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Effects of green certification and labelling on the Spanish fisheries industry

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ABSTRACT

Fisheries and aquaculture are incorporating environmental management system (EMS) tools and certified sustainable products as part of their strategic priorities. Firms have different ways to certify their environmental actions: the International Organization for Standardization (ISO) 14001 and the blue Marine Stewardship Council (MSC). ISO 14001 certifies the adoption of EMSs; and the MSC label guarantees the use of seafood that can be traced back to a sustainable resource. The economic impact and the differences between eco-labeling certifications are topics of great interest for environmental management. This paper analyzes and compares the effect of ISO14001 and the MSC on the results of the Spanish fishing auxiliary industry. We analyzed data from 561 Spanish firms and deployed a multivariate quantitative analysis with data retrieved from the financial accounts of Spanish fish processing and preserving firms, in different economic and financial ratios. Results show that certified firms get better economic ratios, although these benefits are not due to an operational efficiency improvement. Firm size is found to have a moderating effect on the relation between certification and economic performance. Environmental certification on firms' performance provides key information for environmental management-related decision making.

1. Introduction

Sustainable seafood campaigns often look only at consumers, aquafarmers and fishermen, forgetting other actors in the supply chain (Iles, 2004). The sustainability of fish stocks, fishing industries and fishing communities are interrelated (Anderson et al., 2015). Fisheries and aquaculture management have been traditionally focused on biological and ecological questions, but it is necessary to redirect attention to other socio-economic issues that are less commonly addressed. Fisheries and aquaculture management need to link to the broader idea of "food systems", that includes other components such as research, industry, transportation and consumption (Olson et al., 2014) and to adopt a multi-stakeholder approach (Steenbergen et al., 2017).

Environmental proactivity is considered a key element in corporate social responsibility and it has emerged as one of the drivers of competitiveness (Porter and van der Linde, 1995; Porter and Kramer, 2011). The intersection between business and the environment lies in transforming existing markets, allowing the creation of new ones and increasing promotion of the principles of sustainability in business strategies (Carrascosa-López et al., 2012). In this line, fishing and aquaculture industries are adopting a proactive environmental approach (Kay et al., 2016).

The seafood sector is especially sensitive to environmental issues, since there is a growing concern about the sustainability of the existing fishing and aquaculture model. Issues such as the over-exploitation of species, the effects of fishing on entire ecosystems and the reduction of marine biodiversity are some of the main environmental problems related to the intensive exploitation of the marine environment (Sissenwine et al., 2014). Similarly, aquaculture is facing impacts caused by the use of large areas of valuable coastal and inland ecosystems and their effects on the quantity and quality of water resources (Pattanaik and Narendra Prasad, 2011, Troell et al., 2013). The effects on the food chain of the use of fertilizers, disinfectants, pesticides and other feed additives also represent a growing concern which affects fishing and aquaculture as well as other industries related to fish processing and distribution (Uddin et al., 2016; Ottinger et al., 2016).

In this context, many companies decide to go beyond the formal legal requirements and take a proactive attitude towards EMS, (Segarra-Oña et al., 2012). Companies, including those in the food and the fishing industry, voluntarily incorporate EMSs and certify them through ISO 14001 certification. This standard is used and recognized across different industries worldwide. It has been proved that the EMS (more specifically, the ISO 14001) can be a source of competitive advantage for companies. It provides discipline and metrics that ease the decision-

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making processes for managers. It is also a well-recognized eco-label by consumers. For example, Peiró-Signes et al. (2014) demonstrated how hotel guests rated the hotels with ISO 14001 certification higher than those without the certification.

Some companies within the seafood industry have gone further, ensuring that their products come from fisheries and fish farms under responsible management. Today, there are countless certificates and eco-labels that guarantee the sustainable exploitation of the final products. The Marine Stewardship Council (MSC) eco-label is the most recognized certificate worldwide in the fisheries industry.

The aim of this paper is to evaluate the effect of sustainable labelling and environmental management implementation on the economic performance of firms.

2. Ecolabels' analysis and hypotheses statement

The number of eco-certificated fishing companies has been increasing since the late 1990s, but certification schemes for aquaculture are still a relatively new phenomenon. Certified wild catch accounted for 20 % of the total global catch in 2015 (Potts et al., 2016), but only 6% of the total aquaculture production is certified by six major international schemes – Aquaculture Stewardship Council (ASC), Global Aquaculture Alliance Best Aquaculture Practices (GAA BAP), Friends of the Sea (FOS), GlobalGAP, Naturland and Organic – with certified salmon encompassing 56 % of that total (Weitzman and Bailey, 2018).

