Fishing quotas and decision-making in the EU

Estimating policy positions from bargaining outcomes

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Abstract

Overfishing is a global problem, and Europe is no exception, with 40–70 percent of fish stocks overexploited. In this paper, we propose how statistical analysis of quota-bargaining outcomes can shed light on the policy positions taken by the EU's member countries in the behind-closed-doors negotiations for fishing quotas (TACs) and whether some countries are driving the exploitation of fish stocks by bargaining for high TACs. We use panel data on TACs and scientific advice from ICES for 165 zone-species combinations during 2001–2020. Using fixed-effects models, our results suggest that the Faroe Islands', Ireland's, Portugal's and Spain's policy positions correspond to catches significantly above the ICES advice, while Germany appears to prefer catches below the recommended levels. Methodologically, our study contributes by suggesting how unobserved policy positions can be estimated from bargaining outcomes; policy-wise, it contributes to a better understanding of the political processes that determine fishing quotas.

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JEL-codes: D72; Q22; Q28

1. Introduction

Overfishing is a global problem[1] and the European system for fisheries management has been declared to be one of the least successful in the world.[2] It has been estimated that 40–70 percent of Europe's fish stocks are overexploited and that quotas are too high.[3] These unsatisfactory outcomes are at odds with Europe's generally high environmental ambitions. A possible cause is that fishing quotas are set in a complicated political process that is not open to public scrutiny and that, therefore, politicians cannot easily be held accountable for policy failure. In this paper, we propose a statistical method for estimating non-disclosed policy positions from bargaining outcomes. This method can shed light on which EU member states have been driving policy towards unsustainably high fishing quotas and which states have bargained for lower catches.

Since 1983, the European Union (EU) fisheries have been managed under the Common Fisheries Policy (CFP). A key policy instrument is the total allowable catches (TACs), set by the Council of the EU (the Council) following scientific advice from the International Council for the Exploration of the Seas (ICES), consultation with regional stakeholders (industry representatives and environmental groups), and negotiations with third countries.[4] The TACs have the double objective of ensuring sustainable fishing and maximizing yields.[5] Since 2014, decisions have been legally binding for member states, and the EU has aimed to make its fisheries sustainable by 2020.[6] While numerous studies of overfishing exist, only a few directly compare TACs with ICES advice and then mainly use descriptive analysis, such as calculating TAC outcomes aggregated by year and country.

We consider each TAC decision for each species, fishing zone, and year as the unit of observation. The resulting panel dataset can then be subjected to formal econometric analysis, allowing us to estimate the EU member countries' unobserved policy positions when they enter the TAC negotiations. A key contribution is thus that we propose how unobserved policy positions can be estimated from bargaining outcomes. In contrast, the related empirical literature typically departs from independent qualitative estimates of policy positions and then uses econometric techniques to evaluate how influential each negotiating party has been for the final outcome.

We use our proposed method to estimate the EU member states' policy positions for TACs, relative to ICES advice, from a rich dataset on TAC bargaining outcomes. By comparing the politically determined TACs with the scientifically grounded quota advice for different species

[1] Hutchings and Reynolds, 2004; FAO, 2018.
[2] O'Leary et al, 2011.
[3] Carpenter et al, 2016; Colloca et al, 2017; Fernandes et al, 2017; Froese et al, 2018; STECF, 2019.
[4] ICES only advises on TACs for the North Atlantic Ocean and adjacent seas, including the Arctic Ocean, the Azores, the Baltic Sea, the Barents Sea, the Bay of Biscay and the Iberian Coast, the Celtic Seas, the Faroes, the Greater North Sea, the Greenland Sea, Icelandic waters, the Norwegian Sea, and the Oceanic Northeast Atlantic (ICES, 2020).
[5] Carpenter et al., 2016.
[6] Froese et al, 2018; Froese et al, 2021.

and fishing zones, we can estimate parameters that suggest that the Faroe Island, Ireland, Spain and Portugal drive the exploitation of fish stocks by bargaining for high TACs, while Germany appears to be bargaining for TACs below the levels suggested by ICES.

Our study relates to the literature that uses collective bargaining models to shed light on how EU policy is formed and how decisions are taken. Studies in this genre typically establish policy positions through document studies or expert surveys before using quantitative modeling to analyze how power and bargaining effectiveness are distributed between the member states (and, sometimes, the Commission and the Parliament).[7] Our approach is, in some respects, the opposite. The highly structured setting allows us to make assumptions about how influential each member country is in each quota negotiation. These assumptions, together with the observed outcomes, make it possible to estimate the member states' policy positions.[8]

Our dataset has several features that make it possible to identify policy positions from policy outcomes. TACs are set for a large number of geographic zones and fish species, TAC decisions involve various sets of member states, TACs can be compared with the ICES advice and can be converted to a meaningful one-dimensional policy scale. Thus, our key contribution to this literature is to suggest that in some settings, policy positions can be estimated from the outcomes of negotiations rather than evaluated qualitatively. This is particularly interesting in settings where politicians in closed-door negotiations may pursue objectives that deviate from their publicly announced policy platforms.

Intuitively, if the ratio of the TAC to the ICES advice tends to be high (low) when country A has a large stake in a specific negotiation, the estimated parameter representing country A's policy position will also tend to be high (low). Our key identifying assumption is that each country's relative influence in the negotiation is proportional to its share of that TAC. Policy outcomes are hence assumed to be weighted averages of the policy preferences, where weights are observed, but preferences are not. We can exploit the fact that the countries' TAC shares are observable and virtually constant over time, the assumption that a country's political influence for a given TAC is proportional to its share of that TAC, and the assumption that countries' policy positions are consistent across all zones for a given year and species.[9]

[7] When the member states bargain over money – e.g., agricultural support – countries can alternatively be assumed to maximize their share of the funds.

[8] In October 2024, herring quotas in the Baltic Sea increased sharply, even though the stock was depleted. The Swedish representative in the Council, a minister of government, defended Sweden's choice not to vote against the proposal by commenting, "Of course I am disappointed, but we definitely held out as far as we could and dared. Our assessment is that if we had pulled out of the negotiations, the quotas would have been [much] higher." See https://www.dn.se/sverige/kraftigt-hojda-strommingskvoter-i-ostersjon-trots-forskarnas-varningar/, accessed on 7 January 2025.

[9] The data confirm that TAC shares are constant, which is in line with the politically adopted "principle of relative stability" discussed below. While we allow policy positions to change over time and vary between species, we also assume that the countries' *relative* policy positions are constant across species and over time.

In this paper, we use a dataset made available by Griffin Carpenter and The New Economics Foundation (a British think tank). The data covers the period 2001–2020 for 55 species and 241 zone-species combinations. After restricting the data to final agreements with matching ICES observations, we end up with a panel of EU decisions on TACs covering 20 years and 165 zone-species combinations.

Each TAC decision caps the total catch for a particular species in a particular geographical zone, allocated in fixed proportions to the countries entitled to TAC shares for that zone-species combination. Across all included zone-species combinations, the number of countries varies from 1 to 14. For cod, TACs have been allocated to between two and eight countries, with an average of about six countries. Each year, between 8 and 12 such TAC decisions were taken for cod.

We find that relative to the assumed default of following the scientific advice and setting the average ratio of TACs to the scientifically recommended catch, hereafter defined as the exploitation ratio, to 1, our estimates of the policy positions of the Faroe Islands, Ireland, Portugal and Spain are significantly higher (more aggressive), while those of Germany are significantly lower (more prudent). Thus, our evidence suggests that Ireland, Portugal and Spain and, in particular, the Faroe Islands are aiming for higher TACs, while Germany seeks to reduce TACs.

