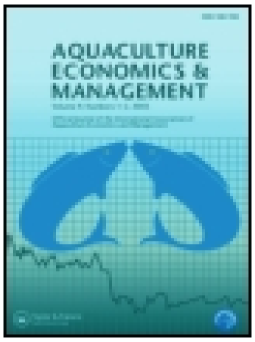

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Are farmed European seabass (*Dicentrarchus labrax*) prices in European Union markets affected by Turkish exports of farmed European seabass?

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ABSTRACT

Often, increases in farmed seabass and seabream production surpluses from Turkey and Greece have been blamed to lead to price declines and aquaculture sector crises. In this study, we investigate whether Turkish exports of farmed European seabass affect prices of European Union (EU) farmed European seabass. This is done by examining the existence of market integration between the prices of Turkish exports of farmed European seabass into the EU and the prices of farmed European seabass commercialized in wholesale markets in Barcelona, Madrid and Paris. Market integration and competition studies in fisheries and aquaculture products have generally focused on analyzing substitutability between species and between wild and farmed conspecifics. Few studies have focused on analyzing market integration between different geographic areas. Market integration analyses between different geographic areas have proven useful in anti-dumping investigations. Results show the lack of market integration between EU imports of Turkish farmed European seabass and main EU wholesale markets; in other words, farmed European seabass prices in EU markets do not seem to be affected by export prices of Turkish farmed seabass.

KEYWORDS
Market integration; competition; cointegration; aquaculture; substitutability

Introduction

Often, increases in farmed seabass and seabream production surpluses from Turkey and Greece, resulting in increases of cheap exports that the demand cannot absorb, have been claimed responsible for price declines and the seabass and seabream aquaculture sector crises. In this study, we investigate whether these claims are true by looking at whether farmed European

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Table 1. Farmed European seabass production in weight (tonnes) and value (million USD [$]) from top 10 producer countries (2016).

Country	Quantity	Value
Turkey	80,847	449.7
Greece	42,557	258.9
Egypt	24,498	61.0
Spain	22,956	166.2
Italy	6800	57.1
Croatia	5310	37.8
Tunisia	2564	14.3
France	2200	20.4
Cyprus	1517	11.0
Others	751	5.6
TOTAL	190,000	1082

Source: FAO-FIGIS (2018).

seabass prices in major EU markets are affected by Turkish exports of subsidized farmed European seabass into the EU.

Turkey is the main European seabass aquaculture producer with 43% of the global farmed seabass production in 2016, followed by Greece (23%), Egypt (13%), Spain (12%), and Italy (4%) (Table 1). In 2013, the main exporter countries were Greece and Turkey with 46 and 25% of the international trade share, respectively, especially to the EU market, with 45% in weight and 20% in value of fresh seabass (Can & Demirci, 2012; FAO, 2017). However, Turkish seabass exports have been gaining market share in the EU market[1]. Turkish seabass exports to main EU markets have increased by 134% between 2010 and 2016, while Greek exports have decreased by 3% (EUMOFA, 2017).

The evolution of the European seabass and gilthead seabream aquaculture production and prices present a similar picture, as companies often produce both species. Global prices of farmed European seabass and gilthead seabream achieved their minimum level in 2001 and 2002, due mainly to major production increases from 2000. Average global ex-farm prices for farmed European seabass fell from almost $17 per kg in the early 1990s to $4.3 per kg in 2002, stabilizing later at around $6 per kg (Figure 1)[2]. Farmed European seabass prices often fell below production costs in certain periods (e.g. during intensive harvesting period in late summer), causing major crises in the sector and resulting in a rationalization of the industry (Rad, 2007; Rad & Köksal, 2000; STECF, 2014; University of Stirling, 2004; Wagner & Young, 2009).