Environmental certification and eco-labels are part of a new wave of environmental policies that emphasize information disclosure as a tool to induce environmentally friendly behaviors both, in firms and consumers (Dietz and Stern, 2002).

According to Bremner (2002), the main issues regarding fish processing are safety and quality. Recently, a third issue is becoming increasingly important: consumer environmental awareness. Several studies highlight the consumers' increasing desire to buy environmentally responsible labelled seafood (Seafood Choice Alliance, 2005; Uchida et al., 2014).

The fishing industry also wants to offer products with eco-labelling and certification schemes (Toonen and Mol, 2013). Large-scale retailers and food services now drive demand for certified fishery products in relation to food safety and quality, sustainability and social criteria (Washington and Ababouch, 2011). Hence, eco-labels and certification schemes could improve access to certain markets and provide a price premium for fish products (Hilger et al., 2019; Nuttavuthisit and Thøgersen, 2017). Eco-friendliness is not the main reason why consumers make purchasing decisions, although it can be considered when choosing among competing products (Ward and Phillips, 2010).

The term "eco-label" commonly refers to a producer's right to use a symbol or phrase on their product labels after passing a voluntary third-party environmental certification (Leire and Thidell, 2005; Rex and Baumann, 2007). Environmental certification is an assessment process that confirms (verifies) that a product complies with a standard set of criteria. Seafood certification has two main goals: to identify producers who meet ecological standards that increase products reliability, and to enhance sustainability and incentivize environmental improvement within the industry (Tlusty, 2012). Both certify that their products come from responsible fisheries and/or aquaculture facilities. The Marine Stewardship Council, the Friends of the Sea (FOS) and the Swedish Association for Alternative Cultivation (KRAV) certificate attempt a broader evaluation of fisheries governance (Karlsen et al., 2012; Galati et al., 2015), whereas FOS and KRAV also include aquaculture products.

The MSC is widely regarded as the highly credible "gold standard" in sustainable fisheries certification (Sutton and Wimpee, 2008; Wakamatsu, 2014; Agnew et al., 2014). Proof of its current influence is its related certificate: the Aquaculture Stewardship Council (ASC). This certificate requires that all companies in the supply chain – from the boat to the plate – must obtain the MSC chain of custody certificate. It is the leading wild-capture fisheries certification program. In 2019, there were 361 certified fisheries and 109 fisheries in assessment, which means that about 15 % of marine wild catch engaged with the MSC program (certified or in assessment) and more than 36,000 products are sold with the blue MSC label.

The ISO 14001 was created to help firms identify and control the environmental impact of their activities, products and services and to help stakeholders recognize firms that are committed to improving their environmental impact (Delmas and Montes-Sancho, 2011). The ISO 14001 does not focus on outcomes, such as pollution or products, but on processes. The ISO 14001 standard describes the basic elements of an effective EMS. If organizations set out to manage environmental matters systematically, they can be expected to learn about production processes that result in pollution, take action against them and perform better than firms that do not (Coglianese and Nash, 2001). We consider the MSC and the ISO 14001 ecolabels as there are not as many aquaculture companies that have adopted the ASC ecolabel so far. We believe that the analysis will provide interesting and valuable insight for aquaculture companies, as well.

According to Weyandt et al. (2011), there are different motivations for implementing ISO 14001 in fish processing plants, including achieving competitive advantage and increasing client confidence and managerial skills. Regarding seafood processing, four areas are important regarding sustainability: energy usage; water usage; effluents; and by-product development (Hall, 2011). To evaluate the environmental impact in these areas, several studies applied carbon footprinting analysis (e.g. Iribarren et al., 2010; Winther et al., 2009) while other authors recommended life cycle assessment tools (e.g. Ziegler et al., 2003 or Vázquez-Rowe et al., 2011). The seafood processing plants that implement EMS are the only ones that have good environmental practices. These authors argue that the aim of EMS is minimizing and controlling the impact of their activities on the environment, while other ecolabels merely comply with legislation. Similarly, Thrane et al. (2009) noted the importance of implementing EMS in cleaner fish processing production in Denmark.