Some of the regressions also suggest that Denmark, both independently and when paired with Sweden, prefers larger catches than scientific advice and that Belgium prefers catches to be lower. How much TACs deviate from the ICES advice also differs between species. For example, in our primary regression, we find that pollack, whiting, dab and flounder, and blue whiting have the highest ratios of TAC to ICES advice, while tusk and black scabbardfish have the lowest. Lastly, our results indicate that the exploitation ratio decreased during the period we observed.

2. Background

In 1976, the EU's member states extended their exclusive economic zones to 200 nautical miles, effective as of 1 January 1977, and, in principle, agreed to create a common fisheries policy. National quota shares were seen as necessary to prevent the kind of "race for fish" seen in some waters.[10] However, the negotiations for TAC shares were concluded only in 1983. The shares were mainly based on historical catches from 1973–1978, with adjustments to compensate for losses for some member states due to non-members extending their exclusive economic zones and with extra compensation for a few countries (UK, Ireland, and Greenland) that had communities that traditionally depended heavily on fishing.[11] Even though the CFP has been revised, these shares have been stable since 1983, when they were originally set. An important change to the CFP came in 2014 when the Council's TAC decisions became legally

[10] See Birkenbach et al, 2017, for a survey.

[11] Hegland and Raakjær, 2008; Leigh, 1983; Starr, 2023. See also Gellermann, 2020.

binding for the member states. When this stricter policy was adopted, the EU also decided that all its fisheries should be sustainable by 2020.

At the request of the European Commission (the Commission), ICES, an intergovernmental marine science organization with a network of almost 6000 scientists, provides scientifically based advice on fishing efforts for different zones and species to the Scientific, Technical and Economic Committee for Fisheries (STECF), an EU committee appointed by the director general responsible for fisheries.[12] Depending on the species, ICES has agreed to use one of three approaches to calculate their advice: the precautionary approach, advice based on maximum sustainable yield (MSY), or a range around MSY.[13] Based on ICES advice and consultations with representatives from industry stakeholders and interest groups, a legislative proposal with TAC levels is drafted.

The TACs are decided during behind-closed-doors negotiations at an Agriculture and Fisheries (AGRIFISH) Council ministerial meeting. Historically, all TACs for EU waters were decided during the December Council meeting, but since 2009, there has been a separate October Council meeting for TACs within the Baltic Sea.[14] TACs within the Atlantic and the North Sea are still decided on during the December Council, and TACs for deep-sea stocks are negotiated every other year. Further, the Council can revise TACs during the year they are valid.[15] Council mandates are used to negotiate TACs, which are shared with non-EU member states.[16]

When the Council approves the TAC decision and legislation, the TACs are divided according to the principle of "relative stability". Thus, there is virtually no variation between years in the fraction of each TAC (i.e., national quota shares or simply "TAC shares") that is allocated to a particular country.[17] For example, if Denmark were allocated 20 percent of the TAC for cod in Zone IIa (located in the North Sea) in 2001, Denmark would be allocated 20, or close to 20, percent of the cod in Zone IIa in all subsequent years. Stable TAC shares presumably facilitate the TAC negotiations, as there will only be one number to negotiate for each species-zone combination: the TAC.[18] This institutional feature makes it easier to elicit the member countries' policy positions from the agreed-upon TACs.

Several studies have criticized the EU's TAC management system, and a small part focuses on deviations from scientific advice and the effects of such deviations.[19] For example, when examining 11 fish stocks between 1987 and 2011, O'Leary et al. (2011) find that 68 percent of the TACs are set above scientific advice and, on average, 33 percent above the recommended

[12] Carpenter et al., 2016; Starr, 2023.
[13] We do not distinguish between the three methods. For an explanation of the methods, see Froese et al. (2021).
[14] Starr, 2023.
[15] Villasante et al, 2010.
[16] Starr, 2023.
[17] Hegland and Raakjær, 2008
[18] Without the principle of relative stability, the countries would have to negotiate the TAC shares and, possibly, which countries are entitled to a share of the TAC.
[19] See, e.g., Villasante et al, 2010; Carpenter et al, 2016.

levels. Using yearly data on TACs, ICES advice, and spawning stock biomass for 18 fish stocks, Cardinale and Svedäng (2008) find that politicians have made a practice of ignoring scientific advice and prioritizing short-term effects.

Froese et al. (2021) investigate the status and exploitation of 119 fish stocks in the Northeast Atlantic and find that only 34 percent of these stocks were sustainably fished and of sufficient size in 2018, while more than 40 percent of stocks were overfished. The authors also find that one-third of the stocks were lower than the biologically safe limit, and two-thirds were below the level corresponding to maximum sustainable yields (MSY).[20]

Carpenter et al. (2016) investigate how well the EU complies with scientific advice on fishing quotas and whether some countries receive higher average excess TACs between 2001 and 2015. To answer these questions, the authors compare the average excess TAC in tonnes between member countries and their ratios of TACs, aggregated for the whole period and across all TAC decisions, to the corresponding scientific advice from ICES. The authors find that Denmark and the United Kingdom receive the largest excess TAC in tonnes and that Spain and Portugal receive the largest percentage excess. While the outcome of EU negotiations and their consequences for individual countries are interesting in their own right, these results do not directly address the countries' policy positions.

3. Theory and previous literature

3.1. Policy positions and power indices

Following the tradition of spatial-voting models, we assume that countries have preferences or ideal positions that can be ordered along a prominent dimension. Below, we will often refer to a country's ideal position as its policy position. We use ICES' scientific advice to scale the policy positions as the point of reference. We assume that policy positions concerning fishing quotas relative to scientific advice vary between EU member countries, depending on voter preferences and how political power is distributed between various parties and interest groups within each country.

In international negotiations in general, and EU negotiations in particular, different countries come with different power to the negotiation table. A country's total power can be assumed to be proportional to its population size, the size of the economy, or be derived from formal voting rules. More sophisticated analysis relies on theoretically derived power indices. For example, the Shapley-Shubik Index is based on the assumption that voting power is proportional to the fraction of times a particular voter (e.g., a country in the Council of Ministers) is pivotal. This fraction, in turn, can be calculated if it is assumed that all preference orders are equally likely.[21]

[20] Maximum sustainable yields are the highest yearly catch that can support a stock long-term.

[21] For an accessible explanation, see Kauppi and Widgrén (2004). The Council's voting system is qualified majority voting. A positive decision requires support from 55 percent of the member countries, representing at least 65 percent of the EU's total population.

Kauppi and Widgrén (2004) implicitly assume that all countries aim to maximize their revenues from the EU and focus on voting power. Power indices are used to explain EU member countries' share of the overall EU budget or a particular spending item, such as agricultural support or structural funds.[22] Kauppi and Widgrén (2004) find that agricultural support from the EU can be explained by voting power and the share of the country's labor force that works in the agricultural sector. Similarly, Kandogan (2000) finds that the share of the total CAP funds to a country can be explained by a combination of power indices and how much the country's share of the population in agriculture deviates from the corresponding EU average.

Starr (2023) uses actual EU voting rules to calculate power indices, including the Shapley-Shubik Index, for countries with stakes in TAC negotiations for the Baltic, Atlantic, and North Sea, respectively. He finds that Germany's influence is especially strong in both negotiations. France, Spain, and the United Kingdom also have high voting power for TAC negotiations within the Atlantic and the North Sea.

3.2. Saliency

An analysis that relies strictly on voting power suggests that large countries are highly influential in all decisions. While this may be true for the most important one-off decisions, even large countries have limited political capital that must be allocated over the multitude of issues that will be negotiated each year and will want to concentrate their influence on *salient* issues. Hence, a common assumption is that influence in less pivotal decisions is proportional to interest or saliency, not only overall political power within the EU.

