Title: A review of gilthead seabream price dynamics in the Spanish market: recent updates on the role of retailers and international trade on price linkages.

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Abstract

This paper extends the results on price integration analysis in the gilthead seabream (*Sparus aurata*) market in Spain previously undertaken trying to improve the knowledge on the topic by testing the conclusions obtained on regard price linkages and exploring new scenarios on the light of new data series. Although the conclusions for the overall market are in the line of those previously observed in market delimitation and price transmission in the domestic value chain, there are significant differences in the relations across the price series when the market is disaggregated according to the countries of origin. This new analysis also covers a recent period of implementation of differentiating strategies in the domestic industry not started in the previous study. While the overall model, with minor differences, confirms Turkey´s price leadership and the influence of domestic wholesale on the changes in the price along the value

chain, alternative models more specific to the country of origin show how alliances along the value chain and differentiation of domestic product provide different distribution channels and different mechanisms of price transmission. Farmers, although they have low ability to affect the prices downstream, at least, they may be moving into a less volatile price scenario.

Keywords: Price integration, Price transmission, Market integration, Value chain, Seafood market, Seabream

1. Introduction

The continuous grow of aquaculture production and the internationalization of seafood markets have increased competition on domestic value chains at the main seafood destinations (Fernández Polanco et al. 2012). The new competitive scenario has changed the price determination process, in which the shortening of the value chains, the appearance of new agents, and an increasing retail concentration are important elements (Anderson et al., 2018; Asche and Smith, 2018).

This development has strongly affected the Spanish seafood market, which is the largest seafood market in the European Union by consumption (EUMOFA, 2019). Traditionally, wholesalers were a key agent of the value chain that used to connect producers with retailers. Nowadays, an increasing proportion of the retail activity concentrates in large retailers. As a consequence, these companies get the scale and the capacity of directly negotiate with domestic producers and exporters in third countries. The case of the gilthead seabream (*Sparus aurata*), the principal product of the Spanish aquaculture industry in terms of value, together with European seabass, clearly illustrates these new competitive environment, in which large retailers' requirements dominate the market, and the domestic product compete with imports from Greece and Turkey largely on price.

Gilthead seabream is the most important species in the Mediterranean aquaculture. Total seabream production has increased from 141,889 tons in 2011 to 237,049 tons in 2018 (96%

aquaculture) with a value of US$1,081 million (FAO, 2020). The major seabream producers are Turkey (76,680 tons in 2018), Greece (56,185 tons), Egypt (29,994 tons), Tunisia (18,463 tons) and Spain (13,810 tons) (FAO, 2020). Turkey and Greece are the main exporting countries, while Spain and Italy are the largest import markets for seabream. Competition between Greek and Turkish seabream also takes place in the destination markets, as in the case of Spain. Traditionally, Greece was the main seabream exporter to Spain, however from 2012 Turkey has overtaken this position, although there is still a significant Greek presence (5,048 tons in 2018 compared to 2,388 tons from Greece) (EUROSTAT, 2019).

In recent years, value chain analyses has become a strategic issue for the economic sustainability of aquaculture, both the study of price interactions along the value chain, and across different products or producers. In the literature, two common forms of analysis of relationships between prices are market integration studies and price transmission analysis (Asche et al., 2007b). Price or market integration is used to study horizontal price linkages in seafood value chains (Fernández-Polanco and Llorente, 2015), while price transmission analysis investigates relationships between different levels in the value chains (Asche et al., 2007a). Price transmission analysis also facilitates the assessment of value distribution and negotiation power and market margins. The market integration studies can investigate the degree of market integration of the same species from different producers (Norman-Lopez and Bjørndal, 2009) or of different species (Ankamah-Yeboah et al., 2017). Price transmission studies typically address particular species, e.g. farmed salmon (Landazuri-Tveteraas et al., 2018), hake (Jaffry, 2005), pangasius (Thong et al., 2020), cod (Asche et al., 2007a), although there are also examples of multi-species analysis, as the case of Sapkota et al. (2015).

The difficulties in access to time series from all the steps in the value chain, in particular wholesale and retail prices, makes studies that combine vertical and horizontal price relationships less common. However, this type of studies provide a deeper knowledge about the species and or markets targeted since it sheds more light on the price determination process. In particular, with what is known as price leadership or a central market, the most important

pricing point may be for a different species in a different market where the price signals moves horizontally as well as vertically to the market of interest. Among the few examples of such studies are the U.K salmon market (Asche et al., 2007b), the world and European markets of frozen and canned tuna (Jiménez-Toribio et al., 2010), and the fresh wild fish market in Spain (Fernandez-Polanco and Llorente, 2015).

