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# Analyzing the Attitudes of Spanish Firms towards Brexit's Effects on the Management of European Fisheries

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**Abstract:** The United Kingdom has played a prominent role in the Common Fisheries Policy—by contributing to fisheries activities and also by participating in the design of the fisheries policy. Brexit is certain to have significant repercussions for European fisheries activities and their management. This study analyses the views held by companies linked to the fisheries sector in Galicia (fishing, wholesale trade, canned fish, aquaculture, and fish processing), one of the European regions most affected by Brexit given that more than 80% of the Spanish fishing fleet working on UK waters is located in this region. We adopt a quantitative methodology based on the Pearson's chi-squared test, the likelihood ratio, and the Fisher's exact test for analyzing opinions about various topics. Results indicate that companies engaged in marine fisheries or trade in fishing goods hold a mostly negative view of Brexit's effects. In total, 30% of those surveyed anticipate that Brexit will have negative consequences for EU workers in UK fishery companies; a slightly higher percentage of these respondents expect the United Kingdom's exit from the EU to depress Spain's foreign trade; over half of those surveyed perceived Brexit as resulting in the adverse scenario of reduced access to fisheries' resources and were in favor of reformulating the current system of total allowable catches (TACs) and quotas among the remaining post-Brexit member states. Most respondents also agreed that Brexit will have negative repercussions on vessels of the Galician fleet operating under the British flag. Our statistical analysis identifies a significant relationship between negative attitudes and the firm's size for fisheries' sectors as a whole; however, no relation between those attitudes and firm size or turnover is identified when the particular fishing companies' perceptions are evaluated.

**Keywords:** Spanish companies; common fisheries policy; attitudes analysis; Brexit; resources management; European trade; fisheries

**JEL Classification:** D22; Q22

## 1. Introduction

Since joining the European Economic Community (EEC) in 1973, the United Kingdom has played a leading role in the Common Fisheries Policy (CFP). This role is exemplified both by the country's contributions to fisheries and aquaculture activities and by its participation in the design of the fisheries policy at all levels (conservation of marine resources, policy structure, markets, and external relations). The British EEC presence also involves sharing Europe's marine territory; this, the coastal zone from 12 to 200 miles offshore, was integrated into the CFP (also known as "Blue Europe") for the purposes of fishery management and access to resources. That integration involved country-based quota allocations under the CFP. Given these circumstances, Brexit will have substantial effects on fisheries' activities

and their management. Our aim in this paper is to examine the opinions of the different fisheries' agents involved. For that purpose we focus on Galicia (northwest Spain), a region that—prior to Brexit—was strongly affected by fisheries' relations with the United Kingdom because most of the Spanish fishing vessels that ply British waters have their home base in this region [1].

In addition to the eventual effects on access to resources and to the immediate implications for other countries and their workers, Brexit could necessitate changes in the traffic of goods from the fisheries' sector and a restructuring of international fishery agreements. It is likely that Brexit will also result in pressures to adjust the distribution of quotas or of European funding (viz., from the European Maritime and Fisheries Fund) among the remaining European Union (EU) members. The ultimate outcome will reflect not only this litany of changes but also any bilateral (EU–UK) agreements that relate to fisheries—agreements that are expected to be more diverse but not necessarily more restrictive than pre-Brexit arrangements.

Under the current CFP framework, the EU shares a considerable amount of the northeast Atlantic fishing stock with the United Kingdom. During the period 2005–2015, the United Kingdom accounted for nearly 10% of both the imports and exports of EU countries' fish products; most of the commercial traffic in this sector was among members of the EU [2,3]. Thus, Spain (our case study) as well as France, Germany, Ireland, and the Netherlands all play a large role in fishery relations with the United Kingdom: either they are the main importers (except for Ireland) of UK fish products, or they share fishing stocks.

In accepting the Brexit referendum's results, the United Kingdom decided to leave the EU. This exit will naturally affect the economic activity of most companies and especially of those related to the seafood industry. For now, Spanish fishers' associations have asked the EU to provide negotiating options that would prevent the loss of fishing opportunities and jobs in the wake of Brexit. They have also asked for Spanish fisheries' structural funds to be respected and asked the EU to bear in mind that the United Kingdom's withdrawal will bring an end to the circumstances that gave rise to the principle of relative stability. Following this principle was meant to correct for previous fishing quota allocations that Spanish fishers viewed as being non-proportional to their respective numbers and fishing capacity [1]. We have situated our analysis of attitudes precisely within this particular context of conditions and affected agents.

Few of the studies just cited analyze the firms' opinions about effects on the common fisheries policy. Yet, knowledge about the affected economic agents' perceptions could help reduce or even prevent conflicts involving fishers [4,5]. Such knowledge could also enhance the legitimacy of regulatory institutions and increase the extent to which relevant actors comply with regulations [6–9]. A number of studies that focus on agents' attitudes toward the decision-making process vis-à-vis fisheries have been conducted in recent decades. Research on the views of fishers has focused mostly on increasing their participation in decision making, and it concludes that greater co-management should render regulatory measures more effective [8,10,11]. Others have analyzed fishers' opinions about the (dis)incentives for complying with fisheries' rules. This research finds that compliance is most strongly affected by individual morality, social pressure, and the perceived legitimacy of the institutions promulgating fishery rules [12–15].

In this context, our study explores the perceptions of companies linked to Galicia's fisheries' sectors regarding Brexit's potential effects on the Common Market; in particular, we explicitly examine the influence of such factors as a firm's branch of activity, turnover, and size (number of employees). Companies' perceptions of Brexit—in light of these factors—have been recently explored in the literature using, basically, contingency tables [16]; however the statistical independence, the degree of internationalization of the companies surveyed, as well as the company's internationalization strategy and its possible expectation of internationalization have not been analyzed. The analysis presented here is an extension of that work and is devoted to bridging this research gap. The Galician firms that operate in the fisheries' activities is the target population of the study and, for it, the data used for the survey is extracted from ARDAN (Report Free Trade Zone-Vigo Spain) and SABI (Sistema de Análisis

de Balances Ibéricos) databases. We use statistical techniques whose results confirm that, in general, (a) perceptions are affected by firm size, yet (b) the attitudes of fishing companies are independent of all the factors just mentioned. Understanding perceptions can help policymakers prepare appropriate contingency plans to mitigate the impact of Brexit on fisheries, especially in the “no deal” scenario, and to redefine UK–EU trade relations. Accomplishing these goals would, in turn, make it easier for firms to make rational decisions about investing in (or divesting from) fisheries.