When discussing the concept of saliency, Leuffen et al. (2014) note that "capabilities are limited and any investment in one issue should imply fewer resources to be spent on other issues" (p. 617). In economists' terminology, this can be interpreted as a budget constraint for political influence. Whenever influence is constrained by a budget, efforts should be focused where it matters – on *salient* issues.[23]

Schalk et al. (2007) argue that the outcome of an EU negotiation will depend on the countries' respective policy positions, their power, and the salience the issue at hand has for the countries. In addition, the nature of the bargaining process will matter. Following earlier research, the authors define salience as "the fraction of the power a member state is willing to utilize to bring the policy outcome closer to its preferred position" (p. 235).[24]

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[22] Other applications of the power-index approach include Baldwin et al. (1997, 2000, 2001).

[23] The concept of "political capital" is discussed in Gratton et al (2022). In their model, the leader of an organization has a stock of political capital that can be used to sway the organization's choice of action. The more that is spent, the stronger the leader's influence will be on that issue's outcome. Differently from our setting, spending capital is also an investment. If the leader's decision turns out well, the leader's political capital will be larger in the next period, while bad decisions erode the stock of political capital. Similarly to our setting, political capital serves as a budget constraint for the exercise of influence.

[24] As discussed above, power can, for example, be measured by the Shapley-Shubik Index or simply by vote share.

Schalk et al. (2007) apply their empirical model to an extensive dataset on member countries' policy positions and the saliency of those issues for the countries. The dataset, consisting of expert opinions on a wide range of issues, was previously assembled by a group of researchers and presented in Thomson et al. (2006). Schalk et al. (2007) use 152 issues in their analysis, which is focused on the power of the presidency of the EU Council.[25]

3.3. Bargaining and outcomes

A model that has been demonstrated to perform well in predicting bargaining outcomes is the Nash bargaining solution (NBS). In the original formulation, the equilibrium maximizes the product of the difference between each party's equilibrium value and the value of the outside option. In EU negotiations, the outside option is often assumed to be the status quo.

It has been shown that if the value of the outside option is much lower than the equilibrium value, the NBS can be approximated by the salience-weighted mean of the parties' respective ideal positions.[26] Thus, eliminating the role of the outside option drastically reduces the complexity of the model in empirical applications.

Relying on Caplin and Nalebuff's (1991) median voter model as well as on Van den Bos (1991) and Achen (2006), Shalk et al. (2007) argue that EU negotiations could be understood as NBS resulting in outcomes that are the weighted means of the countries' policy positions, with weights equal to the product of power and salience.

Giving equal weights to salience and power with Nash bargaining over deviations from policy positions has been labeled the compromise model, further simplifying the analysis.[27] Given that policy positions can be interpreted as locations along one or more policy dimensions and given the countries' weights in the negotiations, a prediction consistent with NBS is that the outcome will be close to the center of gravity.

Franchino and Mariotto (2022) evaluate the performance of cooperative bargaining models on 35 controversial economic governance issues faced by the EU from 1997 to 2013. The member states' policy positions and levels of salience were qualitatively evaluated and assessed from document studies; the authors find that the compromise model was the best-performing model. According to the compromise model, political influence in a particular negotiation can be approximated by the product of (general) political power and the saliency of the specific issue.

3.4. Economic value as a combined measure of power and saliency

A little-noticed interpretation of saliency and the compromise model is that when budget matters and similar economic issues are negotiated, a direct measure of the product of power

[25] Leuffen et al. (2014) use an updated version of the same dataset (Thomson et al., 2012) and find that saliency can be predicted by how well a country is represented by interest groups in Brussels and by the length of its tenure in the EU.

[26] Achen, 2006.

[27] Van den Bos, 1991.

and saliency is economic value, whether in employment, sales, value-added – or revenues from the EU. Power tends to be roughly proportional to population size or the size of the economy; the saliency of an issue or of a sector tends to be proportional to its share of the labor force or of GDP. Hence, the product of power and saliency for a sector *x* of the economy can be approximated with the size of the sector as shown by the following simple equation:

$$\boldsymbol{Saliency \cdot Power = \left(\frac{Sector_x}{GDP}\right) \cdot GDP = Sector_x} \qquad \mathbf{1}$$

The implication is that a measure of a country's influence – the product of power and saliency – over an economic activity is the value of that economic activity for that country. In our application, a country's TAC share is proportional to its economic value at stake in the TAC decision. It can, therefore, be interpreted as a measure of the product of power and saliency.

3.5. Identifying policy positions

We have argued that the outcomes of the negotiations, i.e., the TAC decisions, can be modeled as weighted averages of the countries' policy positions entitled to shares of those TACs. By definition, all countries that fish for a particular species in a particular zone have the same exploitation ratio. However, for a given country, the exploitation ratio will vary between zones, and the set of countries that share a zone will vary, making it possible to identify the countries' policy positions.

Formally, our outcome measure R_{zs}, the exploitation ratio in species-zone combination *zs*, is given by:

$$\boldsymbol{R_{zs} = \frac{\sum_{c=1}^{n_{zs}} w_{czs} \cdot IR_c}{\sum_{c=1}^{n_{zs}} w_{czs}} = \sum_{c=1}^{n_{zs}} w_{czs} \cdot IR_c} \qquad \mathbf{2}$$

where w_{czs} is country *c*'s share of the TAC in zone-species combination *zs*, IR_c is country *c*'s ideal exploitation ratio (or policy position), and n_{zs} is the number of countries with positive shares of the TAC for zone *z* and species *s*.[28]

To summarize, our ambition is to estimate the unobserved policy positions of the EU member countries from the outcomes of the TAC negotiations. We argue that we can do this given a reasonable set of assumptions on how much influence each country has in each negotiation. Our key identifying assumption is that a country's influence in a negotiation is proportional to its share of the TAC. We argue that this is consistent with what is becoming a standard assumption in the literature, that influence is proportional to the product of power and saliency, if we are willing to assume that the economic value at stake can be used as a measure of influence.

[28] We suppress indexation for time *t*.

4. The empirical model

The empirical model corresponding to eq. (2) is:

$$\boldsymbol{r_{zst}} = \sum_{c \in A_{zs}} \boldsymbol{w_{czs}} \cdot \boldsymbol{i_c} + \boldsymbol{\alpha_s} + \boldsymbol{\beta_t} + \boldsymbol{\varepsilon_{zst}} \qquad \textbf{3}$$

where r_{zst} is the natural logarithm of the exploitation ratio *R* for species *s* in zone *z* at time *t*. For the countries active in zone *zs* (that belong to the set A_{zs}), the first term on the right-hand side is the weighted geometric mean of the countries' general overfishing preferences.[29] Here i_c represents the logarithm of the country c's preferences IR_c. The weights w_{czs} sum to 1 over all countries *c* active in zone *z* for species *s* (i.e., over all countries in set A_{zs}) and correspond to country *c*'s share of the TAC for species *s* in zone *z*. The second and third terms represent the species-fixed effects and the time-fixed effects, respectively, while ε_{zst} is the individual error term. Note that it follows from the specification that all countries' exploitation preferences are assumed to vary in the same way across species and over time.

Note also that preferences are the unknown parameters to be estimated while the weights are treated as observations. Since there is minimal variation in the time dimension, the preference parameters are mainly identified through the cross-sectional variation. The same is true for the species-fixed effects; the time-fixed effects are left to account for variations over time.