To date, many studies have linked EMS, especially the ISO 14001, to business results (Melnyk et al., 2002; Montalvo, 2008). These authors found business' results improvement. Other authors investigated the reasons for this positive relationship: Esty and Winston (2009) considered the resulting improved reputation; Florida and Davison (2001) examined the lowered costs; and Bleischwitz (2010) looked at enhancements in productivity. However, none of these works are related to the fishing industry. There are also studies that have related different eco-labels with economic profits. Most of them found a positive relationship, since consumers perceive an extra value in an eco-label (Tlusty and Thorsen, 2017; Carlson and Palmer, 2016). Regarding the sea products, some authors have also proved the positive impact of eco-labels. Teisl et al. (2002) noted an increase of the market share related to dolphin-safe labels on tuna, and Sogn-Grundvåg et al. (2013) found that the MSC gives about a 10 % price premium on haddock products.

The fishing industry must incorporate EMS as one of its strategic priorities. Certifying the use of fishing products obtained from sustainable fisheries (through the MSC) or adopting an EMS (through the ISO 14001) are two possible alternatives, or even complementary ways, to do so. Considering the above, we state our research questions:

Do ISO14001and MSC have any influence on profits?

Do ISO14001and MSC act similarly? Are there any significant differences?

So far, previous studies have analyzed the economic effects of each green label independently. We believe it is important to analyze both environmental certifications together, since companies, for economic reasons, will opt for one certificate or another.

According to Eurofish,[1] Spain holds the largest fishing industry in

[1] https://www.eurofish.dk/

the EU, as it is the largest producer of fish in the EU by volume and the largest consumer market for fisheries and aquaculture products. The fishing fleet is composed of more than 9000 boats, and it is the third-largest in the European Union (EU). It employs more than 36,000 people. The aquaculture sector is a growing sector. In 2016, the total number of aquaculture enterprises was 5,105, including 4905 marine farms and 200 freshwater farms.

The economic impact and the differences between implementing EMS and pursuing environmental labels is an interest topic for companies belonging to the fisheries industry. With this in mind, this paper analyzes the effect of the ISO 14001 and the MSC on the economic results of the Spanish fishing auxiliary industry, as it is representative both at the European and the global level as an industry and a market. This work seeks to address sustainability from the point of view of the fishing industry itself. In other words, it focuses on the companies responsible for processing and preserving the fish. Based on the previous studies, mentioned above, we expect environmental certification to contribute positively to the economic performance of companies.

The importance of firm size on these types of economic analyses has also been considered previously (Segarra-Oña et al., 2012; Miret-Pastor et al., 2014). Controlling for this variable is crucial when considering economic performance indicators that are sensitive to the size of the company. Additionally, Bowen's (2000) review of academic research reported that most studies showed a significant correlation between firm size and environmental performance. Larger firms are more environmentally proactive than small firms (Etzion, 2007). Thus, size is likely to moderate the relations that involve environmental actions and economic performance. Considering the above rationale, this study aim to test two hypotheses:

H1. *Environmental certification contributes to creating profit in the seafood processing industry by improving economic performance.*

H2. *Size acts as a moderating variable in the relationship between environmental certification and economic performance.*

3. Material and methods

For this study, we used the Iberian Balance Sheet Analysis System (SABI) to identify 561 companies classified in "Processing and preserving of fish, crustaceans and mollusks," code 10.20 according to NACE Rev.2 classification from Eurostat. We focused on the 10.20 NACE code, which is in the manufacturing section in NACE classification. It includes: the preparation and preservation of fish, crustaceans and mollusks (freezing, deep-freezing, drying, cooking, smoking, salting, immersing in brine, canning etc.); the production of fish, crustacean and mollusk products; and fish fillets, roes, caviar and caviar substitutes. We focused on manufacturing companies (section C in NACE classification) rather than on companies belonging to the primary sectors (section A in NACE classification), because processed fish accounts for around 55 % of all fish for direct human consumption (FAO, 2018), and more that 75 % of Spanish MSC certifications are classified primarily as involved in the processing and preserving of fish (Fernández Sánchez et al., 2014).