## 2. Case Study and Methods

### 2.1. Case Study

The economic activity related to fishing and aquaculture in Galicia ranges from the extraction and cultivation of fish and shellfish to the processing and cannery industry and the marketing and distribution of seafood. In terms of turnover and according to ZFV Consorcio (Zona Franca de Vigo) [17], the amounts derived from these activities in 2016 (last year available) were EUR 802 million from fishing, EUR 248 million from aquaculture, EUR 861 million from the fish processing industry, EUR 2075 million from the fish cannery industry, and EUR 4872 million from trade. With regard to the gross value added, fisheries and aquaculture contributed EUR 318 million in 2016 (of which EUR 274 million was due to fishing), while industry and marketing contributed EUR 706 million: EUR 106 million from fish processing, EUR 287 million from canned fish, and EUR 313 million from trade. It is worth noting that seven of the top ten Spanish companies are in the fishery industry branch (including the leader, Pescanova) and that half of the ten marketing companies are located in Galicia. More than 38,500 people were directly employed in the Galician fisheries sectors during 2016, accounting for 3.5% of the region’s full-time employment. Among these sectors, fishing contributes about 1.4%, aquaculture 0.5%, processing and canning 1%, and marketing 0.6% [17].

Input–output tables for the Galician economy [18] allow us to deconstruct the value chain for seafood from that region; see Figure 1. The most recent tables were elaborated for 2011, and they show that the main inputs for fishing in that year were fuel (35% of the sector’s intermediate consumption) and services related to the installation and repair of machinery and equipment (11%). The value chain for aquaculture comprises a number of primary activities: electric power and crude oil (29%); stock supply, which originates from hatcheries or nurseries; feed (16%); and fishing (8%). About 32% of fishing and aquaculture production goes to processing and cannery industries and 48% to marketing and distribution (mainly for domestic consumption in Galicia, which includes large retail, restaurants, and the hospitality sector). Traders likewise either distribute the fish species themselves (to end consumers or to other intermediaries, such as large surfaces and retail) or sell it to processors that in turn sell it to other seafood distributors. Almost 90% of processing and canned fishing is destined for marketing and distribution (mainly for consumption in the rest of Spain and, to lesser extent, for exporting to other EU countries).

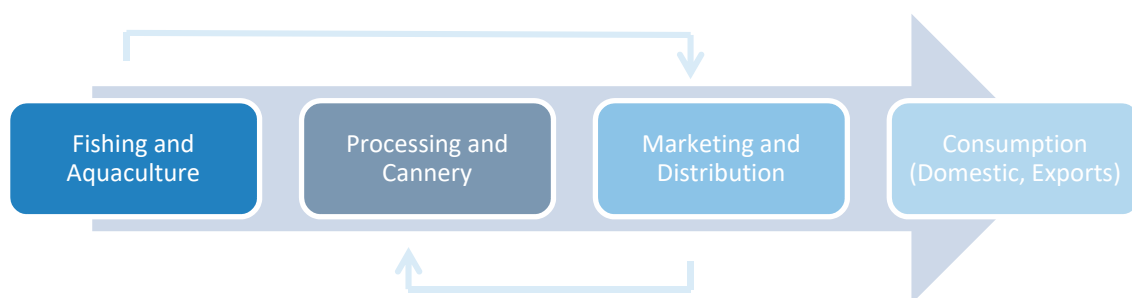


Figure 1. Value chain of Galician seafood.

We analyze the views of companies linked to Galicia's fisheries' sectors, while distinguishing among the most (economically) significant segments of activity: sea fishing, marine aquaculture, fish processing, canned fish manufacturing, and marketing. Thus, our study's target population is Galician companies whose main activity is related to the production, processing, or marketing of marine products. According to the Galician Statistics Institute [19], in 2017 the region was home to: 608 fishing companies with the National Classification of Economic Activities (NCEA) code 03.11, which excludes artisanal and coastal fishing; 185 aquaculture companies with the NCEA code 03.21, excluding rafts that are used mainly for mussel farming; and 202 companies engaged in the processing and canning of marine products (NCEA code 10.2), of which 60 are strictly canning companies. We could not find any disaggregated information on the companies that market fish products; these data are published at the aggregate level as "Marketing of food, beverage and tobacco products" (NCEA code 46.3). There were 3782 such companies in 2017, most of which marketed agricultural products owing to the greater share of those products in Galicia's economy (about 5.3% of GDP, versus 1.3% for fishing and aquaculture in 2016; [18]).

From the ARDAN and SABI databases we extracted information about Galician firms that operated in the fisheries sectors during 2016. The ARDAN database is elaborated by the consortium of the Customs-free Zone of Vigo; it offers updated economic information on more than 100,000 Spanish companies, of which about 43,000 are Galician firms categorized according to their main activity. The SABI database supplies financial information on more than 3.2 million Spanish and Portuguese companies. The data used in our analysis refer to the firms' respective main activity, turnover level, and number of employees. Combining both data sources, the available sample consisted of 686 Galician companies distributed as follows: 204 in the fishing sector, 24 in marine aquaculture, 42 in the processing industry, 37 in the canning industry, and 379 traders. All of these firms were distinguished by turnover level (grouped into six intervals: less than EUR 100,000; EUR 100,000–499,999; EUR 500,000–999,999; EUR 1,000,000–2,999,999; EUR 3,000,000–4,999,999; EUR 5,000,000 or more) and number of employees (grouped into four ranges: fewer than 10 people; 10–49 people; 50–249 people; 250 or more people).