Despite competition at seabream markets in the Mediterranean has increased significantly in recent decades, the literature that helps to understand the competitive relations across this value chain is scarce. Most of the studies focused in competition between wild and farmed seabream, and found that they form two differentiated products in the Spanish market (Rodriguez et al. 2013; Regnier and Bayramoglu, 2017; Bjørndal and Guillen, 2017a,b; Bayramoglu, 2019). However, few studies have focused on analyzing market integration between different geographic areas (Bjørndal et al. 2019) and price interactions along the value chain. Fernández-Polanco and Llorente (2019) developed a price integration analyses in the seabream value chain in Spain, considering both, market delimitation between domestic production and imports, and price transmission from ex-farm, wholesale and retail Spanish prices, and they found significant evidence of relationships. The results showed a well-integrated market across countries at the ex-farm level with a common price determination process. Furthermore, international competition was led by Turkish product while Greek exporters and Spanish farmers, adjusted their prices according to the changes in those of Turkey. On the other hand, price asymmetry were found in price transmission since Spanish farmers were not transferring their costs to the following steps in the value chain, but instead, ex-farm prices are caused by wholesale. However, the analysis did not provide any significant evidence of interaction with retail prices.

More recently, between 2017 and 2019, the seabream value chain in Spain has experienced changes that can have influenced in the configuration of the competitive relations among the main actors. On one hand, the vertical integration of large retailers has continued with the consolidation of their own logistic platforms. At the same time the seabream industry in the Mediterranean has again turned into a regime with rapidly increasing production and price

decline scenario, in which Turkish producers are starting to suffer financial problems, while Greek companies are increasing their production and exports (Llorente et al. 2020).

The purpose of this work is to analyze the role of retailers in the Spanish seabream value chain through the study of price linkages, considering both domestic production and the influence of international trade. Price transmission is tested at ex-farm, wholesale and retail levels considering also the influence of imports from Turkey and Greece.

The paper is structured as follows. The materials and methods section explains the sources of the data, describes the price integration methods used and explore the price series included in the empirical analysis. Then, models are tested covering price transmission in the domestic value chain and the role of international competition. Finally, the work discusses the most recent changes in the Spanish seabream value chain and presents the main conclusions.

2. Material and methods

2.1. Data sources

The prices for seabream at ex-farm, wholesale and retail levels have been collected weekly from 2009 to 2018 by The Spanish Ministry of Agriculture, Fisheries and Food through the Observatory of Food Prices (MAPAMA, 2019), and converted into monthly series. Prices for Spanish imports of fresh whole seabream from Greece and Turkey were collected from the European Commission's Eurostat trade database (EUROSTAT, 2019). Values in € and quantities in tonnes with a monthly frequency from 2009 to 2018 were used for this study. The available harmonized codes are: 03026995 - Fresh or chilled gilt-head seabreams "*Sparus aurata*" (until 2011). 03028530 - Fresh or chilled gilt-head seabreams "*Sparus aurata*" (since 2012).

2.2. Data description

Gilthead seabream prices in the Spanish market followed an upward trend between 2009 and 2015 (Fig. 1). Since 2016, there has been a change in the trend of all the price series with the exception of retail prices. While prices of Spanish farmed seabream and imports from Greece and Turkey were between 5 €/kg and 6 €/kg in 2016, in 2018 those prices ranged from

3.4€/kg to 4.7€/kg. During 2017 and 2018 both farm prices in Spain and those of imports have decreased. The average price of Greek imports in 2018 (4.66€/kg) was 3% lower compared to 2017, 5% less in the case of the Turkish product (4.02 €/kg) and 11% in the ex-farm price (4.51 €/kg). Regarding traders, prices remained more stable, decreasing 2% in the case of wholesalers (5.36 €/kg), and even growing 1% in that of retailers (10.19 €/kg). Despite the general fall in prices, traders' prices have been less volatile than those of producers. The positive evolution of retail prices suggests the ability of retailers to set prices with less dependence on what happens in the previous steps of the chain, and possibly also higher costs downstream in the value chain.