We obtained the economic performance indicators (i.e. total income [TI]; net sales; profit margins; earnings before interest and taxes [EBIT]; earnings before interest, taxes, depreciation and amortization [EBITDA]; return on assets [ROA]; return on capital [ROC]; return on equity [ROE]; productivity [PM]; and productivity per employee [PPE]) from the Iberian Balance-Sheet Analysis System (SABI) database. Table 1 shows the principal variables descriptive statistics by size.

We retrieved data referring to Spanish fish processing firms with the ISO 14001 environmental certification from the information given by the accredited bodies (AENOR, TuVRheinland, Bureau Veritas and others). Furthermore, the MSC database provides the data for all MSC companies that certified their chains of custody

The final dataset is comprised of 532 companies belonging to the 10.20 group, of which 474 had neither certificate; 35 had the ISO 14001; and 33 had the MSC. Ten companies had both certificates.

The intent of the study is to examine ISO certification differences in performance indicators, how those differences are moderated by MSC-certification and whether that interaction is different depending on the size of the company. Thus, initially, we conducted multiple analyses of variance on the influence of two certification variables (ISO, MSC) on the companies' performance indicators (factorial ANOVA). We checked Shappiro-Wilk and Lavene tests and, then, we used Type III square sums when performing the factorial ANOVA, as this will provide a test of unweighted means, which is the appropriate test to conduct with unequal cell sizes. Additionally, if the performance indicators were significantly different for each type of certification, we followed up the analysis with the addition of the size (covariate in factorial ANCOVA), measured as the number of employees, as a control variable, as some of the performance variables should be correlated with the size of the company. However, besides the differences that can be found between certified and non-certified firms, to determine whether the certification causes the differences, we need to use regression analysis to establish whether the ISO 14001 and the MSC significantly affected the economic performance of firms. For this purpose, we used the different economic indicators as dependent variables. We created dummy variables to add to the model the presence or absence of the ISO 14001 and the MSC in the sample companies. We called them ISO and MSC, and we coded them with a 1 if they had the certification, or 0 if they did not.

When working with dummy variables in a regression, the significance of the variables must be tested as a set, using the R^2 method (F-test). That is, we tested the significance of the regression model as a whole to determine if the model is significantly better than would be expected by chance. We followed a stepwise regression approach starting with the variables of interest (MSC, ISO and the interaction MSCxISO), and subsequently, we controlled for SIZE. Thus, we employed the incremental F test used with R^2 change to assess the significance of the addition of the certifications to the model.

Finally, we wanted to test the moderator effects of size in ISO and MSC certification – that is, to check if SIZE changes the relation between the performance indicators and the ISO and MSC variables. To incorporate the joint effect of certification and size effect on the economic performance variable over and above their separate effects, we added interaction terms to the model as cross products after the main effects.

The regression equations took the following forms:

$$\text{Performance indicator} = C + \beta_1 ISO + \beta_2 MSC + \beta_3 MSCxISO + E \quad \text{(Model 1)}$$

$$\text{Performance indicator} = C + \beta_1 ISO + \beta MSC + \beta_3 MSCxISO + \beta_4 SIZE + E \quad \text{(Model 2)}$$

$$\text{Performance indicator} = C + \beta_1 ISO + \beta_2 MSC + \beta_3 MSCxISO + \beta_4 SIZE + \beta_5 SIZExISO + \beta_6 SIZExMSC + \beta_7 SIZExMSCxISO + E \quad \text{(Model 3)}$$

β coefficients are interpreted in relation to the reference category. The group of companies without ISO 14001 and MSC certification were considered in the omitted category or reference category. For example, the regression coefficient β_1 indicated how much more the performance indicator increased (or decreased if β_1 was negative) when the company shifted from 0 (not having the ISO 14001) to 1 (having the ISO 14001) when other indicators remained constant. Additionally, the β coefficients in the model estimated the relative predictive power of the specific levels of each independent variable.

4. Results and discussion

The factorial ANOVA analysis allowed us to test the significance of the differences in the mean values of the economic performance

Table 1
Economic descriptive statistics by size.