5. Data

The data used in this study is an updated version of a dataset used by Carpenter et al. (2016) and has been provided by Griffin Carpenter and the British think-tank The New Economics Foundation. The dataset contains agreements on TACs and scientific fishing advice from ICES for the period 2001–2020. As described above, these are set for combinations of species and geographic zones and are, in most cases, expressed in tonnes per year. The ICES Advice web portal (www.ices.dk) was used to collect data on ICES advice. Council Regulations were collected from the EUROLEX (www.eur-lex.europa.eu) for TAC agreements, including TACs for member states. TACs for other/third countries were collected through literature sources, such as government agency websites and news articles.[30]

A strength of the dataset is that TACs have been matched with scientific advice when ICES fishing zones and TAC areas do not overlap. As there is no available documentation on how the EU matches TAC areas and quotas to the scientific advice from ICES, Carpenter et al. (2016) had to adjust the data. These adjustments include splitting the ICES advice

[29] Equation (1) uses the arithmetic mean. To facilitate the analysis, we depart from the geometric mean in the empirical application. Equation (2) is obtained by taking the natural logarithm of an equation of the format $R = \prod_c {IR_c}^{w_c}$ where $r = \ln(R)$, $i = \ln(IR)$, and indexation for *s*, *c*, and *t* is suppressed.

[30] Carpenter et al.(2016).

proportionally to different TAC areas when an ICES area overlaps multiple TAC areas.[31] When ICES provides a range of advice for an area, the midpoint is used. Lastly, when the ICES advice is expressed in the number of fish, a recalculation to tonnes was made.

We restrict the dataset in two steps. Firstly, for some observations, the scientific advice from ICES is missing. As we both need the TAC and the scientific advice to measure the exploitation ratio, we restrict our sample to TACs with matching ICES advice. This decreases the sample by 35.8 percent. Secondly, the dataset includes both final and non-final agreements. If an amendment is made to an agreement, the original agreement will be viewed as a non-final agreement and the amendment as the final agreement. As there is always a final counterpart to non-final agreements and our interest lies in the final division of TACs between member countries, all non-final agreements are dropped. This further decreases the sample by 7.97 percent and leaves us with an unbalanced panel consisting of 165 zone-species combinations, 100 zones, and 40 species for 2001–2020, with a total of 2,207 observations.

The dependent variable is the exploitation ratio: the ratio of the TAC to the ICES advice by zone, species, and year. For 105 observations, where both their scientific advice and TAC are equal to zero, the exploitation ratio is set to 1. For 270 observations, the exploitation ratio cannot be calculated, as the ICES advice is equal to zero while the TAC is larger than zero. However, as it is informative that fishing is allowed when the advice is not to fish, we retain these observations in an alternative model specification.

Our key explanatory variables are the weights, w_{csz}, for country *c*, species *s*, and zone *z*. The countries included in the dataset are Belgium (*BEL*), Germany (*DEU*), Denmark (*DNK*), Spain (*ESP*), Estonia (*EST*), Finland (*FIN*), France (*FRA*), Faroe Islands (*FRO*), United Kingdom (*GBR*), Ireland (*IRL*), Lithuania (*LTU*), Latvia (*LVA*), Netherlands (*NLD*), Norway (*NOR*), Poland (*POL*), Portugal (*PRT*), and Sweden (*SWE*). We make no distinction between member and non-member states, with the latter category including Norway and the Faroe Islands and, since 2020, the United Kingdom.

While country weights should be constant according to the principle of relative stability, there is, in practice, some variation. The mean deviation from constant weights varies between the countries, from a minimum of 0.0042 to a maximum of 0.06 with an overall average of about 0.0119, to be compared with an overall average weight (or TAC share) of about 0.2 or 20 percent (see Table 8 in Appendix A). One reason for weights to vary is rounding effects for small total catches when individual TACs are measured in integer tonnes. Another reason stems from third countries, such as Norway, sometimes and sometimes not being included in the Council Regulations.[32] In our main specification, we fix the weights at the average value over the 20-year period; in an alternative specification, we allow the weights to vary between years.

[31] For example, if an ICES area covers two TAC areas, with the first corresponding to 80 percent of the ICES area and the second to 20 percent, the first TAC area will receive 80 percent of the ICES advice and the second 20 percent.

[32] For example, it happens that Norway is included in the amendment but not the original agreement.

Two countries were excluded from the data because of a lack of observations. The first one is Russia, with a total of 4 observations. The second is Greece, which is never active in more than one zone-species combination per year. Most of Greece's TACs are in the Mediterranean Sea, which is not included in our dataset.

5.1. Descriptive statistics

Figure 1 shows the annual overfishing and exploitation ratio for our period of observation.[33] Overfishing is measured in thousands of tonnes and displayed on the left axis, while the value-weighted average of the exploitation ratio is displayed on the right. The figure shows that both measures decreased during the period, with underfishing and an exploitation ratio below 1 in 2020. The widened gap between the two measurements during 2012–2018 is due to especially high ICES advice. This can be seen in Figure 2, which shows the annual TACs and ICES advice for our period of observation.

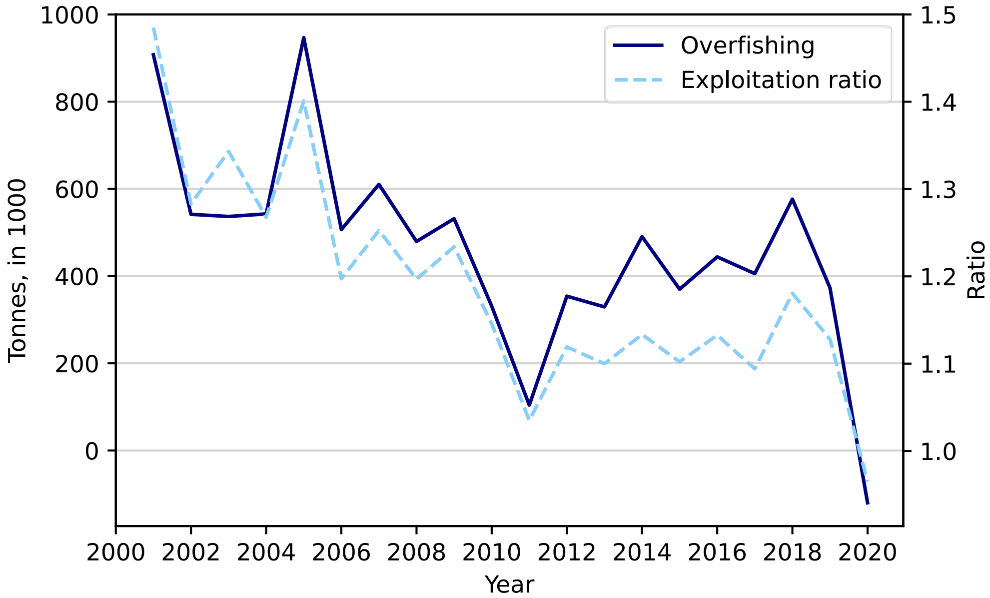

Figure 1: Total overfishing and exploitation ratio by year

Figure 2 shows that both the TACs and ICES' advice have followed an upward trend for most of the period, with a peak in 2017, a subsequent decrease, and an upturn in the ICES advice in 2020. This increase in the ICES advice 2020 caused overfishing to become negative and the exploitation ratio to fall below 1 for the first time.

Figure 3 shows the aggregate overfishing in tonnes and the value-weighted average of the exploitation ratio per country and for all zone-species combinations and years. Countries with large total quotas can have high overfishing in tonnes without necessarily having high exploitation ratios. Norway, for example, has the highest total overfishing, at nearly 2,000,000

[33] The exploitation ratio is calculated by dividing the sum of all TACs for each year by the sum of the scientific advice for the same year.

tonnes, but has an aggregated exploitation ratio more than 20 percentage points lower than that of the Faroe Islands and 10 percentage points below Spain.