## 2.2. Method

### 2.2.1. Questionnaire

The main objective of this study is to analyze how the companies associated with Galician fishery activities view their situation and the possible effects of Brexit on those activities. We pursue that objective by way of different types of hypothesis testing with reference to the type of Brexit implementation model; in this process we aim to estimate and contrast the statistical significance of companies' attitudes in terms of company size, turnover, and subsector. Our analysis considers such related factors as the trade in goods, the movement of workers, and access to fisheries' resources.

Achieving our objective required that we first gather information on fishers' attitudes via questionnaires (one geared to each branch of activity) and from personal and phone interviews. In addition to general questions about turnover, number of employees, and investment (and about the trends of those figures over the two preceding years), as well as the company's internationalization and the role played by public authorities, the questionnaires included two separate sections about Brexit. The first section contained questions for all companies, while the second section contained questions only for companies involved in marine fishing.

In the former Brexit questions, respondents were asked about their general perceptions regarding Brexit's effects on their firm and the economy and about their preferences concerning the duration of the withdrawal process. They also answered questions about how Brexit might affect the EU workers of UK-based fishery companies and how it might affect the flow of exports from the United Kingdom to the EU. Additional questions were related to Brexit's consequences (in terms of international fisheries' agreements and representation in international bodies) for the External Fisheries Policy,

given that a significant fraction of the Spanish (and Galician) fleet fishes in third-country waters or in deep-sea waters managed by international organizations. The EU has agreements in place with non-EU Scandinavian countries whose fishing zones abut European fishing grounds; following Brexit, the United Kingdom could sign on to those agreements. The EU is also part of regional organizations (e.g., the Northwest Atlantic Fisheries Organization, the Commission for the Conservation of Antarctic Marine Living Resources) in which other Commonwealth countries participate and with which the United Kingdom could side in decision-making processes.

In the latter Brexit questions, which related to fisheries' enterprises (NCEA code 0311), respondents were asked their opinions about the current access to British waters (of Spanish-flagged vessels and of British-flagged, Spanish-owned vessels) and also about the current CFP. In particular, respondents were queried about potential changes in the CFP's principle of relative stability, the quota system, and the European Maritime and Fisheries Fund (EMFF). Our choice of questions was based on [1].

Responses to questions about attitudes and perceptions are elicited in a way that is meant to indicate the extent of support for—or opposition to—particular statements of relevance to this research project. For this purpose, we therefore employ a 5-point Likert-type scale in the limits “of fort they differ” and “to fort they agree”. The Likert scale is often used in the behavioral sciences, and we adopt it to measure the attitudes of Spanish companies toward the Brexit process. Because of the relatively small sample size in some segments and the resulting low statistical significance, responses to all completed questionnaire items were transformed in three points.

### 2.2.2. Methodology

The study focuses on the analysis of the relationship/independence between categorical variables. Categories are defined and frequencies are obtained from the results of the survey questions. At the same time, we connect the perceptions of Brexit with the degree of internationalization of the company, surveyed NCEA codes and turnover level, company size and their subsector or turnover.

The Kruskal–Wallis H Test will be used to compare populations. This test is a nonparametric procedure and the objective is to contrast whether the perceptions of companies surveyed on the different aspects linked to the implications of Brexit differ significantly from the perceptions that would be obtained by the subsample of companies that are internationalized or those that are not internationalized:

$$H = \frac{12}{N(N+1)} \sum_{i=1}^k \frac{R_i^2}{n_i} - 3(N+1) \quad (1)$$

where all  $n = n_1 + n_2 + \dots + n_k$  measurements are jointly ranked (i.e., treated as one large sample). We use the sums of the ranks of the  $k$  samples to compare the distributions.

In order to analyze the dependence relationships between categorical variables, such as the firms' responses and different factors, we tested the following null hypothesis.

H0: Responses and factors are statistically independent—that is, there is no association between the company's attitudes and the factors being considered.

Recall that the factors of interest are the firm's subsector, turnover, and size (and that the last variable is proxied by its number of employees). Hypothesis H0 is tested by making statistical contrasts among the qualitative variables' dependence relationships. Toward that end, we use Pearson's [20] chi-squared test as well as the likelihood ratio; the resulting values depend on differences between the expected and observed frequencies of the opinion-based variables for the activity, turnover, and size of our sample companies. We also performed Fisher's [21] exact test. The exact  $p$ -value for the qualitative variables can be determined by considering all tables of such values that (a) have the same row and column totals as the original and (b) are no less extreme in their departure from the null hypothesis [22–24].

Pearson's chi-squared test allows for determining whether or not the categorical variables are associated. For its calculation, the expected frequencies are obtained (i.e., those that should have been observed if the hypothesis of independence were true) and then compared with the frequencies actually observed. In general, for a table with  $r$  rows and  $k$  columns, the value of the chi-squared ( $\chi^2$ ) statistic is calculated as follows:

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^k \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (2)$$

In this expression,  $O_{ij}$  denotes the observed frequencies and is equal to the number of observed cases classified in row  $i$  of column  $j$ . The term  $E_{ij}$  represents the expected or theoretical frequencies, or the number of expected cases corresponding to each row and column; it can also be defined as the frequency that would be observed if both variables were independent. Thus, the  $\chi^2$  statistic measures the difference between the value that should result if the two variables were independent and the value that was observed in reality. The greater this difference, the stronger the relationship between the two variables in question. Because some segments might generate only a small number of observations, we also calculate the likelihood ratio. The Likelihood-Ratio test is a hypothesis test that helps to choose the best model between two nested models and assesses the appropriateness of the fit of two competing statistical models based on the ratio of their likelihoods. The best model is the one that makes the data most likely, or maximizes the likelihood function,  $f_n(X - 1, \dots, X_n | \Theta)$ , and the likelihood function is highest nearer the true value for  $\Theta$ . This test statistic is the ratio between the log-likelihood of the simpler model ( $s$ ) to the model with more parameters ( $g$ ):

$$\lambda_{LR} = -2 \log_e \left( \frac{\mathcal{L}_s(\hat{\theta})}{\mathcal{L}_g(\hat{\theta})} \right) \quad (3)$$