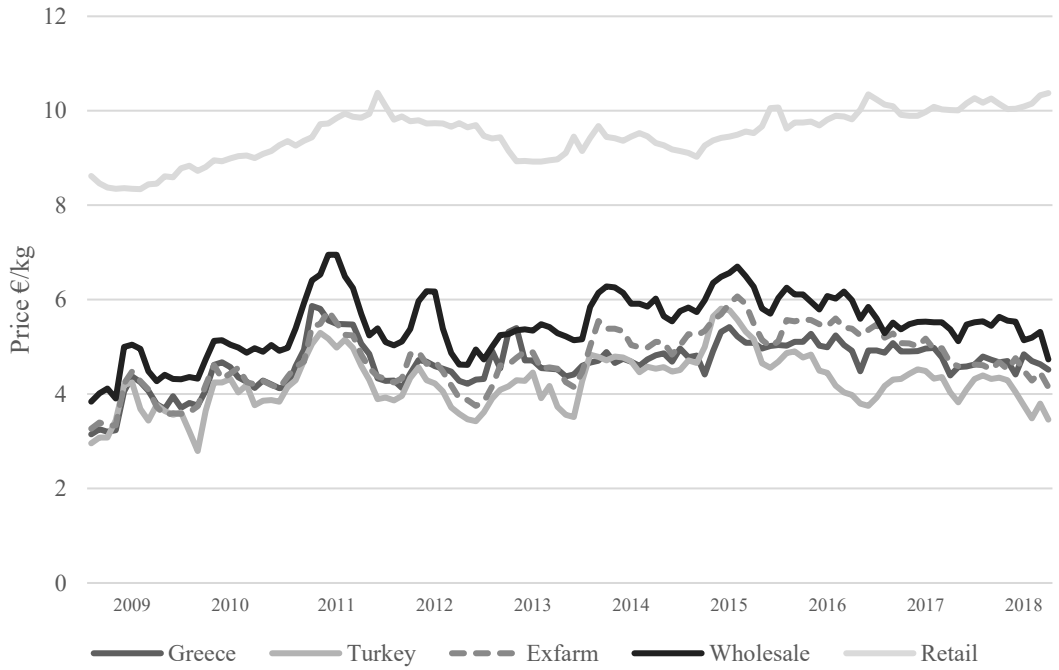

Fig.1. Evolution of prices for the fresh whole seabream value chain in Spain (€/kg) considering ex-farm, wholesale, retail and imports from Greece and Turkey. Source: MAPAMA 2019 and EUROSTAT 2019.

2.3. Price integration

When the purpose of the research is to analyze relationships across prices, cointegration techniques are the primary methods used because most price series tend to be non-stationary (Asche et al., 1999). These models are based on statistical procedures capturing price linkages over time (Fernández Polanco and Llorente, 2019). Therefore, the first step of the statistical procedure followed is testing the stationarity of the price series. The Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1981) is one of the tests used to analyze the time series properties of the data. The null hypothesis of unit root is tested with an autoregressive model for the price

levels and their first differences. When the Ho of unit root is not rejected at their levels but rejected at the first differences, then it can be concluded that the price series are non-stationary.

When the price series are found to be non-stationary, the second step is the cointegration analysis, which will be tested using the Johansen test (Johansen, 1988; 1991). If prices are found to be cointegrated, there exist a link between the prices indicating common price determination processes. Provided that the prices are cointegrated, one can test for weak exogeneity, if linkages are multi- or uni-directional. If they are multi-directional, shocks at any market node will transmit through the system. On the other hand, if they are uni-directional, shocks at the receiving end will not have any impact on prices. If there is one weakly exogenous price in the whole system, this will be the price leader and the market node that sets prices.[1] The Akaike information criterion (AIC), Bayesian information criterion (BIC) and the Hannan–Quinn information criterion (HQC) provided an initial lag order of 1. Further, the lag order was confirmed by using the Wald test in a two lags VAR model resulting in the rejection of models with more than one lag.

3. Results

The ADF test (Table 1) shows all data series are unit root in their levels. Moreover, the hypothesis of a unit root is rejected for the first differences in all price series. Therefore, one can conclude that the price series behave as non-stationary variables.