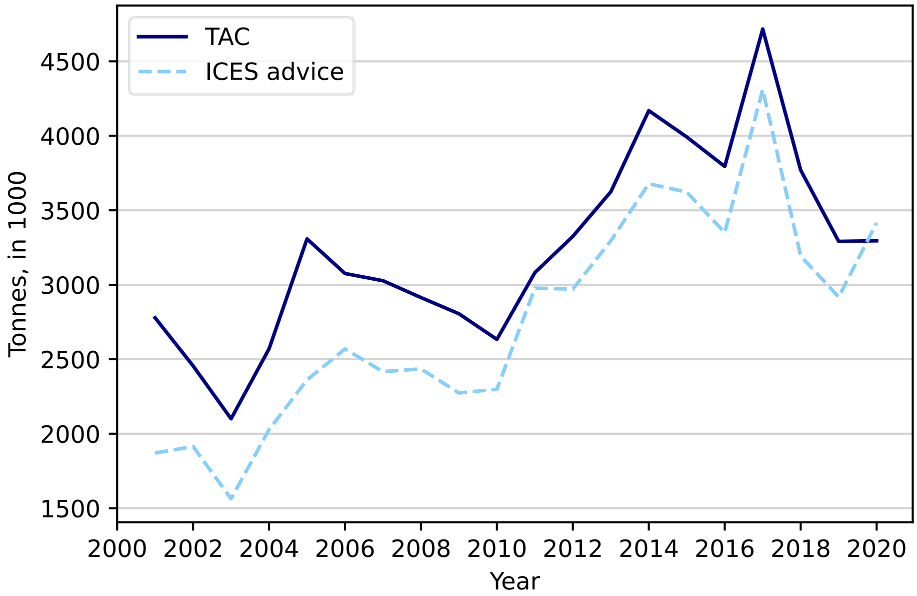

Figure 2: Total TAC and ICES advice by year

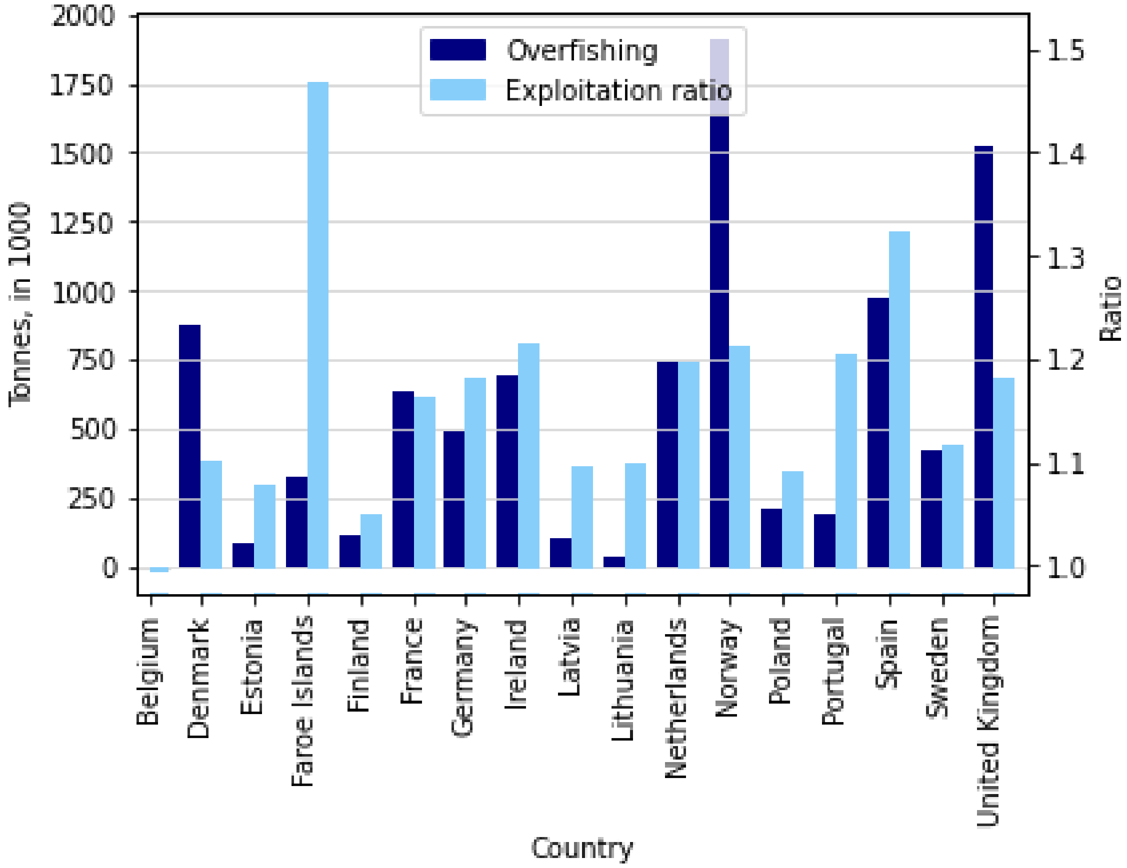

Figure 3: Overfishing and exploitation ratio aggregated by country, 2001–2020

Similarly, the United Kingdom has the second-highest total overfishing, at roughly 1,500,000 tonnes, and an aggregated exploitation ratio just below 1.2. Other countries with high total overfishing, between 500,000 and 1,000,000 tonnes each, are Spain, Denmark, the Netherlands, Ireland, France, and Germany, in descending order.

Table 1: Number of agreements, tonnes per agreement, and overfishing per country

Country	Number of agreements	Number of agreements with advice not to fish	Average TAC share per agreement	Average exploitation ratio per agreement	Average overfishing per agreement (tonnes)
BEL	828	110	0.063	1.291	2,305.256
DEU	1,138	172	0.078	2.812	6,221.712
DNK	918	135	0.405	2.751	6,473.835
ESP	817	151	0.319	1.392	6,769.814
EST	217	37	0.065	1.197	10,235.512
FIN	155	6	0.228	1.245	7,232.186
FRA	1,538	270	0.241	1.593	4,431.878
FRO	129	3	0.032	1.295	33,918.086
GBR	1,339	253	0.292	1.616	4,974.406
IRL	861	204	0.229	1.898	5,718.216
LTU	173	28	0.021	1.274	12,563.285
LVA	166	13	0.096	1.246	13,967.969
NLD	883	133	0.095	1.288	7,143.912
NOR	373	27	0.249	1.273	16,059.593
POL	237	29	0.097	1.189	8,953.672
PRT	410	61	0.24	1.441	9,181.153
SWE	658	96	0.129	3.352	6,529.96
TOT	2,207	375	-	2.155	4,197.96

Note: The number of agreements is the total number of TAC agreements the country is part of during the period. The number of agreements with advice not to fish is the number of TAC agreements the country is part of with scientific advice not to fish anything. The average TAC share per agreement is the mean country weight when the country is part of a TAC agreement. The average exploitation ratio per agreement and average overfishing per agreement is the average exploitation ratio and overfishing in tonnes, respectively, in zone-species combinations where they have a share of the TAC. The countries are indicated by the three-letter abbreviation, where BEL = Belgium, DEU = Germany, DNK = Denmark, ESP = Spain, EST = Estonia, FIN = Finland, FRA = France., FRO = Faroe Islands, GBR = United Kingdom, IRL = Ireland, LTU = Lithuania, LVA = Latvia, NLD = Netherlands, NOR = Norway, POL = Poland, PRT = Portugal, and SWE = Sweden.

Focusing on the aggregate exploitation ratio, the Faroe Islands has the highest aggregated exploitation ratio, at almost 1.5, but relatively low total overfishing in absolute values, below 500,000 tonnes. The Faroe Islands are involved in relatively few agreements, 129 in total, and have the second-lowest average TAC share. However, they are involved in agreements with the highest average overfishing, at 33,918.09 tonnes, as shown in Table 1. Table 1 shows the total number of agreements each country takes part in and how many of them have an ICES advice not to fish. Table 1 also shows the unweighted average for each country's TAC share, exploitation ratio, and overfishing in tonnes for the zone-species combinations of which the country has a share.