		N	TI (10^3EUR)	ROA (%)	ROE (%)	EBIT (10^3EUR)	EBITDA (10^3EUR)	ROC (%)	PM (%)	PPE (10^3€)	ISO	MSC
Small	Avg.	1385	208,686	−0,90	1243	3335	13,252	1159	−4,68	086	7	12
776%	Std. Dev.	1168	203,963	2215	7318	36,473	34,482	6839	4794	3284		
Medium	Avg.	8141	1,853,939	381	738	77,112	127,305	919	066	1114	16	13
177%	Std. Dev.	4852	1,193,870	961	2380	211,717	214,365	1870	1618	4771		
Large	Avg.	27,078	9,699,277	225	919	227,405	403,968	1310	168	1350	12	8
4,7%	Std. Dev.	25,497	7,158,476	667	1815	197,949	286,080	1800	341	2372		

Note: Size determined as stablished by the European Commission. N = number of employees. ISO and MSC indicate the number of certified companies.

Table 2
Factorial ANOVA results. Economic indicators between certified and non-certified firms.

	N	TI (10^3EUR)	ROA (%)	ROE (%)	EBIT (10^3€)	EBITDA (10^3€)	ROC (%)	PM (%)	PPE (10^3€)
Non-certified (intercept)	474	5045.8 (316.5)***	0.01 (0.4)	11.14 (3.3)	180.03 (62.1)***	325.27 (166.8)***	10.92 (4)	−2.75 (0.5)	3.23 (0.9)
ISO	25	29078.2 (152.3)***	1.64 (0.3)	9.01 (0.4)	397.28 (31)***	1495.54 (83.3)***	7.15 (0.4)	−15.94 (0.3)	−6.2 (0.9)
MSC	23	19003.8 (101.2)***	0.33 (0.1)	22.83 (0.1)	344.26 (28.5)***	689.27 (37.4)***	22.83 (0.3)	1.68 (1)	11.72 (1.8)
ISO&MSC	10	103933.9 (47.6)***	3.37 (0)	7.66 (0.2)	2661.33 (21.3)***	4408 (22.6)***	10.32 (0.1)	2.03 (0.4)	6.18 (0.1)
R2		0.331	0.001	0.001	0.094	0.191	0.002	0.004	0.006

*** significant at $p < 0.001$. F-values in parenthesis.

indicators between certified and non-certified firms, and to determine if there are interactions between the two certifications. We performed the factorial ANOVA analysis considering four categories: non-certified companies; ISO 14001 certified companies; MSC certified companies; and both ISO 14001 and MSC certified companies.

Ratio indicators such as ROE, ROA, ROC, PM and PPE showed non-significant effects (see Table 2). Thus, no further analysis is of interest regarding these indicators. On the contrary, we found significant differences for TI, EBIT and EBITDA. Table 2 shows the mean values for the performance indicators for each of the four categories, the F-values, significance and R^2-values from the factorial ANOVA. The results indicated that there was a significant interaction between the two factors ($F(1, 528) = 47.6$, $p < .001$). The nature of this interaction suggests that fisheries with ISO and MSC certification ($M = 103933.9$, $SD = 112{,}981$) might be more effective in retrieving income than the rest of the groups. Moreover, we obtained significant interaction effects for ISO and MSC on EBIT ($M = 2661.3$, $SD = 2509.5$, $F(1, 528) = 28.5$, $p < .001$) and EBITDA ($M = 4408$, $SD = 3869.6$, $F(1, 528) = 37.4$, $p < .001$), meaning that these same companies are also maintaining larger profits than the other groups.

Fig. 1 shows the estimated mean values by the factorial ANOVA model for the three performance variables. The figure clearly shows an ordinal interaction, as lines are not parallel, nor crossing or moving in different directions. Performance variables (TI, EBIT and EBITDA) are greater for ISO and MSC certified companies.

To tease apart the interaction, we tested simple main effects rather than simply interpreting the main effects, which ignores different levels of the second factor. Thus, we tested for the main effect of ISO within each of the two different levels of MSC, and vice versa (see Table 3).

The results shown in Table 3 reveal that there are significant main effects. For example, there is a significant difference in Total Income (TI) values (Difference = 74855.6 $p < 0.001$) for MSC certified versus non-certified companies for companies that are ISO certified. However, we found non-significant differences in EBIT and EBITDA values for MSC certification in terms of non-ISO14001-certified companies. Similarly, we found non-significant differences for EBIT in MSC non-certified companies between those ISO certified and non-certified companies. These values demonstrate the importance of the interaction effect shown in Table 2, as some of the values are not justified by the main effect of the certification.

As indicated before, we followed up the study by adding size, measured as the number of employees, to account for the possible impact of this covariate.

