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PRICE INTEGRATION ALONG THE SPANISH GILTHEAD SEABREAM (*SPARUS AURATA*) VALUE CHAIN

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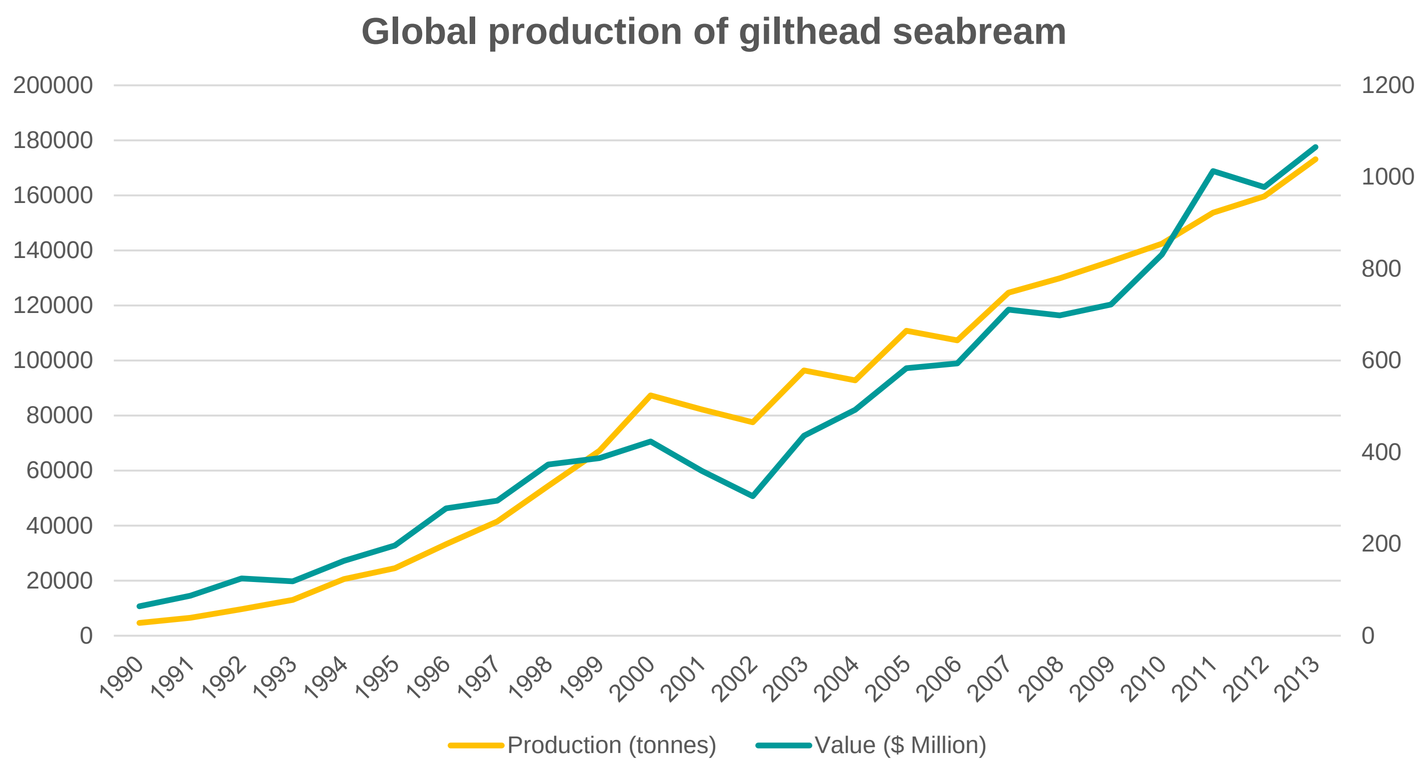
Introduction. Gilthead seabream market evolution