6. Results

As a first step, we check for multicollinearity between the country weights by calculating VIFs (variance inflation factors) for the country weights. According to Table 2, there is an issue of multicollinearity in our data. One way to handle the multicollinearity problem is to merge countries with close-to-perfect relationships between them. Table 9 (see Appendix B), a correlation matrix for the countries' weights, w_{czs}, shows a 95.62 percent correlation between the weights for Estonia and Latvia and an 85.47 percent correlation for Lithuania and Poland. For the rest of the country weights, this correlation is substantially smaller. Hence, to reduce multicollinearity, Estonia and Latvia are merged into one set of observations, and Lithuania and Poland into another.

Table 2: Test of multicollinearity between country weights (VIF)

Country weight	Without grouping	Grouping 1	Grouping 2	Grouping 3
BEL	2.56	2.55	1.82	1.83
DEU	4.61	4.41	3.11	3.10
DNK	16.93	16.91	-	3.73
ESP	10.77	10.72	-	-
EST	17.36	-	-	-
FIN	3.36	3.14	1.87	-
FRA	13.87	13.87	4.05	4.05
FRO	1.49	1.49	1.47	1.47
GBR	13.96	13.95	3.45	3.47
IRL	6.48	6.47	2.44	2.44
LTU	5.97	-	-	-
LVA	17.31	-	-	-
NLD	3.83	3.82	2.13	2.13
NOR	4.7	4.7	2.07	2.07
POL	5.72	-	-	-
PRT	4.24	4.24	-	-
SWE	3.69	3.62	-	-
EST + LVA	-	2.42	1.4	1.4
LTU + POL	-	2.41	1.86	2
ESP + PRT	-	-	2.6	2.6
DNK + SWE	-	-	4.48	-
FIN + SWE	-	-	-	2.8
Average	8.05	6.31	2.52	2.55

Note: The country weights, w_{csz} , are represented by the three-letter abbreviation according to ISO 3166 alpha 3, where BEL = Belgium, DEU = Germany, DNK = Denmark, ESP = Spain, EST = Estonia, FIN = Finland, FRA = France., FRO = the Faroe Islands, GBR = the United Kingdom, IRL = Ireland, LTU = Lithuania, LVA = Latvia, NLD = Netherlands, NOR = Norway, POL = Poland, PRT = Portugal, SWE = Sweden, EST + LVA = Estonia paired with Latvia, LTU + POL = Lithuania paired with Poland, ESP + PRT = Spain paired with Portugal, DNK + SWE = Denmark paired with Sweden, and FIN + SWE = Finland paired with Sweden.

Nevertheless, multicollinearity issues exist, as shown by the VIF values for Grouping 1, which indicate that Denmark, Spain, France, and the United Kingdom highly correlate with the other explanatory variables. Denmark and Spain have the highest positive correlation with other countries for these countries. Denmark's correlation with Sweden is 29.3 percent, and Spain's with Portugal is 22.6 percent. For France and the United Kingdom, their positive correlation with other countries' weights is substantially lower, with a value of 0.044 and 0.112, respectively. This may indicate that the high VIF values for France and the United Kingdom are a result of correlations with our fixed effects, such as species effects, and not a correlation with other country weights.[34]

In Grouping 2, we also group Denmark's and Sweden's country weights and Spain's and Portugal's. Sweden's correlation with Finland is almost as high as with Denmark, so we alternatively group Sweden with Finland in Grouping 3. Thus, in Grouping 3, we pair Estonia and Latvia, Lithuania and Poland, Spain and Portugal, and Finland and Sweden.

Table 3 reports the result from our fixed-effects model. Estimation (1) reports the result without any country groups. Estimation (2) and (3) group countries as explained in Table 2, Grouping 2 and 3, respectively. Our interpretation of the parameter is that it approximates the respective country's policy position. Hence, positive coefficients indicate policy positions above scientific advice, while negative coefficients indicate policy positions below. For example, estimation (2)'s parameter estimates for Germany, -0.473, corresponds to a policy position of $e^{-0.473} \approx 0.62$. The interpretation is that Germany would prefer TACs to be set at just above 60 percent of the scientific advice.

Table 3: Fixed-effects model, r_{zst}

Explanatory variables	Not grouping (1)	Grouping 2 (2)	Grouping 3 (3)
BEL	-0.238 (0.222)	-0.174 (0.188)	-0.174 (0.188)
DEU	-0.609*** (0.219)	-0.473*** (0.18)	-0.466*** (0.179)
DNK	-0.009 (0.138)	-	0.072 (0.065)
ESP	-0.093 (0.145)	-	-
EST	-1.428 (1.064)	-	-
FIN	0.072 (0.194)	0.062 (0.145)	-
FRA	-0.126 (0.141)	-0.065 (0.076)	-0.066 (0.076)

[34] This is supported by Table 15 in Appendix E, as multicollinearity for Grouping 1 decreases when species-fixed effects are excluded. [We are looking into how to group similar species to handle this problem without grouping country weights with relatively low correlation. Any recommendations for how to best group species or other ways to handle the multicollinearity would be appreciated.]

FRO	2.283* (1.329)	2.449* (1.32)	2.434* (1.32)
GBR	0.034 (0.14)	0.094 (0.07)	0.096 (0.07)
IRL	0.356** (0.151)	0.413*** (0.093)	0.416*** (0.093)
LTU	-4.963 (3.498)	-	-
LVA	1.349 (0.92)	-	-
NLD	-0.117 (0.181)	-0.071 (0.135)	-0.068 (0.136)
NOR	-0.161 (0.164)	-0.088 (0.109)	-0.087 (0.109)
POL	1.218** (0.589)	-	-
PRT	0.38*** (0.146)	-	-
SWE	0.169 (0.226)	-	-
EST + LVA	-	-0.094 (0.142)	-0.087 (0.142)
LTU + POL	-	0.569* (0.292)	0.54* (0.303)
ESP + PRT	-	0.42*** (0.11)	0.42*** (0.11)
SWE + DNK	-	0.079 (0.062)	-
SWE + FIN	-	-	0.111 (0.116)
Year & Species Fixed Effects	Yes	Yes	Yes
Observations	1,937	1,937	1,937
Adjusted R^2	0.535	0.534	0.534

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weights for different countries in each agreement. The three-letter abbreviation shows which country the weight corresponds to: *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom, *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

The three estimations in Table 3 have fairly similar results. Portugal has a positive and significant coefficient, both when paired with Spain in estimations (2) and (3) and when estimated separately in estimation (1). Ireland and the Faroe Islands are also positive and significant in all estimations, while Germany has a significant and negative parameter.

Taken literally, the parameter estimates suggest that the Faroe Islands' policy position is that TACs should be set at least ten times higher than what ICES suggests. Using the results from the estimations with groupings, the policy positions of Ireland, Lithuania paired with Poland, and Portugal paired with Spain are estimated to be 50–75 percent higher than ICES's advice. In contrast, Germany's policy position seems to be aiming for about 60 percent of the advised level.

Portugal's and Spain's aggressive policy positions are in line with the findings of Carpenter et al. (2016). However, to our knowledge, findings similar to ours have not been reported in the literature for the Faroe Islands, Ireland, and Germany in the literature.[35]

The fixed effects for the regressions presented in Table 3 are reported in Table 10 and Table 11 (see Appendix C). Table 10 shows that the general trend is that the exploitation ratios decrease with time. Regarding the species fixed effects, pollack, whiting, dab, and flounder have the highest exploitation ratios, in descending order. Conversely, tusk has the lowest exploitation ratios, with black scabbardfish having the second-to-lowest, as shown in Table 11.

In Table 4, we report results after clustering by sea to control for differences that depend on whether a species is located and fished in the Atlantic, the Baltic Sea, or deep-sea. Since 2009, there have also been separate Council meetings for TACs within the Atlantic and the Baltic Sea, which may lead to further differences.

