THE INTEGRATION OF THE SEA BREAM AND SEA BASS MARKET: EVIDENCE FROM GREECE AND SPAIN

Lamprakis Avdelas, Managing Authority for the Operational programme for Fisheries,
lamprakisa@in.gr
Jordi Guillen, University of Barcelona - GEM, jordi@gemub.com

ABSTRACT

The relatively new aquaculture industry of sea bream and sea bass has grown rapidly in Mediterranean countries over the past decade. Greece is the leading production country and Spain is becoming the major market for the two species.

Despite the importance of the industry, in that it contributes to the reduction of the EU trade deficit for fisheries products, and provides jobs in remote and rural areas, little effort has been made to analyse the market mainly due to its relatively low contribution to the GDP in production countries.

This paper constitutes first step towards the understanding of the price formation mechanism for the market of sea bream and sea bass. Price data is used to test the hypothesis that a single European market for these species exists. Monthly price data are used to test the hypothesis for major markets in Greece and Spain. As most economic time series are non-stationary, cointegration is employed to assess the integration of the market.

Keywords: Sea bream, sea bass, price, cointegration, Greece, Spain

INTRODUCTION

The relatively new aquaculture industry of sea bream and sea bass has grown rapidly since the early 1990's, especially in Mediterranean countries. Where Greece is the main producer country of sea bream and sea bass in Europe and Mediterranean; while and Spain is becoming a major market for the two species.

Spain is one of the main fishing consumer countries. Seafood consumption has been traditionally very important in Spain (about 36.5 kg per capita consumed in 2003). Spain's is the second largest market, and its imports have been constantly growing

Because of the importance of these two countries as producer and consumer of sea bass and sea bream our intention is to investigate if the markets for sea bass and sea bream are integrated.

The importance from this paper comes from the fact that no prior study on the spatial integration of sea bream and sea bass markets has been done until the date (as far as the authors know).

THE MARKETS

Greece is the main producer and supplier of aquaculture sea bass and sea bream in the European area. While Italy is the main EU market for sea bream and sea bass, Spain's is the second largest market, and

its imports have been constantly growing during the last years, even Spain is the fifth and third larger producer of sea bass and sea bream, respectively.

Table 1: Production of sea bream and sea bass by country

Production
Seabass (*Dicentrarchus labrax*): World

	2000	2001	2002	2003	2004	2005
			(1000 tonnes)			(Provisional)
Greece	27.0	25.6	24.3	25.4	27.0	35.0
Turkey	19.8	16.7	15.1	21.7	15.0	21.0
Italy	10.3	12.2	10.6	13.0	9.0	10.0
France	7.2	6.9	7.6	9.0	3.8	4.2
Spain	2.5	2.9	3.9	4.6	6.2	6.5
Egypt	10.7	1.6	2.6	3.2	NA	NA
Croatia	1.3	1.5	1.8	1.8	NA	1.6
Portugal	0.7	1.0	0.9	1.4	1.5	1.5
Tunisia	0.2	0.5	0.6	0.5	NA	NA
Others	1.6	1.9	2.3	3.2	0.5	0.5
Total	**61.5**	**54.1**	**54.5**	**62.1**	**63.0**	**80.2**

Source: FAO/AQUAMEDIA (for 2004)

Production
Seabream (*Sparus aurata*): World

	2000	2001	2002	2003	2004	2005
			(1000 tonnes)			(Provisional)
Greece	38.8	40.9	38.1	38.6	49.0	50.0
Turkey	16.3	14.0	12.4	17.5	24.0	15.5
Spain	9.5	11.5	12.4	13.7	13.5	15.6
Italy	7.9	10.5	8.0	12.0	8.5	7.8
Egypt	11.3	3.4	4.1	3.8	NA	NA
Israel	2.5	2.7	2.6	2.5	NA	NA
Portugal	2.0	2.0	2.1	1.5	2.5	3.5
France	1.6	2.0	1.8	1.8	1.3	1.9
Others	5.7	4.7	5.2	6.2	1.5	1.5
Total	**95.4**	**91.7**	**86.5**	**97.6**	**100.3**	**91.1**

Source: FAO/AQUAMEDIA (for 2004)

Source: Globefish

When taking a look at the origin of Spanish imports of sea bass and sea bream it can be seen that Greek imports account for between the 60 and 80% of the total Spanish imports.