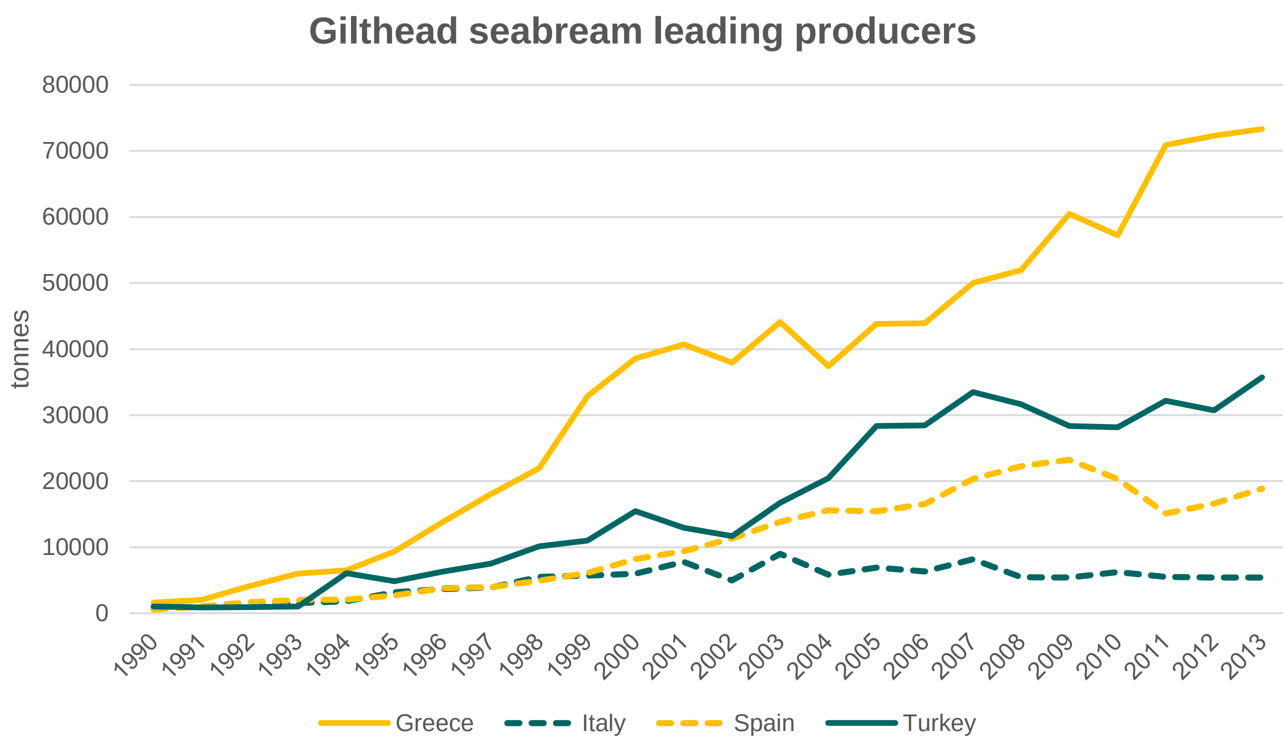
- **Global production of gilthead seabream** (Sparus aurata) increased during the 2008 – 2013 period from 129 thousand tonnes valued 698 million USD in 2008 to **173 thousand tonnes valued 1065 million USD in 2013**.