The chi-squared test merely approximates the significance value because the sampling distribution of the calculated test statistic is only roughly equal to the theoretical chi-squared distribution. If the distribution of data among the cells is extremely unequal, as occurs in our case study, then the expected values may be low; in that case, relying on the chi-squared test would not be suitable. Therefore, in order to complete our analysis of the dependency relationships among categorical variables, we performed Fisher's exact test. It tests the independence of rows and columns in a  $2 \times 2$  table, with 2 horizontal rows crossing 2 vertical columns creating 4 places for data, based on the exact sampling distribution of the observed frequencies. According to Fisher's formula, the probability of getting such a set of values is using a hypergeometric distribution as follows:

$$p = \frac{(a+b)! (c+d)! (a+c)! (b+d)!}{a! b! c! d! n!} \quad (4)$$

where the symbol "!" indicates the factorial operator for  $n$  elements. This test also allows one to evaluate the significance of the association between our attitude variables and each of the three company-based factors. We can determine the exact probabilities of obtaining each of these tables under the null hypothesis of no association (i.e., independence) between the companies' attitudes toward Brexit and the firm-related factors (subsector, turnover, and size) that we consider.

### 3. Results

Of the 686 questionnaires, 275 (40.1%) were completed between June and August 2018 by the manager of the company; this figure represents more than 10% of the targeted population when one considers that most of trading firms marketed agricultural products. Our sample is distributed by economic activity as follows (see Table 1): 58% of the respondents worked in marketing companies, 26% in the marine fisheries subsector, 7% in the manufacture of canned fish, 6% in marine aquaculture, and 3% in fish processing. Table 1 also reports the sample distribution of firms by turnover and size

(i.e., number of employees). The largest portion (41%) of our surveyed companies reported turnover in the range of EUR 1–3 million. These companies tend to be small: more than half (56%) of them employ nine or fewer workers, and the next largest group (39% of the sample) comprises surveyed companies with 10–49 employees.

The table of descriptive statistics for the sample indicates a turnover mean is EUR 7,245,000.00 (minimum value EUR 33,851.00 and maximum value EUR 307,029,987.00). In reference to size of the companies in the sample, the number of employees is 17 in mean, of a minimum value 1, and a maximum value of 384.

Finally, in order to further characterize the sample, we have carried out a disaggregated analysis on the composition of the sample taking into account the internationalization strategy of the sample. We can see the fish marketing, fish processing, and fish canning sector reflect high internationalization.

**Table 1.** Descriptive statistic for the sample.

<b>Factor</b>	<b>Sample (%)</b>	
<b>Sector (NCEA Code)</b>		<b>Internationalization Strategy %</b>
0311: Fishing	26.0	13.5
0321: Marine aquaculture	6.2	23.5
1021: Fish processing	2.9	50.0
1022: Fish canning	6.6	66.7
4638: Fish marketing	58.2	43.5
<b>Turnover (€)</b>		<b>Mean (€) (Minimum/Maximum)</b>
<100,000	0.7	
100,000–499,999	6.7	7,245,000.00 (33,851.00/307,029,987.00)
500,000–999,999	20.8	
1,000,000–2,999,999	40.5	
3,000,000–4,999,999	10.4	
≥5,000,000	20.8	
<b>Size (Number of Employees)</b>		<b>Mean (€) (Minimum/Maximum)</b>
<10	56.4	
10–49	38.5	17
50–249	4.4	(1/384)
≥250	0.7	

Table 2 lists our survey questions, which address five groups of perceptions, and reports values from our statistical analysis of the participants' responses. The results reveal substantial uncertainty (about 60%) surrounding Brexit. This uncertainty pertains not only to general aspects of how the UK withdrawal could affect companies' economic activity but also to more specific questions about its implications for EU workers, trade in goods, and the External Fisheries Policy. With respect to the respondents' general perceptions, the table shows that—notwithstanding the 72.9% who were uncertain—a sizable portion (25.3%) of respondents view Brexit as having negative implications for their respective company's economic activity; only 1.8% perceive it favorably. Of those surveyed, 28.4% expressed a preference for a transitory and flexible application along with the possibility of bilateral agreements; only 4% would prefer that the Brexit terms be applied immediately.

Table 2. Descriptive statistics of the sample.

