sardine) show the lowest similarities with other species. This can be possible due to the lowest number of farmed and shellfish species.
- Prices at the retail level present more similar trends (a higher sum of the correlation coefficients), while prices at the ex-vessel level show less similar trends.
- The degree of correlation between the ex-vessel and the wholesale market is higher for most of the species analysed, as can be seen in table 3.

Table 3: Correlation coefficients between market levels for the 12 species analysed

	E-W	E-R	W-R
Hake	0.94	0.59	0.54
Small Hake	0.74	0.19	0.62
Sardine	0.61	0.27	0.50
Anchovy	0.85	0.55	0.38
Mackerel	0.63	0.40	0.62
Blue Whiting	0.83	0.41	0.58
Horse Mackerel	0.67	0.24	0.35
Megrim	0.91	0.54	0.54
Salmon	0.96	0.63	0.61
Trout	0.49	0.54	0.91
Stripped Venus	0.68	0.19	0.51
Mussels	-	-	0.26

From previous table it can be seen that the sum of the correlation coefficients are higher between the ex-vessel and wholesale markets, then between the wholesale and retail markets and finally between the ex-vessel and retail markets.

Moreover, there is a positive relationship between the species' prices and the correlation coefficients.

This relation between prices and correlation coefficients is stronger and higher at the more upstream levels. The prices and correlation coefficients between ex-vessel and wholesale markets elasticity (relation) is 0.17, with a significance (R-sq.) of 0.5. This elasticity implies that when the species value increase in 1%, the correlation coefficients between ex-vessel and wholesale markets increases in 0.17%.

Causality

Most of the literature on fresh products' markets, conclude that short run variations in the upstream (production level) prices precede changes at the downstream (retail) level prices. Moreover most studies on seafood products state that wholesale markets influence the ex-vessel price, since it is the place where the largest amount of supply and demand it is met.

In order to analyse the influences between market levels it is necessary to apply a test for weak exogeneity, as the Granger Causality Tests. A test already employed in Hartmann, et al. (2000); Jiménez-Toribio, et al. (2003); García Del Hoyo, (2002); etc.

The Granger approach to the question of whether “x” causes “y” is to see how much of the current “y” can be explained by past values of “y” and then to see whether adding lagged values of “x” can improve the explanation. Where “x” and “y” can be “price” and “quantity” or any two other variables.

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_n y_{t-n} + \beta_1 x_{t-1} + \dots + \beta_n x_{t-n} \quad (\text{eq. 1})$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_n x_{t-n} + \beta_1 y_{t-1} + \dots + \beta_n y_{t-n} \quad (\text{eq. 2})$$

“y” is said to be Granger-caused by “x” if “x” helps in the prediction of “y”, or equivalently if the coefficients on the lagged “x”'s are statistically significant (Granger 1969).

The null hypothesis is that “x does not Granger-cause y” in the first regression and that “y does not Granger-cause x” in the second regression. The Granger causality test reports the Wald F-statistics for the joint hypothesis.

$$\beta_1 = \dots = \beta_n = 0 \quad (\text{eq. 3})$$

It is important to note that the statement “x Granger causes y” does not imply that “y” is the effect or the result of “x”. Granger causality measures precedence and information content but does not by itself indicate causality in the strict sense of the term.

Furthermore, the Granger causality test do not incorporate an information criteria, like the Akaike or Schwarz, that could help to choose the proper number of lags required for the analysis. Moreover, the intra-daily nature of the transactions makes an analysis based on weekly data at least criticisable.

Other tests have been also applied in the literature, as the ones in Sims (1972), Hausman (1978) and Geweke, Meese & Dent (1983).

On table 4 there are presented the results from the Granger causality test analysing the relations between markets for the 12 seafood species.

Table 4: Granger causality test results for the 12 species analysed

	E-W	E-R	W-R
Hake	←	→	→
Small Hake		→	→
Sardine	←		→
Anchovy	←		←
Mackerel	→	→	→
Blue Whiting		→	→
Horse Mackerel		→	→
Megrim		→	→
Salmon		→	→
Trout	←		→
Stripped Venus			→
Mussels			

Where “→” stands for relations accepted at a 5% significance level; and “→” stands for the relations accepted at a 10 significance level but rejected at the 5% level.

From previous table 4, it can be concluded that most of the retail prices are influenced by wholesale prices (10 out of 12) and by ex-vessel prices (7 out of 12). Only for

Anchovy, seems that wholesale prices are influenced by retail prices. While for some species, (4 out of 12) ex-vessel prices are influenced by wholesale prices, it is just for Mackerel that wholesale prices are influenced by ex-vessel prices.