Source Fishstat FAO

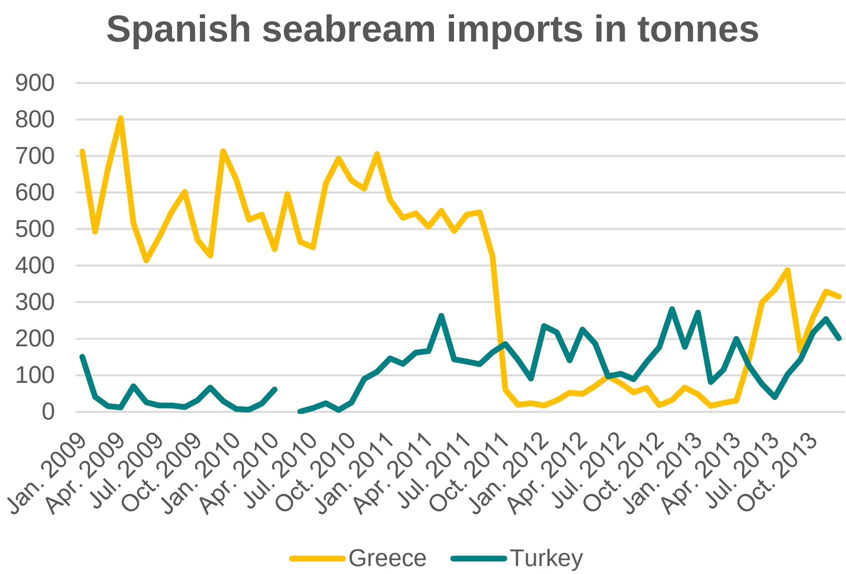
Introduction. Gilthead seabream market evolution

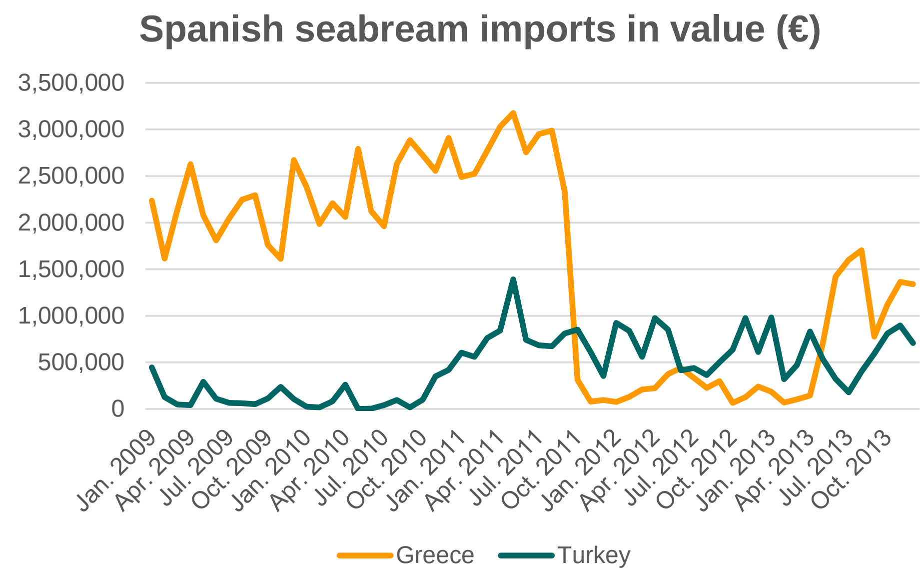
- **Greece and Turkey are the world gilthead seabream leading producers** with 42% and 21% of the volume and 45% and 17% of the value produced, respectively.
- **The EU** produced nearly 109 thousand tonnes, valued 706 million USD, in 2012, **accounting for 63% of global production volume and 66% of the value**.



- **In the EU, the main European producer is Greece** with 73.3 thousand tonnes, **followed by Spain and Italy** with around 18.9 and 5.4 thousand tonnes, respectively (FAO, 2016).