Variables	Mean (S.D.)	Frequency of Occurrence (%)			KRUSKAL-WALLIS (p-Value)
		Level 1	Level 2	Level 3	
<b>General perception of companies surveyed regarding Brexit</b>					
• What is your general perception of the implications Brexit could have for your company's economic activity? (1 = favorable; 2 = unfavorable; 3 = none)	2.71 (0.493)	1.8	25.3	72.9	0.008 (0.754)
• From your point of view, would it be preferable if the Brexit process were: (1 = applied immediately; 2 = a transitory and flexible process with the possibility of bilateral agreements; 3 = do not know)	2.64 (0.559)	4.0	28.4	67.6	0.022 (0.856)
<b>Perception of companies surveyed regarding implications for the FREE MOVEMENT OF EU WORKERS</b>					
• Brexit and its implications for EU workers currently working in fishery sector enterprises in the UK: Do you believe that Brexit could have repercussions on the employment situation of said workers (right of residence, social benefits, etc.)? (1 = yes; 2 = no; 3 = do not know)	2.35 (0.929)	31.6	1.8	66.5	0.019 (0.888)
• Brexit and its implications for EU workers who intend to gain access to the employment market in fishery sector enterprises in the UK: Do you believe that Brexit could involve an important change for workers accessing the UK employment market with respect to the situation of current workers? (1 = yes; 2 = no; 3 = do not know)	2.38 (0.922)	30.5	0.7	68.7	0.158 (0.621)
<b>Perception of companies surveyed regarding implications for FISHERIES COMMODITY TRADE</b>					
• Do you believe that Brexit could impact on Spain: (1 = positively; 2 = negatively; 3 = do not know)	2.48 (0.581)	4.4	43.6	52.0	0.009 (0.516)
• Do you believe that Brexit could impact on your company: (1 = positively; 2 = negatively; 3 = do not know)	2.67 (0.544)	3.7	25.7	70.6	0.079 (0.408)
<b>Perception of companies surveyed regarding implications for the EXTERNAL FISHERIES POLICY</b>					
• Do you believe that, with regard to the External Fisheries Policy (international agreements, presence in international bodies, NAFO, FAO, etc.), the UK's exit would have the following impact: (1 = positive; 2 = negative; 3 = do not know)	2.62 (0.550)	3.3	31.6	65.1	0.061 (0.376)
<b>Perception of MARINE FISHERY firms surveyed regarding implications for ACCESS TO RESOURCES</b>					
• On the whole, do you believe that Spanish fishers (with the Spanish flag) would have the following scenario: (1 = more favorable; 2 = less favorable; 3 = indifferent)	2.18 (0.550)	7.0	66.2	26.8	0.029 (0.589)
• Do you believe, given this new scenario, it would be possible and desirable to reformulate: (1 = the principle of relative stability; 2 = the system of TACs and distribution quotas; 3 = do not know) (The multiple responses showed that 8% favorably perceived reformulating the Principle of Relative Stability (PRS) and TACs together.)	2.67 (0.561)	9.1	17.5	65.4	0.017 (0.155)
• Do you believe that Brexit could involve an important (negative) change for the Galician fleet with the UK flag? (1 = yes; 2 = no; 3 = do not know)	1.75 (0.936)	59.2	7.0	33.8	0.091 (0.816)
• Brexit will mean that there will be one less country contributing funds to the European Maritime and Fisheries Fund (EMFF) and, therefore, one less country involved in the distribution of funds. In this scenario, how will this new situation affect Spain? (1 = it will have a positive effect on Spain, we expect to receive more subsidies; 2 = it will have a negative effect on Spain, we expect to receive fewer subsidies; 3 = do not know)	2.788 (0.475)	2.8	15.5	81.7	0.0282 (0.776)



As regards particular post-Brexit outcomes, 30% of respondents believed that it could affect the free movement, not only of EU workers currently working for fisheries sector enterprises in the United Kingdom (and thus their social benefits, right to remain, etc.), but also EU workers seeking employment in those enterprises. Fewer than 2% of the respondents believed that Brexit would not result in changes. Insofar as the trade in goods is concerned, we find that 43% (resp. 4%) of the companies surveyed view Brexit as having negative (resp. positive) effects on Spain; the uncertainty here is 52%. Furthermore, 25.7% (resp. 3.7%) believe that Brexit could have negative (resp. positive) effects on their own company; however, the majority of those surveyed acknowledged that they had no idea of how Brexit will affect fishery enterprises. Therefore, despite the perception that Brexit will harm the Spanish economy as a whole, opinions are less negative when only its effects on fishing companies are considered—although uncertainty is high in both cases.

With respect to the External Fisheries Policy's scope (i.e., in terms of international agreements, membership in international bodies, etc.), the UK exit is perceived negatively by 31.6% of those surveyed and positively by only 3.3%. Once again, those surveyed are characterized by high uncertainty (65%) regarding Brexit's effects on these aspects of European foreign policy.

Responses to questions concerning the marine fisheries subsector (NCEA code 0311) exhibit less uncertainty than those about other subsectors. Nearly two thirds (66.2%) of those surveyed stated that fishers on Spanish-flagged vessels will be worse-off, under Brexit, in terms of access to fisheries resources; only 7% of respondents expected favorable effects. Survey participants also believed that it was both desirable and possible to reformulate the total allowable catch (TAC) limits, the distribution of quotas, and (albeit to a lesser extent) the principle of relative stability (PRS). Furthermore, almost all respondents who approved of reformulating the PRS likewise favored changing the system of TACs and/or the distribution of quotas. As for the fleet of Spanish-owned but British-flagged vessels, 59.2% of these marine fishing enterprises perceive Brexit as entailing a significantly negative change; only 7% expect no change. Finally, we remark that Brexit means that one less country will be contributing funds to the EMFF (and receiving distributed funds). Just 2.8% of respondents view the net outcome of these changes as having a positive effect on Spain, and 15.5% anticipate a negative impact owing to reduced subsidies. As with the responses related to most other topics, the degree of uncertainty here is high.

The results shown in Table 2 reveal that, for conventional levels of significance, the hypothesis of homogeneity in the behavior of perceptions between the two subgroups of companies cannot be rejected and, therefore, we accept that the perceptions that companies have about the implications of Brexit are no different depending on the degree of internationalization of the company surveyed, which makes the results obtained more robust.

Toward the end of examining these attitudes more closely, we undertake a segmentation analysis of the sample according to companies' main activity, turnover, and size. The results of this analysis are presented in Tables 3–5 (where "Asymp. sig." denotes "asymptotic significance"). Regarding economic effects, results of the chi-squared test of independence—with a value of 30.928 for 6 degrees of freedom (df)—lead us to reject the null hypothesis for firm size; yet the respective values of 14.493 (8 df) and 12.218 (10 df) are such that we cannot reject it for the other two qualitative variables (see Table 3). Thus, we affirm that (i) there is no association (at the 10% significance level) between general perceptions of Brexit and NCEA codes and turnover level, whereas (ii) there is such an association between those attitudes and company size. Because no association is observed between companies' attitudes and their subsector or turnover, we can safely conclude that respondents' negative opinions are independent of those factors. The *p*-values of Fisher's exact test confirm the independence between negative attitudes and the NACE code (0.098,  $p \geq 0.05$ ); turnover (0.301), where the null hypothesis cannot be rejected; and firm size (0.034,  $p < 0.05$ ), where the null hypothesis is rejected.