Thus, these results are in accordance with most of the previous literature on seafood markets.

Elasticity of Price Transmission

George and King (1971), define the elasticity of price transmission as “... the ratio of relative change in retail price to the relative change in the farm-level price”. Likewise, Hildreth & Jarrett (1995), define the elasticity of price transmission as “... the relative change in retail price to the relative change in producers’ price when other factors affecting processors behaviour are held constant”.

Hence, it is going to estimate the elasticity of price transmission, using a similar approach, but referred to different stages in the market chain.

Thus, the Elasticity of the Price Transmission along the market chain can be calculated as:

$$\varepsilon_T = \frac{\partial P_r}{\partial P_e} \cdot \frac{P_e}{P_r} \quad (\text{eq. 4})$$

When estimating the regression that relates the retail prices by the ex-vessel prices:

$$P_r = c + b \cdot P_e + \varepsilon \quad (\text{eq. 5})$$

the parameter $\frac{\partial P_r}{\partial P_e}$ is obtained.

When using the variables in their log form, then the regression coefficients are equal to the Elasticity of the Price Transmission.

On table 5, there are presented the results from the elasticity of the price transmission analysing the relations for the 12 seafood species between the 3 markets levels.

Table 5: Elasticity of the price transmission for the 12 species analysed

	E-W	E-R	W-R
Hake	0.72	0.10	0.12
Small Hake	0.61	0.03	0.14
Sardine	0.25	0.01	0.11
Anchovy	0.57	0.13	0.18
Mackerel	0.31	0.04	0.14
Blue Whiting	0.60	0.05	0.09
Horse Mackerel	0.27	0.03	0.13
Megrim	0.80	0.15	0.17
Salmon	0.83	0.29	0.32
Trout	0.67	0.46	0.57
Stripped Venus	0.42	0.35	0.14
Mussels	-	-	0.12

From the previous elasticities of the price transmission for the 12 species analysed, it can be seen that the elasticities of the price transmission between the ex-vessel and wholesale prices are the highest. While the elasticities of the price transmission between the ex-vessel and retail prices are the lowest, with the exception of the Stripped venus.

Moreover, there is also a positive relationship between the species' prices and the elasticities of the price transmission, especially between the ex-vessel and wholesale market levels.

Furthermore, the elasticity of the price transmission between the ex-vessel and retail prices should be equal to the elasticity of the price transmission between the ex-vessel and wholesale prices multiplied by the elasticity of the price transmission between the wholesale and retail prices.

On table 6, there are compared the elasticities of the price transmission between the ex-vessel and retail prices previously obtained ($E-R_1$), with the elasticities of the price transmission between the ex-vessel and retail prices obtained by multiplying the other price transmission elasticities ($E-R_2$).

Table 6: Elasticity of the price transmission for the 12 species analysed

	E-W	W-R	$E-R_2$	$E-R_1$	Difference
Hake	0.72	0.12	0.08	0.10	-0.01
Small Hake	0.61	0.14	0.08	0.03	0.05
Sardine	0.25	0.11	0.03	0.01	0.01
Anchovy	0.57	0.18	0.10	0.13	-0.02

Mackerel	0.31	0.14	0.04	0.04	0.00
Blue Whiting	0.60	0.09	0.06	0.05	0.01
Horse Mackerel	0.27	0.13	0.04	0.03	0.00
Megrim	0.80	0.17	0.14	0.15	-0.02
Salmon	0.83	0.32	0.27	0.29	-0.02
Trout	0.67	0.57	0.38	0.46	-0.08
Stripped Venus	0.42	0.14	0.06	0.35	-0.29

The difference between both elasticities of the price transmission between the ex-vessel and retail prices for the 11 species (where data is available at the 3 market levels), is less than 5%. Moreover, the main divergence between both elasticities takes place for the Stripped venus.

Long Run Price Transmission Asymmetries

As it can have been seen on the Price transmission elasticities results, the price changes are not fully transmitted between the different levels of the market chain. However, this turns to be a static approach, while sometimes price changes between the market levels may take several periods to adjust.

In accordance, Von Cramon-Taubadel (1998), distinguishes between the short run elasticity which measures the speed of reaction of a price to a change in the leading price, and the long run elasticity which describes the magnitude of this reaction.