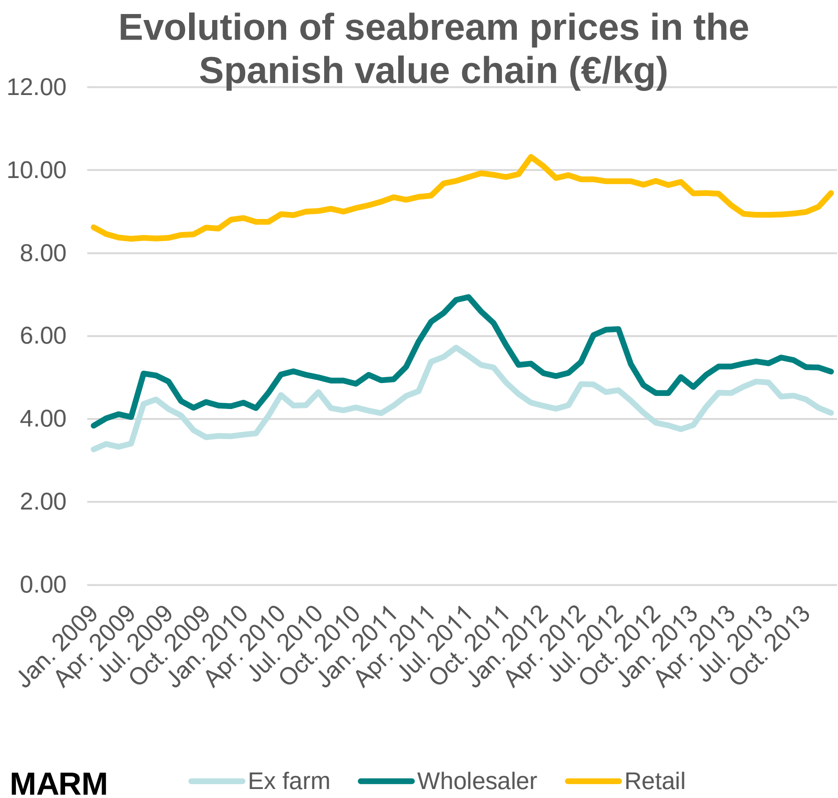
Introduction. Gilthead seabream market evolution





DS-045409-EU Trade Since 1988 by HS2, 4, 6 and CN8. Source EUROSTAT. 03026995 – Fresh or chilled gilt-head seabream “Sparus aurata"

Introduction. Gilthead seabream market evolution



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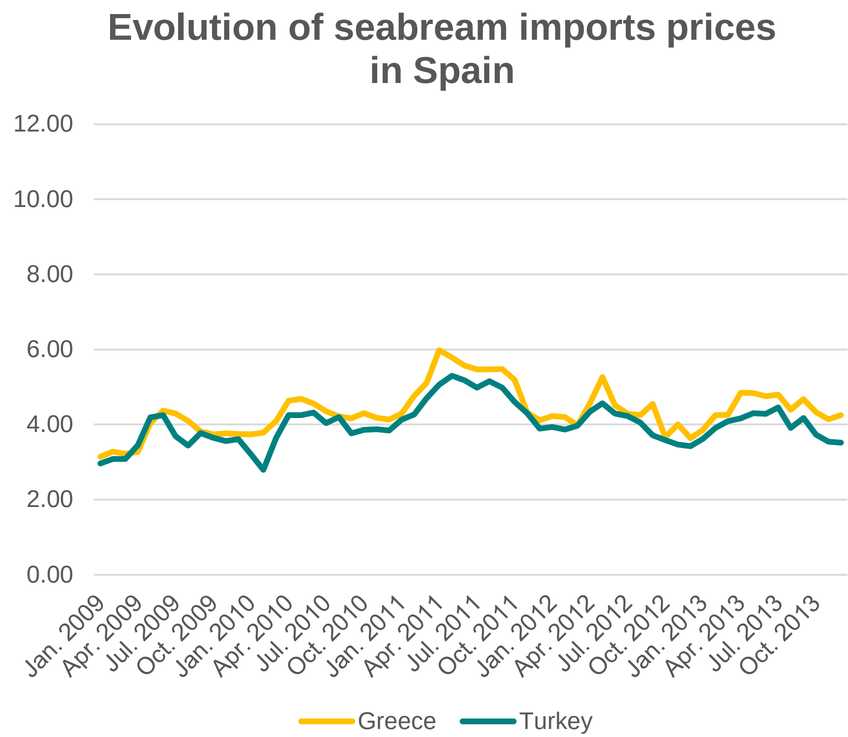