**Table 3.** Chi-squared statistics for general perception and mobility of workers.

Factor	Statistic	Value	df	Asymp. Sig. (2-Sided)	Exact Sig. (2-Sided)
<i>Effects on economic activity of the firm interviewed</i>					
Sector (NCEA code)	Pearson's chi-squared	14.493	8	0.070	
	Likelihood ratio	13.674	8	0.091	
	Fisher's exact test				0.098
Turnover (€)	Pearson's chi-squared	12.218	10	0.271	
	Likelihood ratio	13.830	10	0.181	
	Fisher's exact test				0.301
Size (number of employees)	Pearson's chi-squared	30.928	6	0.000	
	Likelihood ratio	12.132	6	0.059	
	Fisher's exact test				0.034
<i>Application of the Brexit process</i>					
Sector (NCEA code)	Pearson's chi-squared	9.662	8	0.290	
	Likelihood ratio	10.566	8	0.228	
	Fisher's Exact Test				0.400
Turnover (€)	Pearson's chi-squared	16.599	10	0.084	
	Likelihood ratio	17.058	10	0.073	
	Fisher's exact test				0.098
Size (number of employees)	Pearson's chi-squared	19.428	6	0.003	
	Likelihood ratio	17.725	6	0.007	
	Fisher's exact test				0.037
<i>Effects on EU workers who are currently employed in the UK fisheries sectors</i>					
Sector (NCEA code)	Pearson's chi-squared	36.397	8	0.000	
	Likelihood ratio	23.010	8	0.003	
	Fisher's exact test				0.025
Turnover (€)	Pearson's chi-squared	36.210	10	0.000	
	Likelihood ratio	26.065	10	0.004	
	Fisher's exact test				0.031
Size (number of employees)	Pearson's chi-squared	4.526	6	0.606	
	Likelihood ratio	4.779	6	0.572	
	Fisher's exact test				0.820
<i>Effects on EU workers who intend to be employed in the UK fisheries sectors</i>					
Sector (NCEA code)	Pearson's chi-squared	17.883	8	0.022	
	Likelihood ratio	20.337	8	0.009	
	Fisher's exact test				0.078
Turnover (€)	Pearson's chi-squared	35.001	10	0.000	
	Likelihood ratio	17.951	10	0.056	
	Fisher's exact test				0.029
Size (number of employees)	Pearson's chi-squared	5.293	6	0.507	
	Likelihood ratio	5.993	6	0.424	
	Fisher's exact test				0.758

As for the procedures used to implement Brexit, we find that a transitory and flexible process is strongly preferred. Results from our hypothesis testing allow us to affirm that these attitudes are generally shared by the sample as a whole, although there is statistical support—derived using Pearson's chi-squared test and the likelihood ratio—for only an association between those responses and (again) company size (19.428 and 17.725 with 6 df for the chi-squared value and likelihood ratio, respectively). In addition, the significance of the chi-squared value and the likelihood ratio is less than the cut-off (0.05) at which we could reject the hypothesis that perceptions are not independent of firm size. The *p*-value of Fisher's test (0.037) also indicates a low probability of there being no

association between firm size and attitudes concerning a transitory process; in other words, there is a high probability of some relationship between them.

With regard to the free movement of workers, we deduce that Brexit could have repercussions for the situation of EU workers currently employed by companies linked to UK fishery sectors. In particular, results from our hypothesis testing corroborate that certain relationships exist between responses to worker movement questions (on the one hand) and both NCEA codes and turnover levels (on the other hand). The chi-squared value and likelihood ratio are each high (respectively, 36.397 and 23.010 for the NCEA code; 36.210 and 26.065 for turnover), and the low  $p$ -values confirm the probability of an association between the perceptions of negative repercussion for current EU workers in the UK and, respectively, the NCEA code and turnover (i.e., the null hypothesis is rejected for these two variables). Yet, the null hypothesis of no association between a negative perception toward the situation of EU workers in the UK and firm size cannot be rejected, because (a) the significance of chi-squared values and likelihood ratios—as well as the  $p$ -value of Fisher's test—are greater than the critical point (0.05) and (b) the chi-squared values and likelihood ratios are low, which suggests a weak relation between perceptions and firm size.

For the case of potential EU workers, the only clear relationship is that between negative attitudes and turnover; this relation follows from the chi-squared and likelihood ratio results (large values and low probabilities of no association) and the  $p$ -value of Fisher's test ( $p < 0.05$ ). Thus, the null hypothesis is rejected for this factor. For the NCEA variable, the chi-squared probability and likelihood ratio results do not allow one to accept the null hypothesis that perceptions are independent of the firm's sector of activity (relatively large values and low probabilities of independence). Hence there is some association between them; although, Fisher's test indicates that this relation is significant only at the 10% level (we reject the null hypothesis at that level of significance). Finally, we can accept the hypothesis of no association between this attitude and firm size because the statistical values are low, the probabilities of no association are high, and for Fisher's test we have  $p > 0.05$ .

The surveyed companies are fairly pessimistic about Brexit's implications for fishing trade at both the national (Spanish) and company level. Yet, Table 4 shows that, at a more disaggregated level, hypothesis testing supports the existence of an association (at the 10% level) only between these negative perceptions and company size—that is, according to Pearson's chi-squared tests and the likelihood ratios; thus the null hypothesis is rejected for this variable. In addition, the  $p$ -value indicates a low probability of no association between those negative perceptions and firm size. For the other two qualitative variables, we cannot reject the (null) hypothesis of independence because the statistical values are low (for the respective degrees of freedom) and because, for Fisher's test,  $p > 0.05$ .

**Table 4.** Chi-squared statistics for fishing trade and external policy.

Factor	Statistic	Value	df	Asymp. Sig. (2-Sided)	Exact Sig. (2-Sided)
<i>Effects on fishing trade for Spanish economy</i>					
Sector (NCEA code)	Pearson's chi-squared	12.848	8	0.117	
	Likelihood ratio	14.139	8	0.078	
	Fisher's exact test				0.234
Turnover (€)	Pearson's chi-squared	6.457	10	0.775	
	Likelihood ratio	7.453	10	0.682	
	Fisher's exact test				0.913
Size (number of employees)	Pearson's chi-squared	13.395	6	0.037	
	Likelihood ratio	7.845	6	0.250	
	Fisher's exact test				0.072

Table 4. Cont.