Table 2: Spanish imports of sea bass and sea beam by country

Imports
Seabream and Seabass: Spain

	2004	2005	2004	2005
	(tonnes)		(1 000 Euro)	
Seabream				
(all species)				
France	200	136	1 205	1 029
Greece	5 816	6 115	25 160	25 469
Morocco	899	818	3 794	3 356
Total	7 900	7 695	34 372	33 000
Seabass				
France	533	658	5 285	6 108
Greece	5 040	5 212	22 915	22 814
Morocco	140	308	1 164	2 079
Turkey	107	1 910	468	7 736
Total	7 067	8 975	35 847	43 250
Grand Tot.	**14 967**	**16 670**	**70 219**	**76 250**

Source: Spanish national statistics

Source: Globefish

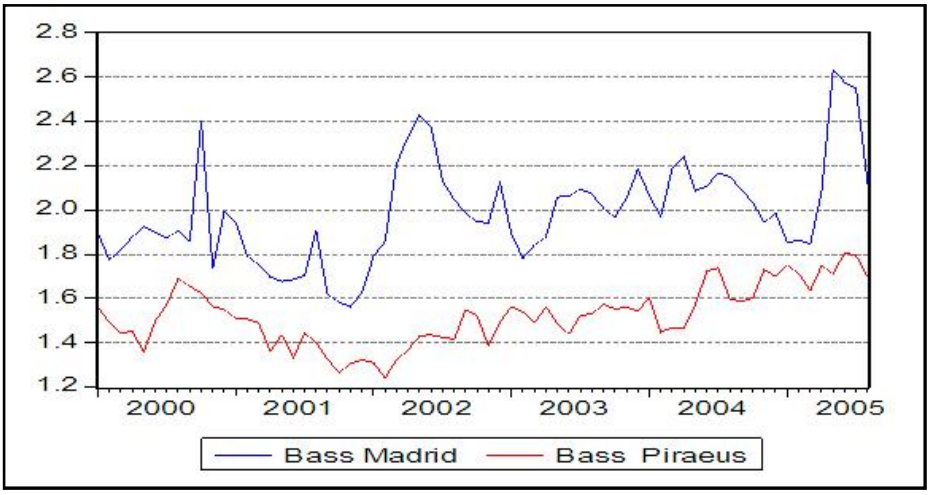
THE DATA

For this analysis there are used the 68 monthly mean price observations for sea bream and sea bass commercialised during the period January 2000 to August 2005 in the Piraeus (Greece) and Madrid (Spain) wholesale markets.

Madrid wholesale market (*mercamadrid*) accounts for about 150 thousand tonnes of seafood commercialised a year [1].