Source EUROSTAT

Research goals

- **Sea bream aquaculture in the Mediterranean Sea faces various constraints that include:**
  - **Increasing supply in fully developed markets**
  - **Effects of financial crises** in many consumer countries
  - Difficulties of negotiating with **concentrated retailers**

- These **constraints have raised interest in analyzing** the ways in which **prices** are set in the **international market and along the value chain**

- Accordingly, **the aims of this work are**:
  - Analyse **international competition in the Spanish seabream market** depending on the country of origin. (**Horizontal price integration analyses**)
  - Analyse the price transmission mechanisms on the Spanish seabream market in order to know **how the negotiation power is distributed along the value chain**. (**Vertical price integration analyses**)

Background

- It is possible to study **price integration** by analyzing **price linkages**
- The price integration analysis has been used in various research applications in the field of fisheries markets:
  - **Different levels of the value chain → Price transmission → Vertical price integration** (Jimenez-Toribio et al. (2003); Guillotreau (2004); Jaffry (2005); Guillotreau et al. (2005); Asche et al. (2007) Guillen and Franquesa (2008); Jimenez-Toribio et al. (2010b); Sakai et al. (2012); Asche et al (2014).
  - **Different products/producers → Market integration → Horizontal price integration** (Nielsen (2004); Asche et al. (2005); Nielsen et al. (2007); Asche et al. (2007); Vinuya (2007); Nielsen et al. (2009); Jimenez-Toribio et al. (2010a); Asche et al. (2012); Rodriguez et al. (2013) Schrobback et al. (2014)).

Materials and Methods

- The **limited sample size** of the data used (2009 to 2013) did **not allow conducting a single model**. Instead, **two separate models were used to illustrate horizontal and vertical price integration**. **Seasonality can not be assessed**.

- The **first model studied price competition** among Greece, Turkey and Spain, the three largest producers of sea bream.
  - **Horizontal price integration** allows identification of who exerts price leadership in markets.
    - Ex-farm prices
    - Import prices

- A **second model studied price transmission** across ex-farm, wholesale and retail prices
  - **Vertical price integration** informs about the transmission of prices across value chain levels and potential issues of market power.
    - Ex-farm prices
    - Wholesale prices
    - Retail prices

- A **new version of the second model** studied transmission across imports from **Turkey**, wholesale and retail prices
  - **Vertical price integration** informs about the transmission of prices across value chain levels and potential issues of market power.
    - Turkey's import price
    - Wholesale prices
    - Retail prices

Materials and Methods

- Given the non-stationary nature of most of the price series, the statistical method used to study the relationships among these is the **cointegration analysis**.

- In the case of price analyses, these models are based on statistical techniques to capture price linkages, where some form of **cointegration between prices defines the market and allows predicting prices and random changes in the price chain**.

- **Co-integration analysis requires non-stationary price series** data and **univariate unit root (nonstationary) test can indicate the stationary properties of the data** (Norma Lopez et al. 2014)

- The **Augmented Dickey-Fuller (ADF)** test (Dickey & Fuller, 1979; 1981) is used to test the time series properties of the data (non-stationarity).

Model 1. linear trend	Z	P
Greece (imports)	-1.996	0.602
Turkey (imports)	-1.675	0.762
Spain (exfarm)	-1.897	0.655

Model 2. no constant	Z	P
Exfarm	0.111	0.717
Wholesaler	0.402	0.799
Retailer	0.508	0.825

Model 2.1. linear trend	Z	P
Turkey (imports)	-1.675	0.762
Wholesaler	-1.137	0.852
Retailer	-2.021	0.589

- All data series are Unit root I(1) at their levels. Unit root is rejected for the first differences in all price series.

Materials and Methods

- When the price series are non-stationary the **Johansen test** (Johansen, 1991) is the natural approach (Asche et al. 2007)
- The Johansen test corrects the problem of non-stationarity in the data series.
- Also **weak exogeneity** and **Granger causality** tests are applied to understand price leadership and price transmission

DATA

- The prices for sea bream at **ex-farm, wholesale and retail levels** have been collected **weekly** for sea bream from 2009 to 2013 by **Spain's Ministry of Agriculture and Food through the Observatory of Food.**
- Prices for Spain's **imports from Greece and Turkey were obtained from the European Commission's Eurostat trade database**.