Aquaculture is the fastest-growing animal food producing sector in the world, contributing increasingly to global food supply and economic growth (Lem, Bjørndal, & Lappo, 2014). The boom of aquaculture has led to higher total seafood supply, lower seafood prices and lower price volatility (Asche, Dahl, & Steen, 2015; Dahl & Oglend, 2014). Through this contribution to the decrease in the prices of seafood and the increase of total supply, aquaculture has accelerated the globalization of trade and increased the concentration and integration of the seafood industry worldwide

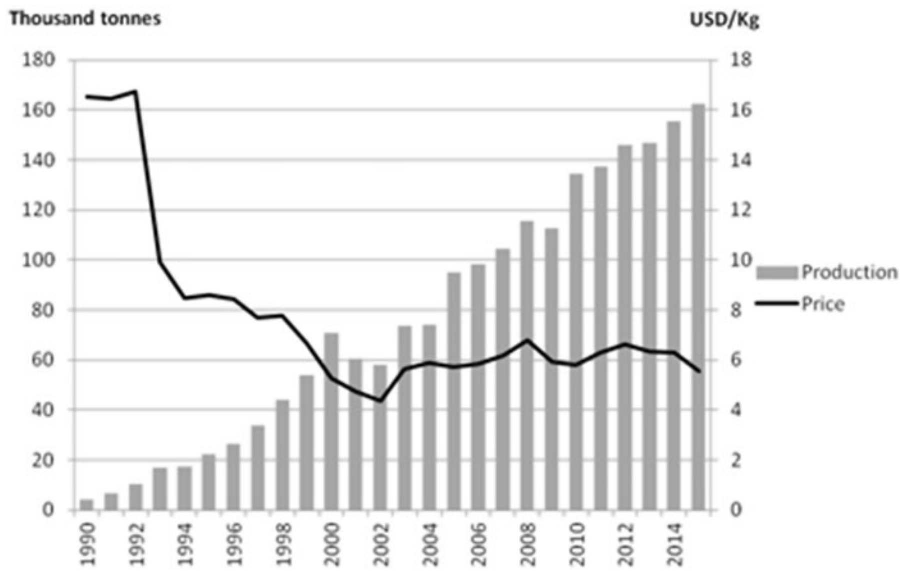

Figure 1. Total aquaculture production (in thousand tonnes) and price of European seabass (in USD/kg) for the period 1990–2015. Source: authors' elaboration of FAO (2017) data.

(Guillotreau, 2004; Schmidt, 2003). In fact, the share of global capture fisheries and aquaculture production entering international trade was 36% in 2014 (FAO, 2016), the highest among food and agricultural commodities when compared with around 10% for meat and 7% for milk and dairy products (Natale, Borrello, & Motova, 2015). Moreover, 78% of the seafood produced worldwide is exposed to international competition (Tveterås et al., 2012).

This international competition means that price interactions operate at a global level and can have serious consequences for wild fisheries and aquaculture producers when products compete on the same market and the imported produce price is lower than the domestic price (e.g. produce comes from countries with significantly lower production costs). Less efficient domestic aquaculture firms and wild fisheries may experience decreases in profits, compromising their future[3]. In some instances, this has given rise to dumping complaints and the introduction of anti-dumping measures (Asche & Bjørndal, 2011).

Several studies have focused on analyzing market integration (i.e., competition) between seafood products from different geographic origins, in particular on the substitutability between farmed imports and domestic produce. However, current knowledge of market competition between different origins is based on a small number of species and markets. Studies have mostly focused on salmon in the EU and US (Asche, 2001; Gordon, Salvanes, & Atkins, 1993; Jaffry, Pascoe, Taylor, & Zabala, 2000; Mickwitz, 1996; Setälä et al., 2008; Virtanen, Setälä, Saarni, & Honkanen, 2005), shrimps in the EU and US (Ankamah-Yeboah, Ståhl, & Nielsen, 2017; Ankamah-Yeboah & Bronnmann, 2018; Asche, Bennear, Oglend, & Smith, 2012; Béné, Cadren, & Lantz, 2000; Kennedy & Lee, 2005), and catfish/tilapia in the US (Hong & Duc, 2009; Kennedy & Lee, 2005; Ligeon, Jolly, & Jackson, 1996; Norman-López & Bjørndal, 2009; Quagrainie & Engle, 2002). In many cases, substitutability between farmed imports and domestic produce is confirmed, even if there are some exceptions (see for a review Bjørndal & Guillen, 2016). Therefore, available studies on competition between origins are based on a limited number of species and countries, many of them rather dated, and none relevant for the Mediterranean region. Hence, this study is a first step to fill this gap by investigating, using cointegration methodology, whether farmed European seabass prices in Paris, Madrid and Barcelona wholesale markets are affected by Turkish exports of subsidized farmed European seabass into the EU.