In the literature there are explanations of lagged relations between different levels of the market chain. Some of these explanations are:

- Heien (1980) and Worth (1999) write that repricing may be costly due to the time requested to put on new labels, but also to the loss of goodwill from consumers who desire stability in prices. In this sense, Balke & Fomby (1997) indicate that the presence of fixed costs of adjustment may prevent economic agents from adjusting continuously. Then, adjustments would only take place when deviation from equilibrium exceeds a critical threshold; so that the benefits of adjustment exceed the costs and incentive economic agents to move the system back towards the equilibrium.
- Heien (1980), also points out the importance of storage in price transmission, in accordance, Wohlgenant (1989) has shown that inventory holding by retailers

can explain for a large part the delay in the price pass-through between wholesale and retail.

- Ward (1982), refers to the perishable nature of products which leads retailers to delay the transmission of upstream price raises in the fear that they will not be able to sell their whole stocks.
- Brorsen et al., (1985), have introduced risk in the analysis.
- Kinnucan & Forker (1987), suggest two other reasons for lagged transmission which are market power and the way data are processed.

Hence, in table 7, there are exposed the long run coefficients of the Price transmission elasticity for the 12 species analysed.

Table 7: Long run coefficients for the 12 species analysed

	E-W	E-R	W-R
Hake	0.89 (1,1)	0.22 (0,1)	0.29 (0,1)
Small Hake	1.15 (1,1)	0.20 (2,2)	0.83 (1,1)
Sardine	0.31 (1,1)	0.04 (0,2)	0.19 (2,1)
Anchovy	0.51 (1,1)	0.37 (0,1)	0.59 (0,1)
Mackerel	0.42 (2,2)	0.15 (2,1)	0.28 (1,2)
Blue Whiting	0.74 (1,1)	0.17 (0,1)	0.21 (0,2)
Horse Mackerel	0.46 (1,2)	0.16 (1,2)	0.33 (1,2)
Megrim	0.72 (1,1)	0.44 (0,1)	0.53 (0,1)
Salmon	0.83 (1,1)	0.55 (0,3)	0.67 (0,3)
Trout	ns (0,2)	1.08 (0,3)	0.63 (1,3)
Stripped Venus	0.74 (1,1)	0.47 (1,1)	0.29 (1,1)
Mussels			0.29 (0,2)

Where the “ns” for the trout means that the result is not significant. In brackets it can be seen the number of significant number of lags for the dependent and independent terms, respectively.

In previous table there are presented the long run coefficients for the 12 species analysed, it can be seen that the long run coefficients between the ex-vessel and wholesale prices are the highest. While the coefficients between the ex-vessel and retail prices are the lowest, with the exception of the Stripped venus.

Moreover, it seems that it is also a positive relationship between the species’ prices and the long run coefficients (as well as it was for the elasticities of the price transmission).

Finally, when comparing these results with the Price transmission elasticities (table 5), it can be seen how the long run coefficients are higher than the price transmission elasticities (in 31 of the 33 cases analysed, and with a mean 20% higher). This means that the price change adjustment between market levels often is larger and takes several periods.

Price transmission asymmetry

In the literature, the analysis of Price transmission asymmetries is often used to investigate the existence of market power. There is the common perception that market power may be exerted by retailers not to fully transmit decreases in their supply price, while perfect transmit the price increases.

Therefore, price transmission asymmetry may be a source of distortion in the transmission of information down the marketing chain, in relation with the supply shocks. This may lead to inefficiencies in the market, preventing from an optimal allocation. In this sense, a decrease in the input price associated with an increased primary production, if it is not transmitted to the retail level, then the retail price may not equalise the market clearing price and the production will be in excess.

Moreover, the presence of asymmetry in the vertical price transmission is often considered as a collusive behaviour. This could be reinforced in the seafood sector, as the retail level seems more concentrated than the production one (ex-vessel).

However, other explanations than market power have been given for the asymmetric price transmission, such as inventor holding, perishable nature of goods, public intervention (Kinnucan & Forker, 1987), existence of repricing costs, etc.

As it was already defined in equation 5, the Elasticity in the Price Transmission was estimated assuming a double log relationship.

$$P_r = c + b \cdot P_e + \varepsilon \quad (\text{eq. 5})$$

In order to investigate the presence of price transmission asymmetry, it is estimated the equation 5, with the inclusion of P_e^+ and P_e^- variables, accounting for the positive and the negative price changes at the ex-vessel level.

$$P_r = a + b P_e + c P_e^+ \quad (\text{eq. 6})$$

$$P_r = a + b P_e + c P_e^- \quad (\text{eq. 7})$$

Where this variables accounting for the positive and the negative price changes, here used in their absolute terms, are defined:

$$P_e^+ = \Delta P_e = P_e - P_{e-1} \quad \text{if } \Delta P_e > 0 \quad (\text{eq. 8})$$

$$P_e^- = \Delta P_e = P_e - P_{e-1} \quad \text{if } \Delta P_e < 0 \quad (\text{eq. 9})$$

Thus, when the coefficient c is significant (and so, different than 0), then there is asymmetry.