Results

MODEL 1. MARKET INTEGRATION ANALYSIS

- The model involving the prices of imports from Greece and Turkey and the Spanish ex-farm prices resulted in **one cointegrating vector**.

Rank	Eigenvalue	Trace	p	Lmax	p
0	0.50548	59.503	0.0003	33.800	0.0022
1	0.35154	25.703	0.0504	20.791	0.0281
2	0.097261	4.9115	0.6155	4.9115	0.6171

- This implicated that **the three origins compete in the same delimitated market (Spain)**.

- Subsequent tests (**Weak exogeneity** test) indicated that **Greek prices were endogenous**, meaning that price changes for Greek are following the prices of Spanish and Turkey producers, which are exogenous.

Constrain	Statistic	p
a[1] = 0 (Greece)	7.54009	0.0060 (endogenous)
a[2] = 0 (Turkey)	0.323521	0.5695 (exogenous)
a[3] = 0 (Spain)	0.0320448	0.8579 (exogenous)

Results

MODEL 1. MARKET INTEGRATION ANALYSIS

- In order to obtain a more detailed information about the competitive relations between the origins in the market, we applied the **Granger causality test**.

Greece		
	All the lags from Greece	F(1. 54) = 1.1289 [0.2927]
	All the lags from Turkey	F(1. 54) = 1.6458 [0.2050]
	All the lags from Spain	F(1. 54) = 2.8205 [0.0988]
Turkey		
	All the lags from Greece	F(1. 54) = 0.0259 [0.8727]
	All the lags from Turkey	F(1. 54) = 5.8646 [0.0188]
	All the lags from Spain	F(1. 54) = 1.6551 [0.2037]
Spain		
	All the lags from Greece	F(1. 54) = 0.0372 [0.8478]
	All the lags from Turkey	F(1. 54) = 2.2915 [0.1359]
	All the lags from Spain	F(1. 54) = 6.4896 [0.0137]

Note, may it be significant with longer series?

- Spanish and Turkish prices were found to be exogenous, caused by variables not included in the model, such as long-term contracts with local retailers or other institutions.

Results

MODEL 2. PRICE TRANSMISSION ANALYSIS

- The model assessing **price transmission along the Spanish value chain also found one cointegrating vector.**

Rank	Eigenvalue	Trace	p	Lmax	p
0	0.78397	101.36	0.0000	73.553	0.0000
1	0.43969	27.809	0.0000	27.805	0.0000
2	7.4558e-005	0.0035789	0.9758	0.0035789	0.9726

- In this case, it confirmed that **shifts in ex-farm price reached the retail level**, **suggesting that no actors exerted definitive market power**.

- However, **ex-farm and retail prices were found to be endogenous**, and can be explained by the links among them and the wholesale level.

Constrain	Statistic	p
a[1] = 0 (Exfarm)	29.9492	4.43518e-008 (endogenous)
a[2] = 0 (Wholesaler)	0.0371	0.8473 (exogenous)
a[3] = 0 (Retailer)	14.7113	0.0001 (endogenous)

- The **prices at the wholesale level**, instead, **were exogenous** and affected by causes not included in this model.

Results

MODEL 2. PRICE TRANSMISSION ANALYSIS

- In order to obtain a more detailed information about the price behavior along the value chain, we applied the **Granger causality test**.