Table 1. Augmented Dickey-Fuller test for the seabream price series

	None		**Constant**		**Linear trend**	
	Levels	1st diff.	Levels	1st diff.	Levels	1st diff.
Greece	0.121207	-10.4603***	-3.3176**	-10.942***	-3.326*	-10.977***
Turkey	-0.389	-8.202***	-2.473	-8.243***	-2.201	-8.417***
Ex-farm	-0.201	-8.209***	-2.235	-8.009***	-1.828	-8.241***
Wholesale	-0.241	-8.154***	-2.679	-8.888***	-2.404	-8.971***
Retail	1.095	-8.782***	-1.216	-9.705***	-1.723	-9.661***

Note: *** 99% CL; ** 95% CL; * 90% CL

Johansen test for a model involving the five price series results in a two vector system. According to the Weak Exogeneity test, the price of Greece and wholesale are endogenous

[1] Such price leaders is common in many commodity markets with the Brent Blend crude oil price as one of the most well known.

variables, which would change as a consequence of changes in the prices of the other three value chain nodes. These results confirm the previously observed effect on Greek prices caused by Turkey, and the exogeneity of retail. However, the role of wholesalers and domestic farmers' prices differ from the previous study with shorter series. The new results suggest domestic farmers are now a cause of changes in the price of wholesale and imports from Greece, as if they were the reference price. Such a change could be the result of a successful differentiation strategy undertaken in the last four years, or significant changes in the equilibrium prices at the international market. In the first case, domestic farmers' prices should not be affected by those of imports, and would not be price takers in the domestic value chain. In the other alternative, linkages across import prices should be transmitted to the domestic value chain. In order to clarify these relations and solve the question, alternative more specific models are tested analyzing the dynamics ruling price transmission for each producing country within the Spanish market. Further, the larger the number of variables included in a model the greater the noise, so it is expected that different submodels will result in an improvement of the significance of the parameters.

Table 2. Results of model 1. Johansen and Weak Exogeneity Test for price transmission in the Spanish domestic value chain of seabream

Johansen test				
Rank	Eigenvalue	Trace test	Lmax test	
0	0.26977	103.49***	36.784*	
1	0.23342	66.705**	31.101*	
2	0.16616	35.604	21.261	
3	0.079412	14.344	9.6808	
4	0.039070	4.6629	4.6629	
Weak exogeneity test (LR-Statistics)				
Greece	Turkey	Ex-farm	Wholesale	Retail
8.15097**	3.9639	0.695594	7.04477**	1.03761

Note: *** 99% CL; ** 95% CL; * 90% CL

A first model analyses price transmission in the domestic value chain considering ex-farm, wholesale and retail prices. A second model considers competition across imports from Greece, as the reference of international trade, and the other actors in the domestic value chain. Finally, the third model also considers the interaction between all the agents involved nowadays in the

seabream market where Tukey is hypothesized as the price leader and Greek series are remove to reduce noise.

3.1. Domestic value chain

The cointegration test in the domestic value chain results in a one vector system. Retail price series are exogenous and wholesale and ex-farm endogenous (Table 3).

Table 3. Results of model 2. Johansen and Weak Exogeneity Test for price transmission in the Spanish domestic value chain of seabream

Johansen test			
Rank	Eigenvalue	Trace test	Lmax test
0	0.12001	85.654***	65.841***
1	0.021215	19.813	11.043
2	0.016884	8.7694	8.7694
Weak exogeneity test (LR-Statistics)			
Ex-farm	Wholesale	Retail	
16.6826***	24.6062***	2.2533	

Note: *** 99% CL; ** 95% CL; * 90% CL

The resulting relations show an upstream transmission of prices in which farmers are price takers from wholesalers and these from retailers (Fig. 2). Retailers and wholesalers are able to transfer backward any increase in their costs or change in the price of equilibrium. Farmers, instead, have to fix their prices according to the requirements of the following steps of the value chain, not been able to transfer changes in their costs. Such a situation may put in risk the profitability of the domestic bass and bream farming industry.

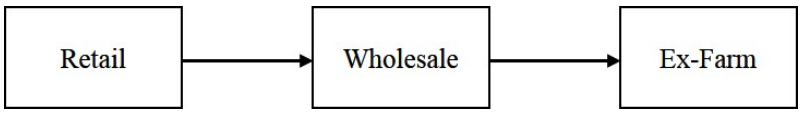

Fig.2. Flow chart of price relations along the domestic value chain of seabream in Spain. Source: Author's own

3.2. International value chain

The resulting model of price transmission in the domestic value chain for seabream shows some statistical differences when the import price series are included in a scenario of international competition. The relations across the prices of seabream imports from Greece and Turkey was analyzed in Fernández-Polanco and Llorente (2019), finding that Turkish prices were a cause of changes in the Greek prices. This relation affects the linkages in the domestic

value chain in the process of fixing the final retail price. The relations across domestic and international prices vary depending on where the imports are coming from. The large number of statistical associations involved across the involved variables complicates the comprehension of the dynamics of the full system; making some relevant associations appear as no significant. In order to avoid these kinds of biases the following sections will analyze the different effects and connections when imports from Greece and Turkey are considered independently. The comparison of the two models will allow presenting an overall system of price linkages in the Spanish value chain in the framework of an international market.