Table 4: Fixed-effects model, r_{zst}, clustered by sea

Explanatory variables	Not grouping (1)	Grouping 2 (2)	Grouping 3 (3)
BEL	-0.238 (0.108)	-0.174* (0.042)	-0.174** (0.038)
DEU	-0.609 (0.923)	-0.473 (0.926)	-0.466 (0.931)
DNK	-0.009 (0.128)	-	0.072*** (0.006)
ESP	-0.093 (0.124)	-	-
EST	-1.428 (2.735)	-	-
FIN	0.072 (0.139)	0.062 (0.18)	-
FRA	-0.126 (0.106)	-0.065 (0.239)	-0.066 (0.239)
FRO	2.283** (0.33)	2.442*** (0.212)	2.434** (0.255)
GBR	0.034 (0.013)	0.094 (0.12)	0.096 (0.131)
IRL	0.356** (0.073)	0.413** (0.07)	0.416** (0.074)
LTU	-4.963 (8.599)	-	-
LVA	1.349 (2.346)	-	-
NLD	-0.117 (0.113)	-0.071 (0.049)	-0.068 (0.056)
NOR	-0.161*** (0.01)	-0.088 (0.134)	-0.087 (0.084)
POL	1.218 (2.12)	-	-

[35] Starr (2023) reports that Germany has an especially high voting power in the Atlantic and Baltic Seas.

PRT	0.38*** (0.034)	-	-
SWE	0.169 (0.118)	-	-
EST + LVA	-	-0.094 (0.072)	-0.087 (0.084)
LTU + POL	-	0.569 (0.538)	0.54 (0.676)
ESP + PRT	-	0.42* (0.143)	0.42* (0.143)
DNK + SWE	-	0.079* (0.022)	-
FIN + SWE	-	-	0.111 (0.23)
Year & Species Fixed Effects	Yes	Yes	Yes
Observations	1,937	1,937	1,937
Adjusted R^2	0.553	0.551	0.555

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weights for different countries in each agreement. The three-letter abbreviation shows which country the weight corresponds to: *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom, *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

According to Table 4, the results for Faroe Island, Ireland, and Portugal and Spain are stable after clustering by sea, while Germany and the paring of Lithuania and Poland become insignificant. In estimations (2) and (3), we also get a negative and significant coefficient for Belgium. In contrast, Denmark's, both when paired with Sweden in estimation (2) and by itself in estimation (3), is positive and significant. This suggests that, in terms of policy positions, Belgium's position is to fish 84 percent out of the advice, and Denmark's and Sweden's are around 8 percent above.

From our main results, we find strong evidence for the Faroe Island, Ireland, and Portugal and Spain aiming for TACs higher than ICES' advice. Without clustering by sea, the paring of Lithuania and Poland also has a significant and positive estimate, while Germany's is significantly negative. After the clustering, the latter two estimates become insignificant, while Denmark paired with Sweden gets a significant and positive estimate and Belgium a significant and negative.

7. Sensitivity Analysis

In this section, we report several sensitivity analyses, three of which are presented in Table 5. In estimations (1), (3), and (5), the countries are grouped according to Grouping 2, and in estimations (2), (4), and (6), according to Grouping 3.

As mentioned in the data section, the ratio of TAC to ICES cannot be calculated when the latter is set to zero, leading to a loss of 270 observations.[36] One way to handle this problem is to use

[36] When both the TAC and ICES advice are zero, we set the ratio to 1 and can use the observation.

overfishing in tonnes as the base of our explanatory variable, instead of the exploitation ratio R. We first define overfishing (OVF) as TAC – ICES. However, OVF is negative for 290 observations. As we still want to logarithm the data, we use a transformation that treats zeros, positive, and negative values symmetrically. We take the natural logarithms of the absolute values plus one and then add the sign, using the following calculation: $sign(OVF) * \ln(|OVF| + 1)$. We call the new dependent variable *lnOVF*. Column (1) and (2) in Table 5 reports the results from the fixed-effects model when we use the (natural logarithms of) overfishing in tonnes for all observations.

In columns (3) and (4) in Table 5, we weigh observations according to the size of the catches. There are two justifications for this. Firstly, the assessments of fish stocks may be more reliable for plentiful species. Thus, the ICES' advice would be more reliable, and the outcomes of the quota negotiations would be more aligned with the member states' policy positions. Secondly, it is rational to assume that countries not only use more of their power on stocks with a larger TAC ratio but also on plentiful stocks. To account for these effects, we weigh the observations with the square root of the ICES advice.

Our main regressions are based on final agreements. However, member states can be assumed to argue for their interest to the same degree when the original agreements and the amendments are negotiated. Thus, we also estimate policy positions from original agreements. Results are reported in columns (5) and (6) in Table 5.

Table 5: Sensitivity analysis, three fixed-effects models

Explanatory variables	*lnOVF*		Weighted regression		Original agreements	
	(1)	(2)	(3)	(4)	(5)	(6)
BEL	0.77 (1.621)	0.848 (1.621)	-1.322*** (0.268)	-1.325*** (0.268)	-0.21 (0.192)	-0.211 (0.192)
DEU	-2.032 (1.55)	-1.959 (1.541)	0.142 (0.133)	0.123 (0.133)	-0.455** (0.184)	-0.446** (0.184)
DNK	-	-0.333 (0.542)	-	0.049 (0.062)	-	0.053 (0.068)
FIN	-1.873 (1.312)	-	0.01 (0.067)	-	0.081 (0.15)	-
FRA	-0.089 (0.62)	-0.093 (0.62)	-0.029 (0.088)	-0.028 (0.088)	-0.077 (0.079)	-0.079 (0.079)
FRO	69.21*** (12.052)	69.559*** (12.047)	1.204*** (0.457)	1.231*** (0.0458)	2.931** (1.451)	2.905** (1.451)
GBR	-0.716 (0.581)	-0.805 (0.583)	-0.037 (0.064)	-0.038 (0.064)	0.099 (0.072)	0.104 (0.073)
IRL	1.271* (0.752)	1.26* (0.751)	-0.096 (0.09)	-0.096 (0.09)	0.395*** (0.096)	0.4*** (0.096)
NLD	3.198*** (1.212)	3.128*** (1.212)	-0.118 (0.108)	-0.126 (0.108)	-0.086 (0.14)	-0.081 (0.14)
NOR	-1.354 (0.957)	-1.268 (0.954)	-0.013 (0.056)	-0.02 (0.056)	-0.128 (0.122)	-0.128 (0.122)
EST + LVA	2.402* (1.289)	2.308* (1.289)	0.122 (0.075)	0.116 (0.076)	-0.085 (0.145)	-0.072 (0.146)
LTU + POL	3.155 (2.532)	4.121 (2.603)	0.109 (0.122)	0.14 (0.125)	0.562* (0.3)	0.505 (0.31)

	(1)	(2)	(3)	(4)	(5)	(6)
ESP + PRT	1.574* (0.903)	1.593* (0.903)	-0.071 (0.112)	-0.069 (0.112)	0.428*** (0.112)	0.428*** (0.112)
SWE + DNK	-0.622 (0.509)	-	0.026 (0.059)	-	0.068 (0.065)	-
SWE + FIN	-	-2.155** (0.969)	-	-0.007 (0.061)	-	0.142 (0.12)
Year & Species Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,207	2,207	1,832	1,832	1,864	1,864
Adjusted R^2	0.454	0.455	0.659	0.659	0.532	0.532

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weights for different countries in each agreement. The three-letter abbreviation shows which country the weight corresponds to: *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom., *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden. For the variables including a +, we pair two countries together as one.

Columns (1) and (2) in Table 5 show that the Faroe Islands still is the country with the highest positive and significant coefficient. Ireland and the paring of Spain and Portugal are also still significant and positive, suggesting that their policy position is to fish more than ICES advice. The estimates for the Netherlands and the paring of Estonia and Latvia become significantly positive in this estimation, also suggesting an aggressive policy stance. At the same time, the pairing of Sweden and Finland yields a significantly negative estimate. Most of the significantly positive coefficients have values of about 2 to 4.[37] However, the coefficient for Faroe Island is about 70, which is considerably larger than other coefficients, again indicating that this country aims for the highest TACs.