Methodology

Market competition and integration are commonly analyzed by looking at whether the prices of products are related over time, which allows price adjustment between markets to take time (Ravallion, 1986). In other words, it is investigated if the price of a product (dependent variable P_1, is the farmed seabass price in EU markets) can be explained by the price evolution of another product (explanatory variable P_2, is the price of the EU imports of farmed seabass from Turkey), as well as its own previous price evolution.

$$P_{1,t} = \alpha + \sum_{j=1}^{m} \beta_j P_{1,t-j} + \sum_{i=0}^{n} \delta_i P_{2,t-i} + e_t \tag{1}$$

where α is a constant term and e_t is a white noise error term. Thus, if δ_i is equal to 0, there is no relation between the prices of both products, and consequently, there is no market integration; while, if δ_i is different from 0, there is a relation between the prices of both products, so there is market integration. Hence, whether the farmed European seabass prices in EU markets are affected by imports of farmed European seabass from Turkey.

The relationships between variables (i.e., the degree to which variables are dependent upon each other) have traditionally been studied with ordinary regression analysis. Such methodology can only be used when variables are stationary (Squires, Herrick Jr, & Hastie, 1989; Asche, Gordon, & Hannesson, 2004), but many economic variables, such as prices, are often non-stationary (i.e., have trends). The use of cointegration methodology is required to estimate real long-run relationships between non-stationary variables, in order to avoid obtaining spurious relations that may emerge when using regressions (Ardeni, 1989; Goodwin & Schroeder, 1991; Whalen, 1990). Cointegration, in particular, the multivariate Johansen cointegration test (Johansen 1988, 1991; Johansen & Juselius, 1990), is currently the most commonly used empirical tool to test for market integration, including seafood products (e.g. Nielsen, Smit, & Guillen, 2009; Norman-López & Asche, 2008).

When there is cointegration between prices, the prices exhibit one or more long-run relationships. These prices may drift apart due to random shocks, sticky prices, contracts, etc. in the short run, but in the long run, the economic processes force the prices back to their long-run equilibrium path, resulting in stationary differences between them (Engle & Granger, 1987; Harris, 1995). Therefore, when there is cointegration, it implies the existence of a stable long-run relationship between the prices, and consequently, prices are integrated and the products are considered to form part of the same market (Asche, Steen & Salvanes, 1997).

Under the Johansen approach, data are split into two groups: the variables in their levels and their first differences. Using the canonical correlation technique, there are found the linear combinations of the data in their levels that are highly correlated with the differences. If the correlation is sufficiently high, these linear combinations are stationary, and so are the cointegration vectors. The multivariate approach developed by Johansen defines a vector Z_t, containing n potentially endogenous variables, where it is possible to specify a data generating process and model Z_t as an unrestricted vector autoregression (VAR) with up to k-lags of Z_t:

$$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \mu + \varepsilon_t \tag{2}$$

where Z_t is $(n \times 1)$, each of the A_i is an $(n \times n)$ matrix of the coefficients, μ is the constant term and $\varepsilon_t \sim$ niid $(0,\Omega)$, so it is assumed to be an independent and identically distributed Gaussian process. Equation (2) can be reformulated in a vector error-correction (VECM) form by subtracting Z_{t-1} from both sides:

$$\Delta Zt = \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k} + 1 + \Pi Z_{t-k} + \mu + \varepsilon_t \tag{3}$$

where,

$$\begin{aligned} &\Gamma_i = -(I - A_1 - \ldots - A_i), \;\; (i = 1, \; \ldots, k-1), \;\; \text{and} \\ &\Pi = -(\mathrm{I} - A_1 - \; \ldots \; - A_k). \end{aligned} \tag{4}$$

The system of equations (2) and (3) contains information on both the short- and the long-run adjustment to changes in Z_t. The rank of Π, denoted as r, determines how many linear combinations of Z_t are stationary (i.e., cointegration vectors). Testing for cointegration is, therefore, the same as determining how many cointegration vectors are. If $r = N$, the variables are stationary. While if $r = 0$, none of the linear combinations are stationary. When $0 < r < N$, there are r cointegration vectors of Z_t.