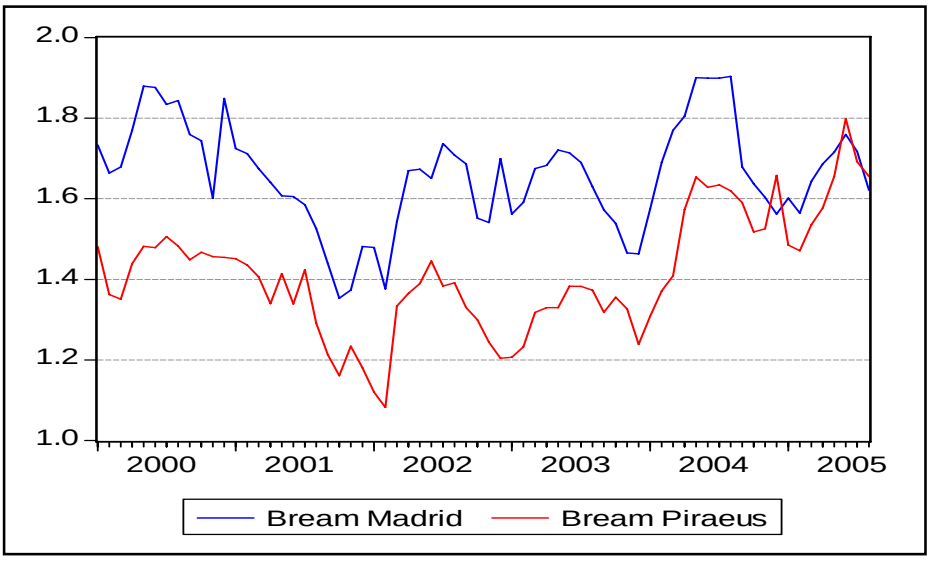
On figure 1, it can be seen the price evolution for sea bass in Piraeus and Madrid wholesale markets for the period of analysis.

Figure 1: Price evolution for sea bass in Piraeus and Madrid wholesale markets



While on next figure it can be seen the price evolution for sea bream in Piraeus and Madrid wholesale markets for the period of analysis.

Figure 2: Price evolution for sea bream in Piraeus and Madrid wholesale markets



On next table, the descriptive statistics for the prices of sea bass and sea bream commercialised in the Piraeus and Madrid wholesale markets are presented.

Table 3: Descriptive statistics for sea bass and sea bream

	Bass Piraeus	Bass Madrid	Bream Piraeus	Bream Madrid
Mean	4.63	7.50	4.19	5.30
Median	4.59	7.08	4.14	5.34
Maximum	6.10	13.95	5.43	6.71
Minimum	3.46	4.77	3.26	3.87
Std. Dev.	0.63	1.90	0.49	0.68
Skewness	0.39	1.39	0.53	0.22
Kurtosis	2.53	5.16	2.91	2.77
Jarque-Bera	2.30	35.08	3.24	0.68
Probability	0.32	0.00	0.20	0.71
Sum	314.64	510.17	285.22	360.25
Sum Sq. Dev.	26.58	241.56	16.19	31.39
Coef. Variation	0.14	0.25	0.12	0.13
Observations	68	68	68	68

Where it can be seen that prices in Madrid are 62 and 28% higher than in Piraeus for sea bass and sea bream, respectively.

On next table, it can be seen the price correlation matrix for the product prices at the two markets.

Table 4: Correlation matrix for sea bass and sea bream

	Bass Piraeus	Bass Madrid	Bream Piraeus	Bream Madrid
Bass Piraeus	1	0.42	0.75	0.37
Bass Madrid	0.42	1	0.53	0.33
Bream Piraeus	0.75	0.53	1	0.62
Bream Madrid	0.37	0.33	0.62	1

ANALYSIS

As most economic time series are non-stationary, standard regressions can not be applied for the analysis of most economic series, instead, cointegration is going to be employed to assess the market integration.

Before testing for cointegration, it is necessary to verify the variable integration order. The most common procedure is the Augmented Dickey-Fuller (ADF) test. The null hypothesis of the existence of a unit root in the series means that the series is non-stationary against the alternative hypothesis of stationarity.

So, it is investigated the stationary properties of the price series, using Augmented Dickey Fuller tests on the logs of the price series. This can be performed by running the Augmented Dickey-Fuller test (ADF) developed by Dickey and Fuller [2,3].

All ADF tests have been performed with EViews 4.1., and in order to determine the appropriate lag length, it has been start with a sufficiently high lag length (13), and was chosen the lag length that

minimizes the Akaike Information Criterion. The test for unit root in levels included trend and intercept parameters, but in those series that the trend was found insignificant and the AIC was lower when not considering it, the trend parameter was removed. Results are shown on next table.