Then there are 4 possible cases where “ c ” is significant, and then asymmetry exists.

- “ c ” in P_e^+ significant and >0 (+) implies that when the upstream price increases, price downstream increases more than proportional.
- “ c ” in P_e^+ significant and <0 (-) implies that when the upstream price increases, price downstream increases less than proportional.
- “ c ” in P_e^- significant and >0 (+) implies that when the upstream price decreases, price downstream decreases less than proportional.
- “ c ” in P_e^- significant and <0 (-) implies that when the upstream price decreases, price downstream decreases more than proportional.

On table 8, there are presented the positive and negative price transmission asymmetry results for the 12 seafood species between the 3 markets levels.

Table 8: Asymmetry for the 12 species analysed

	E - W		E - R		W - R	
	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
Hake			--	++	--	++
Small Hake				++	--	++
Sardine	++				--	+
Anchovy	++		--	++	--	++
Mackerel		++		++	--	++
Blue Whiting				++	--	++
Horse Mackerel			--	+	--	++
Megrim			--	++	--	++

Salmon		++	--	++	--	+
Trout					--	++
Stripped Venus				++	--	++
Mussels					-	

Where 2 positive or negative signs mean that the “c” coefficient was significant (and so asymmetry exists) at a 5% level, while only one sign means that the coefficient was significant at a 10% level.

From these results it can be clearly seen that price transmission asymmetry is relevant (at least between some market levels). Major trends are:

- When the upstream price decreases, the downstream price decreases less than proportional.
- When the upstream price increases, the downstream price increases less than proportional.

However, even there is price transmission asymmetry; market power does not seem to be the reason. This is because even the fact that when upstream price decreases, the downstream price decreases less than proportional, which would be a clear market power sign; when the upstream price increases, the downstream price increases less than proportional, which is opposite to the market power perception.

Hence, the reason for the asymmetric price transmission seems to be just the lower volatility in the downstream market levels, which may be due to the existence of more substitutes and sources available.

Concluding remarks

This paper analyses the Price Transmission behaviour for the twelve main seafood products consumed in Spain along the Spanish market chain using 2005 and 2006 weekly data.

From these 12 fresh seafood species analysed, 8 of them can be considered wild fish species (Hake, Small Hake, Sardine, Anchovy, Mackerel, Blue Whiting, Horse Mackerel and Megrim). While for the other 4 species, the main production source is aquaculture; 2 of them are fish species (Salmon and Trout), and the other 2 are shellfish

(Stripped Venus and Mussels). Moreover, of this 4 farmed species, the national Spanish production is the main source for Trout and Mussels.

During the study there are mainly analysed the Price transmission elasticity, the long run coefficients of the Price transmission elasticity and the Price transmission asymmetry for the twelve seafood products in three different market levels (Ex-vessel, Wholesale and Retail).

From these results it can be seen that Price volatility differs between market chain levels and products (wild/farmed), being normally less volatility in downstream levels (retail) and in farmed species.

Price causality analysis confirms that upstream levels (wholesale and ex-vessel levels) lead to changes in the downstream level (retail). However, it seems to be the wholesale level the one benchmarking.

Price transmission elasticity shows that retail level is not so much affected by upstream price changes; but the wholesale and ex-vessel levels are the ones more interrelated.

The long run coefficients of the price transmission elasticity are higher than the “static” price transmission elasticities. This implies that the price change adjustment between market levels takes some time until is fully transmitted.

Finally, the Price transmission asymmetry is relevant, especially when analysing the retail market. However, market power does not seem to be the reason, this is because even when upstream price decreases, the downstream price decreases less than proportional, which would be a clear market power sign; when the upstream price increases, the downstream price increases less than proportional, which is opposite to the market power perception. Hence, it seems that the lower volatility in the downstream market levels, which may be due to the existence of more substitutes and sources available is just the reason for the asymmetric price transmission.