The results shown in Table 4 indicate that when adding size as a covariate ($F(1, 481) = 800.7$ $p < 0.001$), the impact of ISO ($F(1, 481) = 17.8$ $p < 0.001$), MSC ($F(1, 481) = 9.6$ $p < 0.01$) and the interaction MSCxISO ($F(1, 481) = 6.8$ $p < 0.05$) are still significant, but the explained variance of the factorial ANCOVA increases dramatically to R^2 ($R^2 = 0.749$), which suggests a significant but small impact of the certification on the total income.

On the contrary, when testing for size impact on EBIT, only size ($p < 0.001$) and the interaction MSCxISO ($p < 0.05$) remained significant, and R^2 increased to 0.2. Furthermore, for EBITDA, size ($p < 0.001$) and ISO ($p < 0.05$) remained significant, and R^2 increased to 0.446. These results suggest that the control variable (size) is affecting the relation between the performance variable and the variables of interest in the study and the interaction between ISO and MSC has a limited impact on the proportion of the variance explained.

As indicated previously, from these results we could not determine whether the certification directly caused the differences. Thus, in this study, we used regression analysis to establish if the ISO 14001 and the MSC significantly affected the economic performance of firms. For this part of the study, we report the analysis for TI, EBIT and EBITDA, as no relation was found between the other performance indicators and the variables of interest in the previous analysis.

The results shown in Table 5 indicate first (Model 1) that ISO and MSC certification – acting in an isolated way – positively affect total income ($\beta_1 = 0.243$, $\beta_2 = 0.131$), EBIT ($\beta_1 = 0.048$, $\beta_2 = 0.033$) and EBITDA ($\beta_1 = 0.214$, $\beta_2 = 0.059$). Beta coefficients indicate a bigger impact of ISO certification over MSC certification in determining the TI, EBIT and EBITDA. Moreover, the interaction term that incorporates the joint effect of ISO and MSC certification on a dependent variable over

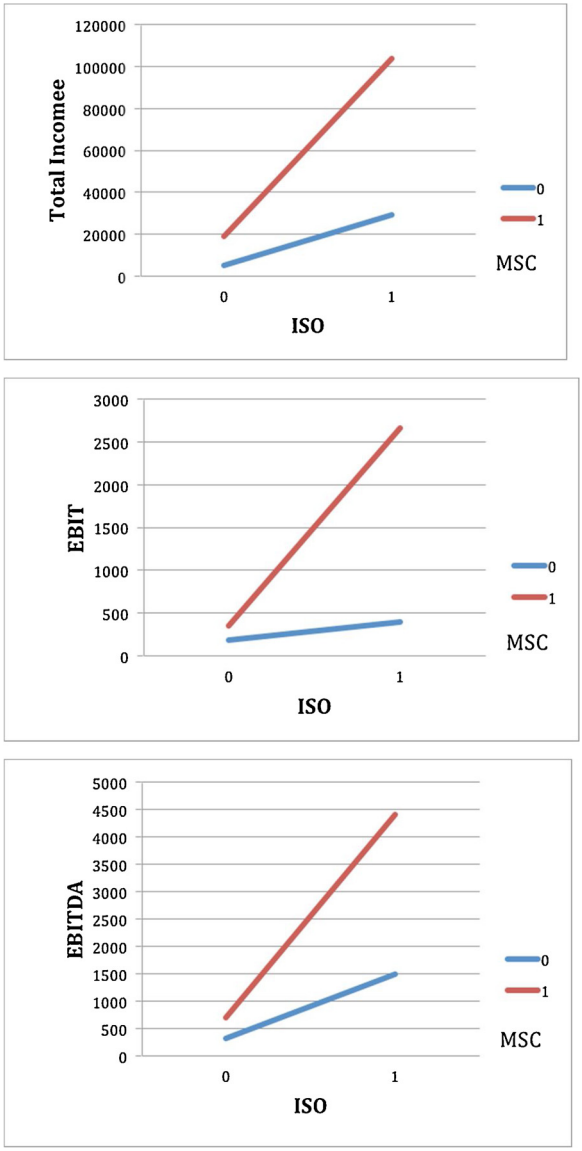

Fig. 1. Estimated mean values by the factorial ANOVA model for TI, EBIT and EBITDA.

and above their separate effects was revealed to have a positive and relatively important impact on the performance variable ($\beta_{3TI} = 0.329$, $\beta_{3EBIT} = 0.258$, $\beta_{3EBITDA} = 0.249$). The proposed models with the variables of interests have a limited capability ($R^2_{TI} = 0.330$, $R^2_{EBIT} = 0.093$, $R^2_{EBITDA} = 0.190$) to explain the variance of the dependent variable. The model is considered significantly better than would be expected by chance, and we reject the null hypothesis of no linear relationship of each of the performance variables to the certifications, confirming our first hypothesis for some performance variables (TI, EBIT and EBITDA).