Determining the lag order of the model is a critical issue in cointegration. This happens because a series should be non-stationary to apply cointegration, but the stationarity properties of a series can change with the number of lags considered as explanatory variables. Estimating initially the optimal number of lags for one series using a unit root test may be of little help. The optimal number of lags for one series (e.g. estimated with a unit root test) may be different from the optimal number of lags for another series we want to compare. In addition, these lag-lengths may be different from the optimal number of lags that explains the relationship between the series according to the cointegration results. Moreover, different lag length selection criteria often lead to different conclusions regarding the optimal number of lags that should be used. Meanwhile, the choice of the lag length can considerably affect the results of the cointegration analysis (Emerson, 2007). Hence, following Bjørndal and Guillen (2017b), we determine the number of lags using three different criteria: (i) Log Likelihood, (ii) Akaike Information Criteria, and (iii) Schwarz Criteria.

Four different outcomes can be obtained from the cointegration tests when estimating them for the number of lags obtained using the previous criteria:

- All tests show two cointegration equations. Then prices are stationary and cointegration methodology cannot be applied, instead, regression methodology should be used.
- All tests show zero cointegration equations. Then prices are not cointegrated, and consequently, products are not in the same market.
- All tests show one cointegration equation. There is then the need to investigate the stationarity properties of the series. There are two options. It could be that both series are non-stationary and they are cointegrated (i.e., are part of the same market), so there is only one cointegration equation. But it could be possible that one of the series is stationary and the other one is non-stationary, and consequently, they are not cointegrated.
- Outcomes from the tests report different numbers of cointegration equations depending on the lag chosen. There is then the need to investigate the stationarity properties of the series, and results should be considered with caution.

Data

For this study, we use the 208 average weekly prices of EU imports of fresh whole Turkish farmed European seabass and of fresh whole farmed

Table 2. Annual average price ($/kg) of farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets and of Turkish exports into the EU for the period 2011–2014.

Market	2011	2012	2013	2014
Madrid wholesale	8.6	8.1	8.8	8.9
Barcelona wholesale	7.9	8.2	8.0	8.4
Paris wholesale	11.0	8.1	8.8	9.0
Turkish exports into the EU	6.5	6.6	6.0	9.0

European seabass commercialized in Barcelona, Madrid and Paris wholesale markets for the period 2011–2014 (Table 2). Prices of EU imports of Turkish farmed European seabass and of farmed European seabass commercialized in Paris wholesale market have been obtained from the EUMOFA website, while prices of farmed European seabass commercialized in Barcelona and Madrid wholesale markets have been obtained from their own websites[4].

According to FAO (2017), Turkey exported 17,000 tonnes of fresh European seabass in 2013, valued over $91 million, which represented in weight a 25% of the farmed European seabass national production.

Mercamadrid and Mercabarna (Madrid and Barcelona wholesale markets) are the main wholesale markets in Spain. They together cover almost 50% of the total seafood commercialized in the Spanish wholesale markets network. In 2014, they commercialized 4870 tonnes of farmed European seabass and 360 tonnes of wild-caught European seabass, amounting to over 30% of the Spanish production of European seabass. During the period of analysis, Turkish exports of farmed European seabass represent 15 and 18% of the farmed European seabass commercialized in Madrid and Barcelona wholesale markets, respectively. Rungis, Paris wholesale market, is the largest wholesale market in France, with 945 million USD of total sales of seafood products and around 97,500 tonnes of seafood commercialized in 2015. In this study we consider the 400–600 g whole fresh farmed European seabass produced in France commercialized in Rungis wholesale market.

Figure 2 shows the price evolution of farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets and EU imports from Turkey for the period 2011–2014. It can be observed in Figure 2 that farmed European seabass prices of both Turkish exports into the EU and in main EU wholesale markets follow a similar evolution, even if prices of Turkish exports are significantly lower. With the exception that French farmed seabass prices have a decreasing trend during the first 9 months of 2011, while Turkish and both Spanish farmed European seabass prices show an increasing trend. It can also be observed the presence of seasonality, as farmed European seabass prices decrease during December.