References

- Asche, F.; Menezes, R. & Ferreira Dias, J. 2002. Transmission of price signals in cross boundary value chain. *Proceedings of the 12th EAFE Conference*. Faro Portugal, March.
- Balke, N.S. & Fomby, T.B. 1997. Threshold cointegration. *International Economic Review*. 38(3):627-645.
- Brorsen, B.W.; Chavas, J.P.; Grant, W.R. and Schnake, L.D. 1985. Marketing margins and price uncertainty: the case of the US wheat market. *American Journal of Agricultural Economics*, 67:521-528.
- Buse, R. C. & Brandow, G. E. 1960. The relationship of volume prices and costs to marketing margins for farm foods. *Journal of Farm Economics* 42:362-370.
- Dalrymple, D. G. 1961. On the nature of marketing margins. *Agricultural Economic* 824. Michigan Agricultural Experiment Station. East Lansing.
- García Del Hoyo, J.J. (Ed.). 2002. *Análisis Bioeconómico y Estadístico de Pesquerías Andaluzas*. Servicio de Publicaciones de la Consejería de Agricultura y Pesca.
- Gardner, B.L. 1975. The Farm-Retail Price Spread in a Competitive Food Industry. *American Journal of Agricultural Economics* 57(3):399-409.
- George, P.S. & King, G.A. 1971. *Consumer demand for food commodities in the United States with projections for 1980*. Giannini Foundation Monograph No. 26. University California, Berkeley.
- Geweke, J.; Meese, R.; Dent, W. 1983. Comparing alternative tests of causality in temporal systems. Analytic results and experimental evidence. *Journal of Econometrics* 21:161-194.
- Gjølberg, O. & Johnsen, T. 1999. Risk Management in the Oil Industry: Can Information on Long – Run Equilibrium Prices Be Utilized? *Energy Economics* 221:517-527.
- Gonzales, F.; Guillotreau, P.; Le Grel, L. & Simioni, M. 2002. Asymmetric price transmission with consistent threshold along the fish supply chain. *IIFET Proceedings*.
- Goodwin, B.K. & Holt, M.T. 1999. Price Transmission and Asymmetric Adjustment in the U.S. Beef Sector. *American Journal of Agricultural Economics* 81(3):630-637.
- Granger, C.W.J. 1969. Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. *Econometrica*.
- Hartmann, J.; Jaffry, S. & Asche, F. 2000. Price relationships along the value chain: An analysis of the hake market in France. *IIFET Proceedings*.
- Hausman, J. A. 1978. Specification Tests in Econometrics. *Econometrica*.

- Heien, D.M. 1980. Mark up pricing in a dynamic model of the food industry. *American Journal of Agricultural Economics* 62:11-18.
- Hicks, J.R. 1956. *A revision of demand theory*. Oxford, Clarendon Press.
- Hildreth, C. & Jarrett, F.G. 1995. *A statistical study of livestock production and marketing*. Cowles Commission Monograph No. 5. John Wiley & Sons, Inc. New York.
- Jiménez-Toribio, R.; García-Del-Hoyo, J.J. & García-Ordaz, F. 2003. Vertical Integration and Price Transmission in the Spanish Distribution Channel of the Striped Venus. *XVth EAFE Conference*.
- Jaffry, S. 2004. Asymmetric Price Transmission: A Case Study of the French Hake Value Chain. *Marine Resource Economics*, 19(4):511-523.
- Kinnucan, H.W. & Forker, O.D. (1987). Asymmetry in Farm-Retail Price Transmission for major dairy Products. *American Journal of Agricultural Economics* 69: 285-292.
- Ministerio de Agricultura Pesca y Alimentación (MAPA). Several years. *La alimentación en España*. Madrid.
- Shepherd, G. S. 1962. *Marketing farm products-economic analysis*. 4th ed. Iowa State University press, Ames.
- Sims, C. A. 1972. Money, Income and Causality. *The American Economic Review*.
- Thomsen, F.L. 1951. *Agricultural marketing*. Mc Graw-Hill book co., Inc. New York.
- von Cramon-Taubadel, S. (1998). Estimating Asymmetric Price Transmission with the Error Correction Representation: An Application to the German Pork Market. *European Review of Agricultural Economics* 25: 1-18.
- Ward, W.R. 1982. Asymmetry in retail, wholesale, and shipping price point pricing for fresh vegetables. *American Journal of Agricultural Economics* 64:205-212.
- Waugh, F.V. 1964. *Demand and price analysis*. Technical bulletin No. 1316. US. Department of Agriculture. Washington DC.
- Wohlgenant, M.K. 1989. Demand for Farm Output in a Complete System of Demand Functions. *American Journal of Agricultural Economics* 71(2):241-252.
- Wohlgenant, M.K. 2001. Marketing Margins: Empirical Analysis. In: Gardner, B.L. & Rausser, G.C. (eds.). 2001. *Handbook of Agricultural Economics*. Chapter 16, pages 933-970.
- Worth, T. (1999). The F.o.b.-Retail price relationship for selected fresh vegetables. Economic Research Service/USDA - Vegetables and Specialties.