Model 2 incorporates SIZE into the variables of interest and was revealed to have a significant ($p < 0.001$) impact on the variance explained ($R^2_{TI} = 0.749$, $R^2_{EBIT} = 0.200$, $R^2_{EBITDA} = 0.446$), which was expected according to the literature and the ANOVA results. However, we wanted also to test the role of SIZE as moderator in the relation between the performance variables and the certifications. Model 3 incorporates the joint effect of SIZE with the ISO, MSC and MSCxISO. The proposed models were revealed to increase significantly the variance explained, uncovering the moderator effect of size ($R^2_{TI} = 0.761$, $R^2_{EBIT} = 0.228$, $R^2_{EBITDA} = 0.478$). The negative betas on size cross products and the small β_1 and β_2 values indicate the strong moderating effect that size has on these relations. Moreover, MSC and ISO negative cross products betas indicate an attenuation of the impact of the certifications as size increases. In other words, the negative value of the interactions SIZExMSC and SIZExISO in Model 3 indicates a reduction of the size effect in the presence of any of these certifications alone. Additionally, the negative sign of the MSCxISO interaction in the Model 3 for TI is largely compensated by the MSCxISOxS interaction, as companies with both MSC and ISO certification are mostly large firms with an average number of employees of around 330.

The empirical study was deployed with a dataset of Spanish companies. This could be considered a limitation of the study, but, on the contrary, we argue that results are transferable and its applicability goes beyond barriers due to: 1) the importance of the Spanish fishing and aquaculture industry worldwide and, 2) because of the increasing interest of the society regarding sustainable consumption, especially regarding the food industry. The way food is produced, processed, transported and consumed has a significant impact on whether sustainability is achieved throughout the whole food supply chain (Govindan, 2018).

The benefits of adopting an ecolabel require the consumer to know and to be conscious of their benefits. In fact, an important limitation of this study is that it provides a static picture. It would be interesting to repeat this study in a few years to analyze the evolution of both certifications. The results of the use of the MSC label are conditioned by the use of this certificate only in fisheries. The use of certified fish affects the performance of the fish processing industry. We believe this will eventually lead to the logical growth and development of new eco-labels and environmental schemes in aquaculture. It is to be expected that these issues will become increasingly important, and not only because of the greater concern of managers and consumers, but – as seen in this study – also because of the interest of the fish processing industry. This work opens the door to future studies with different methodologies and datasets. We still have to identify and analyze other institutional factors that could affect our results. Nevertheless, the analysis of the effects of environmental certification on firms' performance is relevant enough for strategy, design and implementation, and provides key information for environmental management-related decision making.

5. Conclusions

Our objective in this paper was to analyze the economic impact on seafood processing firms when they adopt environmental certification. In an initial analysis, we found that companies with environmental certifications or labels performed significantly better that those without them in total income, EBIT and EBITDA. However, we found no

Table 3
Main effects of ISO and MSC on economic indicators.

		TI	EBIT	EBITDA
ISO = 0	MSC = 1 vs MSC = 0	139,578 (1017)**	1642 (053) n.s.	364 (188) n.s.
ISO = 1	MSC = 1 vs MSC = 0	74,855,6 (9529)***	22,641 (3285)***	29,125 (3918)***
MSC = 0	ISO = 1 vs ISO = 0	240,324 (3266)***	2172 (101) n.s.	11,703 (2103)***
MSC = 1	ISO = 1 vs ISO = 0	849,302 (1197)***	23,171 (3357)***	37,187 (6233)***

*** significant at $p < 0.001$, ** significant at $p < 0.01$, n.s. = not significant. F-values in parenthesis.

Table 4
Factorial ANCOVA results on economic indicators considering size and ecolabels.