3.2.1. Imports from Greece

The cointegration test for the model of price transmission with the prices of seabream imported from Greece results in a two vector system (Table 4). The price series of imports and ex-farm appear as endogenous variables, and the trade levels, wholesale and retail, as exogenous.

Table 4. Results of model 3. Johansen and Weak Exogeneity Test for price transmission in the Spanish value chain of seabream considering Greek international competition

Johansen test			
Rank	Eigenvalue	Trace test	Lmax test
0	0.23349	73.159***	31.111**
1	0.21528	42.048**	28.364***
2	0.074218	13.684	9.0226
3	0.039059	4.6616	4.6616
Weak exogeneity test (LR-Statistics)			
Greece	Ex-farm	Wholesale	Retail
16.1854***	5.35125**	1.55902	1.25457

Note: *** 99% CL; ** 95% CL; * 90% CL

When studying causal associations across paired price series (Table 5) the link direct between retail and ex-farm domestic prices remains non-significant. The price of seabream imported from Greece, instead, is causally affected by Spanish retailers' price. Thus, beyond the indirect upstream relation through wholesalers, retailers also affect domestic farmers' prices indirectly through their effect on Greek import prices. No relation was found across traders prices. Wholesale price series are a cause of the changes in the price at the two sources of

supply. The lack of connection across retail and wholesale, with regard the domestic model, suggests a stronger influence of the linkages with the Greek price series.

Table 5. Bivariate causal analysis for the price transmission model in Spain considering Greek international competition

Variables	Weak Exogeneity Test	Relation
Retail Ex-Farm	No cointegration	Independence
Retail Greece	7.4751 14.7419***	Retail → Greece
Wholesale Ex-Farm	0.7943 9.0688***	Wholesale → Ex-farm
Wholesale Greece	0.0575 17.1369***	Wholesale → Greece
Ex-Farm Greece	13.1391*** 0.0328	Greece → Ex-Farm
Wholesale Retail	No cointegration	Independence

Note: *** 99% CL; ** 95% CL; * 90% CL

The resulting model draws a situation in which Greek prices are fixed by local traders in Spain, and are transferred to the domestic production prices in the negotiation with wholesalers. Spanish farmers do change their prices following changes in Greek prices, and both are caused by changes in the wholesale price. Greek prices do accommodate as well to the changes in retail price, perhaps due to increasing upstream integration by the large retail chains.

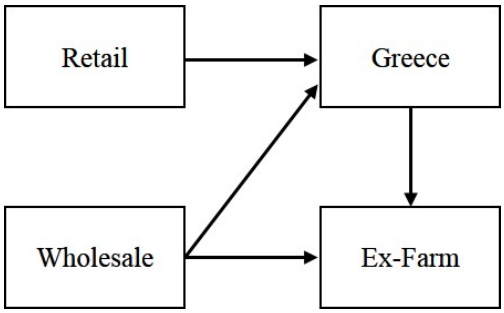

Fig.3. Flow chart of price relations along the domestic value chain of seabream in Spain considering Greek international competition. Source: Author's own

3.2.2. Imports from Turkey

The resulting system for the model of price transmission with the price series of seabream imported from Turkey shows a different scenario than the previously seen with imports from

Greece. The model results in a one cointegrating vector with imports from Turkey and the wholesale price as endogenous and ex-farm and retail as exogenous.

Table 6. Results of model 4. Johansen and Weak Exogeneity Test for price transmission in the Spanish value chain of seabream considering Turkish international competition

Johansen test			
Rank	Eigenvalue	Trace test	Lmax test
0	0.2684	72.200***	36.576***
1	0.1637	35.625	20.914
2	0.0798	14.711	9.737
3	0.0416	4.9740	4.974
Weak exogeneity test (LR-Statistics)			
Turkey	Ex-farm	Wholesale	Retail
3.8503***	0.5093	7.1974***	0.0099

Note: *** 99% CL; ** 95% CL; * 90% CL

No direct association across retail price and the two sources of supply was found in this new model. Since there is also no significant relation across retail and wholesale, retail prices are independent in the model and not affected or affect any of the other price series. Significant bivariate relations are found across the prices of imports from Turkey, Spanish ex-farm and wholesale.