Factor	Statistic	Value	df	Asymp. Sig. (2-Sided)	Exact Sig. (2-Sided)
<i>Effects on fishing trade for the firm interviewed</i>					
Sector (NCEA code)	Pearson's chi-squared	13.219	8	0.105	
	Likelihood ratio	17.527	8	0.025	
	Fisher's Exact Test				0.290
Turnover (€)	Pearson's chi-squared	8.946	10	0.537	
	Likelihood ratio	10.073	10	0.434	
	Fisher's exact test				0.704
Size (number of employees)	Pearson's chi-squared	17.985	6	0.006	
	Likelihood ratio	10.786	6	0.095	
	Fisher's exact test				0.020
<i>Effects on the External Fisheries Policy</i>					
Sector (NCEA code)	Pearson's chi-squared	12.353	8	0.136	
	Likelihood ratio	11.668	8	0.167	
	Fisher's exact test				0.198
Turnover (€)	Pearson's chi-squared	48.909	10	0.000	
	Likelihood ratio	52.910	10	0.000	
	Fisher's exact test				0.021
Size (number of employees)	Pearson's chi-squared	22.250	6	0.001	
	Likelihood ratio	20.744	6	0.002	
	Fisher's exact test				0.035

We also analyze the surveyed companies' opinions about how Brexit would affect the External Fisheries Policy. The results, which are also reported in Table 4, show that the United Kingdom's exit from the EU is expected to have a negative effect on all branches of activity. Hypothesis testing confirms that there are some distinguishable and statistically significant relationships involving company turnover and size, since the statistical values are high (48.909 and 52.910 for turnover, and 22.250 and 20.744 for size, for the chi-squared value and likelihood ratio, respectively) and since the  $p$ -value of Fisher's test is less than 0.05 in both cases. For the NCEA code variable, we accept the null hypothesis of no association between that negative perception and subsector because the chi-squared and likelihood values are low, the probabilities of independence between the variables are relatively high, and the  $p$ -value of Fisher's test exceeds 0.05. In short, our analysis detects—among those individuals surveyed—a pervasive expectation that Brexit will have a negative effect on Spain and its companies. The results obtained from independent tests for contrasts lead us to conclude that there is statistically significant evidence for rejecting the null hypothesis and thus accepting the alternative, relationship hypothesis for turnover level and company size affecting perceptions in the cases just described.

Finally, our detailed examination of marine fishery enterprises (see Table 5) establishes that, for the most part, Spanish fishers anticipate that Brexit will result in reduced access to resources; hence these respondents are more than willing to consider reformulating the system of TACs, quota distributions, and/or the PRS. Companies in this subsector perceive Brexit as likely to reduce opportunities for the Galician fleet operating under the British flag. The econometric results are unclear but suggest there is no association between the perceptions and the respective variables. The low statistical values, combined with the chi-squared probability and likelihood ratio exceeding the critical threshold of 0.05, lead us to accept the hypothesis that these perceptions are independent of the turnover level and firm size for all questions. In addition, and according to Fisher's test, the null hypothesis—that these views are independent of both company size and turnover—cannot be rejected because the  $p$ -values are considerably higher than 0.05. Hence, we deduce that, among enterprises in the marine fishery subsector, the prevailing overall view of Brexit outcomes is negative.

**Table 5.** Chi-squared statistics for fishing firms' views.

Factor	Statistic	Value	df	Asymp. Sig. (2-Sided)	Exact Sig. (2-Sided)
<i>Effects on fishing trade for Spanish economy</i>					
Sector (NCEA code)	Pearson's chi-squared	12.848	8	0.117	
	Likelihood ratio	14.139	8	0.078	
	Fisher's exact test				0.234
Turnover (€)	Pearson's chi-squared	6.457	10	0.775	
	Likelihood ratio	7.453	10	0.682	
	Fisher's exact test				0.913
Size (number of employees)	Pearson's chi-squared	13.395	6	0.037	
	Likelihood ratio	7.845	6	0.250	
	Fisher's exact test				0.072
<i>Effects on fishing trade for the firm interviewed</i>					
Sector (NCEA code)	Pearson's chi-squared	13.219	8	0.105	
	Likelihood ratio	17.527	8	0.025	
	Fisher's Exact Test				0.290
Turnover (€)	Pearson's chi-squared	8.946	10	0.537	
	Likelihood ratio	10.073	10	0.434	
	Fisher's exact test				0.704
Size (number of employees)	Pearson's chi-squared	17.985	6	0.006	
	Likelihood ratio	10.786	6	0.095	
	Fisher's exact test				0.020
<i>Effects on the External Fisheries Policy</i>					
Sector (NCEA code)	Pearson's chi-squared	12.353	8	0.136	
	Likelihood ratio	11.668	8	0.167	
	Fisher's exact test				0.198
Turnover (€)	Pearson's chi-squared	48.909	10	0.000	
	Likelihood ratio	52.910	10	0.000	
	Fisher's exact test				0.021
Size (number of employees)	Pearson's chi-squared	22.250	6	0.001	
	Likelihood ratio	20.744	6	0.002	
	Fisher's exact test				0.035

#### 4. Conclusions

Since the mid-20th century, the intensity of fishing activity in European Atlantic waters has increased significantly, resulting in conflicts between countries (the “Cod War” between the United Kingdom and Iceland in 1960, for example), successive adaptations of fisheries' regulation (starting with the first agreements of the 1966 London Conference, which were followed by the impacts of the provisions derived from UNCLOS (United Nations Convention on the Law of the Sea) III with the implementation of the EEZ (Exclusive Economic Zone)), and the generalization of the trade in fisheries between European countries.

For our case study, which refers to the relationships arising from the activity of Spanish fishing companies in waters of British sovereignty, the institutional context of reference prior to Brexit, is based on three fundamental pillars: (i) the implementation in the European Common area of the EEZ since 1977, (ii) the starting of Blue Europe with a specific Community regulation based on the system of TACs and Quotas and the Principle of Relative Stability (first decrees of 1983), and (iii) the specific Treaty of Accession for Spain and Portugal (with effect since 1986), where the fisheries chapter was of some importance.