Table 5: Unit root tests for the series analised

	Levels	1st differences
Bass Piraeus	-1.60 (3)	-8.37 (2)*
Bass Madrid	-3.43 (1)	-9.48 (0)*
Bream Piraeus	-2.46 (0)	-9.57 (0)*
Bream Madrid	-2.65 (0)	-8.08 (0)*

Where the number of lags is shown inside the parentheses, and * denotes when the null hypothesis of the existence of at least one unit root (non-stationarity) is rejected at a 5 % significance level.

The null hypothesis of the existence of at least one unit root cannot be rejected (at a 5% level) for any of the price series. While for the first differences of the price variables the null hypothesis of the existence of a unit root is rejected. So, it can be concluded that all the price series are non-stationary I (1) processes.

When testing for cointegration it has been employed the Johansen test [4,5] bivariate procedure. Cointegration analysis allows finding long term relationships between non-stationary variables. The lag length in the cointegration analysis has been chosen by minimizing the Akaike Information Criterion.

On table 6, the cointegration tests are reported for the sea bass prices at the Piraeus and Madrid wholesale markets

Table 6: Cointegration test for sea bass at the Piraeus and Madrid wholesale markets

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.177158	16.52941	15.49471	0.0348
At most 1	0.053945	3.659985	3.841466	0.0557

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.177158	12.86943	14.26460	0.0821
At most 1	0.053945	3.659985	3.841466	0.0557

From the results obtained on the previous table it can be seen that there is one cointegration equation, so markets are cointegrated.

Table 7: Cointegration test for sea bream at the Piraeus and Madrid wholesale markets

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.221027	22.31106	25.87211	0.1303
At most 1	0.079853	5.575841	12.51798	0.5160

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.221027	16.73522	19.38704	0.1165
At most 1	0.079853	5.575841	12.51798	0.5160

From the results obtained on table 7, it can be seen that the Piraeus and Madrid wholesale markets are not cointegrated for sea bream.

Then it can be continued to analyse the degree of integration the characteristics of the Piraeus and Madrid wholesale markets for sea bass.

Next, in table 8, it is tested for the Law of One Price (LOP) for the sea bass in the Piraeus and Madrid wholesale markets.

Table 8: LOP for sea bass in Piraeus and Madrid wholesale markets

Restrictions:

B(1,1)=1
B(1,2)=-1

Tests of cointegration restrictions:

Hypothesized No. of CE(s)	Restricted Log-likehood	LR Statistic	Degrees of Freedom	Probability
1	107.9012	0.044210	1	0.833464

Results from the previous table shows that the LOP is not rejected.

Finally, it is performed a Pairwise Granger Causality Test, in order to know if any of the two markets is influencing the other.

Table 9: Pairwise Granger causality tests results

Pair wise Granger Causality Tests

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
Piraeus does not Granger Cause Madrid	67	0.30474	0.58285
Madrid does not Granger Cause Piraeus		3.33021	0.07269

The results of the test show that the null hypothesis that Madrid wholesale market prices do not cause Piraeus wholesale market prices are rejected at a 10% significance level, but not at a 5% level.

So forth, Madrid prices may cause (in the Granger sense) the Piraeus prices at the wholesale level.

CONCLUSIONS

From these results it can be concluded that the sea bass markets in Piraeus and Madrid are integrated; while not for sea bream. Even thought, the limited time period of the analysis does not allow to offer strong conclusions.

Even this analysis it is on a preliminary stage, this analysis is relevant as it is the first study on the spatial integration for both species, sea bream and sea bream, on two major markets and producers countries.

REFERENCES

[1] MERCASA. Web site: http://www.mercasa.es
[2] Dickey, D. A. and Fuller, W. A. 1979. Distribution of the estimators for autoregressive time series with a unit root. Journal of American Statistical Association, 74: 427-431.
[3] Dickey, D. A. and Fuller, W. A. 1981. Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica, 49: 1057-72.
[4] Johansen, S. 1988. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control, 12: 231-54.
[5] Johansen, S. 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian autoregressive models. Econometrica, 59(6): 1551-80.