Table 7. Bivariate causal analysis for the price transmission model in Spain considering Turkish international competition

Variables	Weak Exogeneity Test	Relation
Retail Ex-Farm	No cointegration	Independence
Retail Turkey	No cointegration	Independence
Wholesale Ex-Farm	3.35829* 2.34093	Ex-farm → Wholesale
Wholesale Turkey	10.2998*** 3.68013*	Wholesale ⇔ Turkey
Ex-Farm Turkey	3.27325** 3.91365***	Ex-Farm ⇔ Turkey
Wholesale Retail	No cointegration	Independence

Note: *** 99% CL; ** 95% CL; * 90% CL

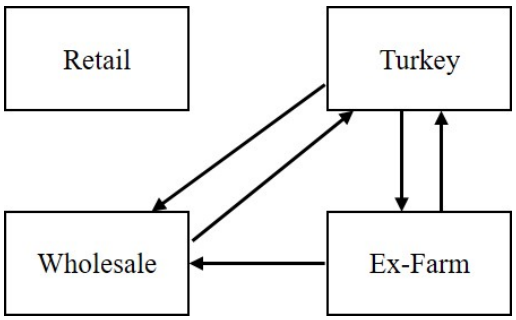

Fig.4. Flow chart of price relations along the domestic value chain of seabream in Spain considering Turkish international competition. Source: Author's own

4. Discussion and conclusions

The most recent previous analysis (Fernández-Polanco and Llorente, 2019) about the seabream value chain in Spain concluded that the fresh seabream market is delimitated and price competitive. The evolution of prices between Greek, Turkish and Spanish products is related and they behave as substitutes. International competition is led by Turkish exports. Results from the price transmission model suggest an upstream connection in which the changes in the ex-farm price are caused by changes in the wholesale level, and both are independent from retail. The data available in that study did not allow clarifying the role of retailers in the value chain.

In the present study, the availability of new data allows the analyses to be updated. This work adds value not only because it improves knowledge about the role of large retail chains, but because it includes in the analysis a period of significant changes in the seabream markets in general, and in the Spanish one in particular. In the general context, during 2017 and 2018 a new downward trend in prices has been consolidated, due to the increase in production generated by the recovery of Greek companies, and the increase in Turkish exports due to the financial problems of sector. In Spain, producers launched a new quality brand for domestic seabream.

The results from the tested models allow making some new conclusions about the price dynamics along the Spanish value chain for seabream, and the changes that have taken place in

recent years. Findings illustrate the way in which prices are fixed in the domestic market and the different effects of international trade.

Prices are transmitted upstream in the domestic value chain. Shocks in prices have their origin at the retail level and from there they are transferred up to the farm level. In this market, farmers have difficulties for transferring changes in their costs to market prices, since they are price takers. Market structures differ along the value chain, from more to less competitive from retail to farms. These situations increase the potentially of traders for exerting bargain power on farmers, and put in risk the profitability of the farming industry.

International trade affects the price linkages along the value chain in different ways. There is a clear different direction in the causal relations along the different levels of the value chain when it comes to Greek or Turkish seabream. While the Turkish model is dominant in aggregated figures, there are two differentiated vectors of opposite price linkages as a result of the different contracts and negotiations among exporters and importers.

Relevant volumes of imports from Greece are purchased by large retailers and wholesalers, most likely under medium long term agreements. Greek imports are the only source of seabream in the analysis whose prices are directly caused by the Spanish retail industry. They are also caused by Spanish wholesalers. The ability of Spanish traders to affect the Greek process is higher that on Spanish farmers, who get a premium for the domestic origin. However, Spanish prices have to adapt to the changes in Greek prices, since they are changing according to the needs of the same customers.

The case of Turkish imports is a typical example of competition with a price leadership. Turkey operates with the cheapest prices in the market. When Turkish price changes, this shock is transferred to the upcoming value chain levels. This is, traders take the new price and may use it for bargain with other providers. This is what can be deduced from the linkages in the price transmission model with the Turkish data. However, it is worth to mention that domestic seabream appears well differentiated, since the association with wholesale prices is almost non-significant and the effect of domestic price on Turkish imports is stronger than the opposite. It

is more likely that the domestic price is being used as a reference for Turkish exporters to fix an attractive cheaper price for Spanish importers.

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