Exfarm		
	All the lags from Exfarm	F(12. 12) = 9.6631 [0.0002]
	All the lags from Wholesaler	F(12. 12) = 6.4350 [0.0015]
	All the lags from Retailer	F(12. 12) = 9.2387 [0.0003]

Wholesaler		
	All the lags from Exfarm	F(12. 12) = 1.5538 [0.2282]
	All the lags from Wholesaler	F(12. 12) = 2.5647 [0.0582]
	All the lags from Retailer	F(12. 12) = 1.3029 [0.3270]

Retailer		
	All the lags from Exfarm	F(12. 12) = 2.8418 [0.0414]
	All the lags from Wholesaler	F(12. 12) = 2.8921 [0.0390]
	All the lags from Retailer	F(12. 12) = 171.93 [0.0000]

- **Domestic ex-farm prices were related to retail prices**, but they did **not seem to affect wholesale prices**.

Results

MODEL 2.1. PRICE TRANSMISSION ANALYSIS

- Second estimation of the second model. To clarify the relationships among the different price series.
- When the **prices of domestic ex-farm prices were substituted for Turkish imports , one cointegrating vector was found.**

Rank	Eigenvalue	Trace	p	Lmax	p
0	0.64068	96.167	0.0000	49.130	0.0000
1	0.55673	47.037	0.0000	39.052	0.0000
2	0.15325	7.9850	0.2606	7.9850	0.2608

- Once again, **wholesale prices were exogenous**, **affecting both Turkish and retail prices**.
- This meant that **Turkish exporters were adopting the prices of Spanish wholesalers**, and **Spanish retailers adapted their prices as the wholesale price changed**.

Constrain	Statistic	p
a[1] = 0 (Turkey)	3.5532	0.0594 (endogenous at 90% sig. And exogenous at 95% sig.)
a[2] = 0 (Wholesaler)	0.8215	0.3647 (exogenous)
a[3] = 0 (Retailer)	3.6913	0.0547 (endogenous at 90% sig. And exogenous at 95% sig.)

Results

MODEL 2.1. PRICE TRANSMISSION ANALYSIS

- In order to obtain a more detailed information about the price behavior along the value chain, we applied the **Granger causality test**.

Turkey		
	All the lags from Turkey	F(12. 10) = 1.2384 [0.3725]
	All the lags from Wholesaler	F(12. 10) = 2.8789 [0.0518]
	All the lags from Retailer	F(12. 10) = 1.8319 [0.1728]

Wholesaler		
	All the lags from Turkey	F(12. 10) = 2.0395 [0.1338]
	All the lags from Wholesaler	F(12. 10) = 4.6161 [0.0107]
	All the lags from Retailer	F(12. 10) = 1.6639 [0.2139]

Retailer		
	All the lags from Turkey	F(12. 10) = 1.2993 [0.3439]
	All the lags from Wholesaler	F(12. 10) = 1.3075 [0.3402]]
	All the lags from Retailer	F(12. 10) = 2.3000 [0.0982]

- **Results suggest that retailer prices are exogenous and Turkish are endogenous** (depend at 90% sig from the wholesalers)

Conclusions

Aim 1. Market delimitation

- As was expected, **the Spanish seabream market is delimitated, and competitive.**
- The ex-farm prices of sea bream in Spain are **partially affected by international competition led by Turkish imports** and by the prices set by wholesalers.

Aim 2. Price transmission

- Spanish **farmers' prices interact with the retail level** in a bidirectional relation **indicating perfect price transmission** between agents.
- **Retailers accommodate the prices** of sea bream according **to changes in farmers' costs**, and **also respond to changes in wholesale prices**.
- While the results in assessing the exercise of market power at any level of the value chain are not conclusive, **there is evidence that Spanish wholesalers could exercise some degree of negotiation power**.
- While totally independent of the behavior of the other actors, wholesale prices for sea bream affected all other observed prices. **All levels of the value chain adjusted their prices to changes in the wholesale level, whether for domestic or imported sea bream**.

Conclusions

- **We need more data.**

  We will be able to developed an extended model, which includes Turkey, Greece, Exfarm and Retailer.

- **This extended model will allow us:**

  1) Firstly, confirm or reject the results showed in the present work.

  2) We will be able to apply more complex models

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THANK YOU

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