This context had several effects of different significance for Spanish fishing companies. First, it provided greater stability for the activity of these undertakings, ending the period of uncertainty (1977–1986) following the introduction of the EEZ which led to the sequence of annual agreements limiting the entry authorizations of Spanish fishermen in European waters, in which they had operated in previous years. On the other hand, since the Spanish accession, a series of strategic actions and positions were followed, both by Spanish fishing companies, as well as British fishermen and managers, seeking to protect their respective interests, with sometimes conflicting episodes (such as the mentioned cases of quota hopping and regulatory provisions of the activity, followed by legal positions in European courts). Furthermore, focused on extractive activity, other commercial and logistical actions were followed, consolidating an active and significant business network (assets, commodities, and people) in both countries.

Brexit arises in this scenario, with intense and variable previous interactions, but is certainly increasing and in consolidation. Its consideration should allow us to not only understand the importance of the perceptions of fishery agents who are the subject of this study but also to relativize the results obtained from their answers, helping to ask future questions. The first assessment that the responses of the agents consulted allow us to make is the finding of the state of uncertainty generated by the process. This perception is undoubtedly related to the lack of definition and sequence of the Brexit process. But the possible underlying influence of previous reality and experiences accumulated through previous interactions in the indicated context should not be dismissed.

Brexit could certainly affect the Spanish fleet because many of its vessels currently fish in British waters. In this study we have analyzed the opinions of companies in the Galician fisheries sector about the possible impact of Brexit on their economic activity. In these coordinates, following the above exercise, we can assess general results of the perceptions of Galician fishing companies and other more concrete results on the impact of Brexit relating to aspects considered, sub-sectors involved and dimensions of the companies concerned.

Our results clearly show that survey respondents have an overall negative view of the effects that Brexit might have. More specifically, about 30% of those surveyed anticipate that Brexit will have negative consequences for EU workers in UK fishery companies; a slightly higher percentage of these respondents expect the United Kingdom's exit from the EU to depress Spain's foreign trade. Likewise, more than half of those surveyed perceived Brexit as resulting in the adverse scenario of reduced access to fisheries' resources. In light of that possibility, nearly all of those surveyed were in favor of reformulating the current system of TACs and quotas among the remaining, post-Brexit member states. Most respondents also agreed that Brexit will have negative repercussions on vessels of the Galician fleet operating under the British flag. Our statistical analysis identifies a significant relationship between negative attitudes about Brexit outcomes and the focal company's size for fisheries' sectors as a whole; however, no relation between those attitudes and firm size or turnover is identified when the particular fishing firms' perceptions are evaluated.

This study's results can be used to identify the possible negative (though highly uncertain) effects that may follow from Brexit. Thus, the UK exit could affect the legal status of our surveyed (and similar) companies; thereafter, these Spanish sectors might well face reduced investment levels. Of course, this case study can hardly incorporate all the possible effects that Brexit might entail. For example, the EU and UK criteria for international fishery relations will now differ; hence, we are likely to see separate bilateral agreements and/or international bodies adopting different positions with respect to future fishery regulations. Furthermore, some internal EU decisions could be altered—for instance, the allocation of quotas and the distribution of European funds in the fisheries' sector. The latter will be affected quantitatively (i.e., by the withdrawal of a net contributor), and the criteria for defining priorities or distribution might also be altered if the EU's internal balance changes post-Brexit.

Regardless of the exit scenario, UK–EU trade relations are bound to be redefined. In fisheries, this implies future negotiations on access to British waters for European vessels, the definition and implementation of the common management of shared stocks with a distribution of fishing possibilities, and new trade agreements to reduce or eliminate potential customs and tariff barriers. At first, the current access to British waters could be extended over a transitional period, perhaps until the end of 2020 (as originally foreseen in the initial agreement with the EU). The United Kingdom would, thus, regain its sovereignty, although it would then be necessary to reset relations between the two parties. This negotiation is vital for the future of European fisheries, since the EU's remaining member states depend on British waters for 33% (by volume) and 25% (by value) of their marine production [2]. It follows that closing those waters to European fishing fleets would have a severe effect on European markets and income.

With respect to the common management of shared fishing grounds and in particular to the distribution of fishing opportunities, the remaining 27 members of the EU must proceed to reallocate their fishing quotas under the new circumstances while retaining—to the extent that this is possible—the principles of maximum sustainable yield and respect for the rules of fishing control. The Spanish government should take advantage of these new conditions to replace those European rules that discriminate against the Spanish fleet; one example is the principle of relative stability, which was adopted in 1983 before Spain joined the EU. The government could propose revised guidelines and assignments so that they correspond more closely with production capacities of the Spanish fleets involved. Additional factors that merit attention include the extent to which citizens depend on the focal fishing grounds; the socioeconomic effects of Brexit in areas and/or regions that are highly dependent on fishing; and the common and sustainable management of fish stocks.

The last-mentioned factor will entail the establishment of customs tariffs. Trade relations between the EU and the United Kingdom must be re-established within the framework of the World Trade Organization. Spain is one of the world's leading importers of seafood. Therefore, the Spanish government should seek to ensure that trade agreements with the United Kingdom guarantee a supply of fish with reduced tariff rates—to meet not only the Spanish market's direct needs but also the needs of its processing and cannery industry—without a significant increase in the prices of imported products.

Finally, we remark that this study has some limitations related to our analysis of how strongly certain variables and factors are related. Hence, future research could profitably focus on assessments of such strength by elaborating contingency tables related to our nominal qualitative variables (perceptions) and particular factors: sector of activity, level of turnover, and firm size. Another limitation of our study is its relatively small sample size; increasing that size, if possible, would render the sample more truly representative. Another benefit of a larger sample is that it would enable full use of a five-point scale, and the preferences of respondents within each analyzed sector would have greater statistical significance; one could then assess whether, for example, larger (or exporting) companies exhibit a comparatively more negative attitude toward the effects of Brexit.

In any case, and since Brexit is a recent process with uncertain dynamics, this study provides a basis for continuing to analyze, in the future, the perceptions of these agents in successive phases of the process.

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