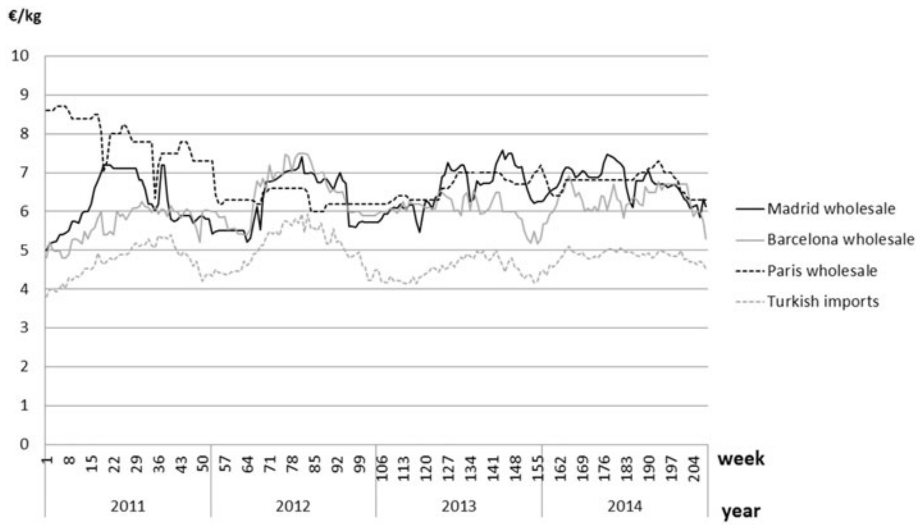

Figure 2. Weekly price data of farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets and EU imports from Turkey for the period 2011–2014.

Results

The lag length selection is done for three different criteria (Log Likelihood, Akaike Information Criteria, and Schwarz Criteria). In Supplementary material 1, the different values obtained for each criterion at each lag length are presented. In Table 3 we present the optimal lag length for each criterion, summarizing the results in the Supplementary Materials 1.

According to the three different criteria, the optimal lag length for testing the relation between the Barcelona wholesale and Turkish export prices is 1 lag; while for testing the relation between the Madrid wholesale and Turkish export prices, and between the Paris wholesale and Turkish export prices are 0 and 1 lags. Table 4 presents the cointegration results for farmed European seabass by wholesale market according to the lag length previously obtained.

The cointegration test between prices of farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Barcelona wholesale market shows 0 cointegration equations considering 1 lag. Therefore, there is no market integration between EU imports of farmed European seabass from Turkey and farmed European seabass commercialized at the Barcelona wholesale market.

Likewise, the cointegration tests between prices of farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Paris wholesale market show 0 cointegration equations considering 0 and 1 lags. Therefore, there is no market integration between EU imports of farmed European seabass from Turkey and farmed European seabass commercialized at the Paris wholesale market.

Table 3. Optimal lag length for EU imports of Turkish farmed European seabass and farmed European seabass commercialized at different wholesale markets by criteria.

Market	Likelihood Ratio	Akaike Information Criteria	Schwarz Criteria
Barcelona wholesale and Turkish exports	1	1	1
Madrid wholesale and Turkish exports	1	1	0
Paris wholesale and Turkish exports	0	1	0

Table 4. Cointegration test for EU imports of Turkish farmed European seabass and farmed European seabass commercialized by wholesale market.

Market	Lags	No. of CE(s)	Eigenvalue	Likelihood ratio	5% Critical value	Acceptance
Barcelona	1	None	0.062152	19.92650	19.96	Acceptance
		At most 1	0.032038	6.707962	9.24	Acceptance
Madrid	0	None	0.062635	23.80025	19.96	Rejection
		At most 1	0.049051	10.41105	9.24	Rejection
	1	None	0.064990	21.22076	19.96	Rejection
		At most 1	0.035181	7.377945	9.24	Acceptance
Paris	0	None	0.056108	18.63931	19.96	Acceptance
		At most 1	0.032636	6.801959	9.24	Acceptance
	1	None	0.053356	16.52213	19.96	Acceptance
		At most 1	0.026208	5.391114	9.24	Acceptance

Table 5. Regression test results for prices of farmed European seabass from the Madrid wholesale market and Turkish exports considering 0 lags.

	Lags	Number of significant relations (Total relations)	Market integration
Price in Madrid related to Turkish exports	0	1 (1)	Yes
Price of Turkish exports related to Madrid wholesale	0	1 (1)	Yes

However, the cointegration test between prices of farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Madrid wholesale market shows 2 and 1 cointegration equations when considering 0 and 1 lags, respectively. So, prices of EU imports of farmed European seabass from Turkey and farmed European seabass commercialized at the Madrid wholesale market behave as stationary series when no lags are considered, and consequently regression methodology needs to be applied in order to assess market integration (see Table 5). Instead, when considering 1 lag, the stationary behavior of the series needs to be further analyzed (see Table 6).