	TI (10^3EUR)	EBIT (10^3EUR)	EBITDA (10^3EUR)
Non-certified (intercept)	5492.95 (15.1)***	194.52 (1.43)n.s	351.9 (5.34)*
ISO	30265.17 (17.83)***	413.52 (1.81)n.s	1557.49 (6.7)**
MSC	19003.73 (9.62)*	344.26 (3.19)n.s	689.27 (0.25)n.s.
ISO&MSC	103933.9 (6.03)***	2661.33 (5.29)*	4408 (1.26)n.s.
Size (employees)	(800.7)***	(64.17)***	(222.26)***
Corrected model	(358.28)***	(30.03)***	(96.78)***
R^2	0.749	0.2	0.446

*** significant at $p < 0.001$, ** significant at $p < 0.01$, * significant at $p < 0.05$.
n.s. = not significant. F-values in parenthesis.

Table 5
Regression models results for the economic indicators.

	Total Income			EBIT			EBITDA		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
(Constant)	5,492,949	−794,673	−406,074	194,519	53,529	−29,29	35,190	8056	1519
ISO	2,477,222 (0243)	62,321 (0061)	1,377,799 (0135)	219 (0048)	−196,74 (-0043)	−250,69 (-0055)	120,558 (0214)	40,549 (0072)	−267,35 (-0048)
MSC	1,351,078 (0131)	23,113 (0022)	865,759 (0084)	14,975 (0033)	−101,39 (-0022)	55,919 (0122)	33,737 (0059)	−145,94 (-0026)	61,949 (0109)
MSCxISO	6,015,795 (0329)	1,447,989 (0079)	−10140,13 (-0055)	209,807 (0258)	107,381 (0132)	81,464 (0,1)	251,315 (0249)	54,193 (0054)	91,208 (009)
SIZE		24,797 (0782)	23,264 (0734)		556 (0395)	883 (0627)		107 (0612)	1328 (076)
ISOxS			−63,92 (-0184)			−1,9 (-0123)			479 (0251)
MSCxS			−80,18 (-0224)			−11,46 (-0723)			−12,5 (-0634)
ISOxMSCxS			1908 (0508)			929 (0558)			393 (019)
Anova F	7928***	35,828***	21,745***	1649***	3003***	2013***	3766***	9678***	6248***
R2	0330	0749	0761	,093	,200	,228	,190	,446	,478
Change F		80,070***	821***		6417***	574***		22,226***	972***
R2 change		0418	0012		,107	,028		,256	,032

*** significant at $p < 0.001$.

differences in the other ratios we tested. These results suggest that certifications and labels have an impact in terms of increasing sales or prices, resulting in an improvement of the total income and, consequently, an improvement in profits. In contrast, they are not impacting the overall financial condition of the firms.

In other words, the implementation of EMS and environmental labels have not been effective in getting operational advantages and efficiency improvements on the internal processes. In the fishing industry, the firm's approach to environmental management looks more like a marketing than an operational approach.

Our study also confirms the size effect concluding that big firms are more environmentally proactive, we could expect companies adopting EMS or environmental labels to be larger. We confirmed the important impact of size in the indicated economic results. However, our cross study relating size and certification reveals that regardless of the size of the firm, there is a positive impact of the certifications on the economic results. The latter confirms that EMS and environmental labels are creating value in the seafood processing industry by improving economic performance through a significant increase of the sales or the price of the products.

Additionally, we demonstrated that size had a moderating effect on the relation between the certification and the performance. The model revealed that generally, there is an attenuation of the impact of ISO and MSC certification on economic performance as size increases. We found a better economic performance in large firms that had implemented the ISO 14001, while the impact of the MSC was diluted.

These results are in line with many others that have demonstrated the role played by the size of companies in the economic effects of environmental certification. The analysis showed the ISO 14001 had a greater impact than the MSC. Therefore, the implementation of an EMS seems to have, today, a greater effect on results than the adoption of an eco-label that certifies that the fish-related product came from sustainable managed fisheries. However, this conclusion must be tempered by the recent implementation of the MSC in Spain.

CRediT authorship contribution statement

Angel Peiró-Signes: Conceptualization, Methodology, Software, Data curation, Writing - original draft. **Lluís Miret-Pastor:** Conceptualization, Validation, Writing - original draft, Writing - review & editing, Data curation. **Marival Segarra-Oña:** Conceptualization, Validation, Writing - review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.aqrep.2020.100396.

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