The ADF Test statistics for prices of farmed European seabass imported to the EU from Turkey are higher than the MacKinnon critical value for rejection of the hypothesis of a unit root at a 5% significance level. So, the prices of farmed European seabass imported to the EU from Turkey behave as a non-stationary series. While prices of farmed European seabass commercialized at the Madrid wholesale market behave as stationary when considering 1 lag. Consequently, there is also no market integration between farmed European seabass imported to the EU from Turkey and farmed

Table 6. Unit root test considering intercept for farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Madrid wholesale market considering 1 lag.

Lags	Series	ADF test statistic
1	Turkish exports	−2.600
	Madrid wholesale	−3.516*

*Denotes rejection of the hypothesis at 5% significance level. Critical values at 1%: −3.46, 5%: −2.88, 10%: −2.57.

Table 7. Summary of the market integration outcomes for EU imports of Turkish farmed European seabass and farmed European seabass commercialized in main wholesale markets.

Market	Lags	Market integration	Methodology	Market integration
Barcelona	1	No	Cointegration	No
Madrid	0	Yes	Regression	Uncertain (Low)
	1	No	Cointegration	
Paris	0	No	Cointegration	No
	1	No	Cointegration	

European seabass commercialized at from the Madrid wholesale market when considering 1 lag.

Therefore, regression analysis should be used to assess market integration between prices of farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Madrid wholesale market when no lags are considered. Thus, it is needed to investigate whether the price in the Madrid wholesale market (in time t) is related to the price of Turkish exports (in time t, no lags in this case), and vice versa. Table 5 summarizes the outcomes of the regression analysis that are presented in the Appendix.

Results from the regression tests show that farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Madrid wholesale market are integrated when considering no lags. Consequently, the existence of market integration between farmed European seabass imported to the EU from Turkey and farmed European seabass commercialized at the Madrid wholesale market is uncertain as we obtain different results when considering different lags.

Table 7 summarizes the market integration outcomes from the cointegration and regression methodologies for EU imports of Turkish farmed European seabass and the farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets.

Concluding remarks

Mismatched supply and demand patterns in past years resulting in cheap imports of farmed European seabass and gilthead seabream from Greece and Turkey have often been claimed responsible of the crises in the EU's European seabass and gilthead seabream aquaculture sector.

Economic performance of EU aquaculture companies producing European seabass and gilthead seabream is rather low. STECF (2014, 2016, 2018) estimated net profit margin for EU companies producing European seabass and gilthead seabream to have oscillated between 0 and 7% during the period 2010–2016. There are few studies investigating the economic performance of the aquaculture production of European seabass in Turkey, but they show a more profitable sector than the EU one. Koçak and Tatlıdil (2004) provided first estimates of total production costs of farmed European seabass in the Milas District (Turkey, Aegean Sea) were $2.34 per kg, resulting in a profit of $0.41 per kg (15% net profit margin). Bozoglu and Ceyhan (2009) estimated that total farmed European seabass production costs were $4.77 per kg, while the ex-farm price was $5.24 per kg, leading to a 10% net profit margin in 2005. While Peker and Ertekin (2012) estimated farmed European seabass production costs to be about $4.91 per kg and $4.97 per kg for earthen ponds and cages in 2010, respectively, resulting in the profitability of 20.7% and 18.9% for earthen ponds and cages, respectively. More recently, Arikan and Aral (2019) estimated that in 2014–15, total farmed European seabass production costs were $4.57 per kg and net profit margin reached 19% in Muğla Province (Turkey, Aegean Sea). This higher profitability of Turkish producers can be explained in part because of lower production costs (mainly labor cost) and economies of scale, a sustained depreciation of the Turkish lira versus the EU euro that resulted in cheaper Turkish exports for EU consumers and the subsidies that producers have received until recently (Globefish, 2017)[5].

However, while market integration (competition) studies were available for farmed salmon, shrimps, and catfish/tilapia in the EU and US, there was a lack of such studies for the Mediterranean area and Mediterranean species.

Thus, our study is the first step to fill this gap. In our study, we have investigated market integration between EU imports of Turkish farmed European seabass and the farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets for the period 2011–2014. Our results, despite some uncertainties, suggest the lack of integration between EU imports of Turkish farmed European seabass and the farmed European seabass commercialized in Barcelona, Madrid and Paris wholesale markets. Therefore, prices of EU imports of Turkish farmed European seabass seem not to affect the farmed European seabass commercialized in Spanish and French wholesale markets.

These uncertainties come from the fact that the choice of lag length can drastically affect the results of the cointegration tests and consequently on the conclusions of the market integration analysis (Emerson, 2007). Indeed, in this study, we determine the number of lags using three different criteria: Log Likelihood, Akaike Information Criteria, and Schwarz Criteria. This has led to contradictory results depending on the number of lags chosen (i.e., depending on the criteria used) in the stationary behavior of the price series, and consequently on the methodology applied (i.e., cointegration and regressions). In addition, regression methodology tends to accept more the relation between variables than cointegration methodology, and regression methodology was fully applied in the cases where market integration was found. This is evident in those cases where the initial cointegration analysis showed that zero lag was the preferred model. So, for example, it cannot be fully assured the existence of market integration between farmed European seabass imported to the EU from Turkey and from the Madrid wholesale market as we obtain different results when considering different lags.

The lack integration between the EU imports of Turkish farmed European seabass and the farmed European seabass commercialized in Spanish and French wholesale markets is surprising as Spanish and French markets are very exposed to international competition (e.g. Turkish exports) (see, for instance, Tveterås et al., 2012), even if the Spanish market is very dependent on domestic production and the French market is more dependent on imports from closer origins (e.g. Spain and Greece) (Globefish, 2017). Indeed, Turkish exports of farmed European seabass represented less than 20% of the farmed European seabass commercialized in Spanish wholesale markets during the period of analysis. While prices of Turkish exports of farmed European seabass were about 35% less on average than prices in Spanish and French wholesale markets.

In 2014, Russia set an embargo on certain agricultural food products, including fish, from the EU, the USA, Norway, Canada and Australia (Kutlina-Dimitrova, 2017). This embargo led to a significant increase in Turkish seabass exports to Russia. We have repeated the analysis for the period 2010–2013, i.e., excluding 2014. Results confirm even more clearly the lack of market integration between the prices of farmed European seabass in main EU wholesale markets and of Turkish exports (see Supplementary material 2).

Thus, this lack of integration for the period analyzed make us believe that prices of farmed European seabass in Spanish and French wholesale markets may be more affected by Greek exports into other EU countries, as well as domestic production, mainly from Spain. The Italian market is the main buyer of Turkish farmed European seabass. Unfortunately, available price data from the Milano and Rome wholesale markets from the EUMOFA website are of low quality (e.g. constant prices) and with many missing observations, which undermine any potential analyses of the Italian market. In any case, when looking at Figure 2, we can observe that when farmed European seabass prices decrease in December, prices of Turkish exports are the ones declining first. Thus, it could be possible that Turkish exports only significantly affect EU markets at some particular points in time, e.g. where the volume of Turkish exports increases. But the lack of Italian data and the level of aggregation of currently available data do not allow us to investigate this hypothesis.

Notes

1. The EU is a major market for seafood, with 12.3 million tonnes consumed in 2011, worth a total 72.7 billion USD. Spain is the largest seafood market in the EU, with an apparent consumption of 15.7 billion USD, followed by France and Italy with 13.9 and 13.5 billion USD, respectively (DG MARE, 2015). The main consumers of European seabass in the EU are Italy, Spain, France, and the United Kingdom.
2. The average exchange rate between euro and US dollar was 1 EUR equal to 1.1095 USD in 2015, as reported by the European Central Bank.
3. Studies show that farmed European seabass does not compete with wild seabass species in France (Regnier & Bayramoglu, 2017), Italy (Brigante & Lem, 2001), Spain (Rodríguez Rodríguez & Bande Ramudo, 2015; Bjørndal & Guillen, 2017a) and Turkey (Bayramoglu, 2018).
4. Eumofa website: http://www.eumofa.eu, Mercabarna website: http://www.mercabarna.es, and Mercamadrid website: http://www.mercamadrid.es.
5. In 2011, 23.8% of the Turkish seabass production was subsidized. Subsidies of $0.47 (0.85 TL) per kg of seabass produced were given to farms with yearly production capacity up to 251 tonnes per year, and $0.24 per kg to farms with a yearly production capacity between 251 tonnes and 500 tonnes per year in 2012. Subsidies were doubled for organic production (SPO, 2014).

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