When using weighted regression, two country weights are significant – those of Belgium and the Faroe Islands, as shown in columns (3) and (4) in Table 5. Compared to our main regression in Table 3, the coefficient for the Faroe Islands increases in significance but decreases in magnitude, to a level corresponding to catches 3–3.5 higher than the scientific advice. In contrast, Belgium's estimated policy position is about 70 percent below ICES' advice.

Columns (5) and (6) in Table 5 show that when basing our regression on original agreements, whether final or not, we get similar results as when we use final agreements. Germany still has significantly negative estimates, while those for the Faroe Islands, Ireland, and Portugal, both independently and when paired with Spain, are significant and positive. The estimate for Lithuania and Poland is also marginally significant in estimates based on Grouping 2.

In our model, we assume that the country weights for each zone-species combination are stable over time, according to the principle of relative stability. To test to which extent this influences our results, we estimate the effects using actual yearly TAC shares as weights; results are reported in Table 6. Estimations (1) and (2) are solely based on the annual TAC share, which excludes observations with TAC equal to zero. Thus, we impute the constant weight for

[37] This would approximately correspond to setting the TACs 10-50 tonnes above ICES' advice – in the same order of magnitude as the values reported in Table 1.

observations without an annual TAC share in estimations (3) and (4). Further, estimation (1) and (3) is based on the Grouping 2, while (2) and (4) are based on Grouping 3.

Table 6: Sensitivity analysis, yearly country weights

Explanatory variables	Without imputed values		With imputed values	
	(1)	(2)	(3)	(4)
BEL	-0.129 (0.192)	-0.128 (0.192)	-0.151 (0.187)	-0.15 (0.187)
DEU	-0.377** (0.181)	-0.366** (0.181)	-0.314* (0.177)	-0.304* (0.176)
DNK	-	0.155** (0.068)	-	0.109* (0.065)
FIN	0.077 (0.149)	-	0.063 (0.145)	-
FRA	0.015 (0.079)	0.014 (0.079)	-0.004 (0.076)	-0.005 (0.076)
FRO	0.529 (0.444)	0.535 (0.444)	0.64 (0.434)	0.644 (0.433)
GBR	0.124* (0.073)	0.125* (0.073)	0.09 (0.07)	0.093 (0.07)
IRL	0.467*** (0.095)	0.468*** (0.095)	0.433*** (0.091)	0.436*** (0.091)
NLD	0.011 (0.138)	0.014 (0.138)	-0.007 (0.134)	-0.002 (0.135)
NOR	-0.169 (0.108)	-0.165 (0.108)	-0.143 (0.105)	-0.141 (0.105)
EST + LVA	-0.055 (0.145)	-0.046 (0.145)	-0.068 (0.142)	-0.057 (0.142)
LTU + POL	0.359 (0.285)	0.352 (0.294)	0.343 (0.279)	0.319 (0.286)
EST + PRT	0.434*** (0.112)	0.433*** (0.112)	0.429*** (0.108)	0.428*** (0.108)
DNK + SWE	0.159** (0.066)	-	0.117* (0.063)	-
FIN + SWE	-	0.157 (0.123)	-	0.145 (0.115)
Year & Species Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,837	1,837	1,937	1,937
Adjusted R^2	0.539	0.439	0.533	0.533

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weights for different countries in each agreement. The three-letter abbreviation shows which country the weight corresponds to: *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom., *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden. For the variables including a +, we pair two countries together as one.

As shown in Table 6, we lose significance in some instances when using yearly weights. In particular, this is the case for the Faroe Islands. However, most parameter estimates remain relatively close to those when using constant weights, and in some cases (the UK, Denmark, and the combination of Denmark and Sweden), the estimates gain statistical significance. The coefficient for Ireland remains positive and significant, as does the paring of Spain and

Portugal. The estimate for Germany remains negative, but the absolute size of the estimated coefficient is smaller, suggesting Germany aims for TACs at about 70 percent of the ICES advice.

8. Conclusion

Our results mostly show positive and significant estimates for the Faroe Islands, Ireland, and Portugal, both individually and when paired with Spain, indicating that these countries aim for catches above the scientific advice. In contrast, we find a negative and, in most regressions, significant coefficient for Germany, suggesting a policy position corresponding to TACs below ICES' advice. The results are especially stable for Ireland and Portugal. The estimates for the Faroe Islands are significant for all estimates except when using yearly weights.

Under most of our modeling assumptions, the results suggest that the Faroe Islands has an especially aggressive policy position and would want to allow catches much higher than the advice. Some of the regressions also suggest that the Netherlands and Denmark, both independently and when paired with Sweden, prefer larger catches than the scientific advice, while Belgium prefers lower.

We can also interpret some results from our species and year-fixed effects. According to our species fixed effects, the exploitation ratio is the highest for TACs that apply to the species pollack, whiting, dab, and flounder. TACs for tusk have the lowest exploitation ratios, with black scabbardfish having the second lowest. Regarding the year-fixed effects, the general trend is that the exploitation ratios decrease with time.

Beyond these findings, our study provides a foundation for further research on policy positions in TAC negotiations. A relevant avenue for future work is examining whether national policy positions remain stable after Brexit, given that this marks the first time since 1983 that the shares of national quotas within a TAC have been renegotiated. Investigating potential shifts in negotiation strategies and their long-term implications could offer valuable insights into how political and economic changes influence quota-setting dynamics.

Further, the method proposed in this study offers a way to gain insights into the behind-closed-door negotiations. It is often said that politicians prioritize short-term goals over long-term objectives, such as sustainable fishing. Increased transparency regarding the TAC negotiations could influence politicians towards a more responsible policy.

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Appendix A: Descriptive statistics

Table 7: Descriptive statistics, dependent and independent variables

Variable	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	N	N if positive	Mean if positive
OVF (tonnes)	4,199.651	160	480,077.9	-143,510.8	22,405.99	8.016	127.493	2,205	1,443	7,800.335
R (ratio)	2.226	1.085	755.56	0.002	22.295	30.268	949.987	1,936	1,936	2.226
r (ln ratio)	0.167	0.082	6.627	-6.263	0.726	-2.703	43.302	1,936	1,174	0.41
lnOVF	3.563	5.081	13.082	-11.874	5.237	-0.846	3.052	2,205	1,443	6.773
BEL	0.024	0	0.625	0	0.081	5.471	35.922	2,205	820	0.064
DEU	0.04	0.001	0.8	0	0.102	4.404	24.399	2,205	1,135	0.076
DNK	0.169	0	1	0	0.296	1.671	4.298	2,205	917	0.405
ESP	0.117	0	0.968	0	0.254	2.315	7.044	2,205	812	0.319
EST	0.006	0	0.461	0	0.042	9.61	102.27	2,205	217	0.066
FIN	0.016	0	0.898	0	0.101	7.568	61.598	2,205	155	0.228
FRA	0.168	0.039	0.94	0	0.251	1.522	4.047	2,205	1,533	0.241
FRO	0.002	0	0.098	0	0.01	6.556	50.232	2,205	129	0.032
GBR	0.176	0.08	0.976	0	0.244	1.537	4.511	2,205	1,331	0.292
IRL	0.089	0	0.909	0	0.188	2.734	10.229	2,205	856	0.229
LTU	0.002	0	0.056	0	0.008	5.315	32.179	2,205	176	0.022
LVA	0.007	0	0.539	0	0.048	9.802	105.607	2,205	166	0.096
NLD	0.038	0	0.797	0	0.111	4.512	25.803	2,205	882	0.095
NOR	0.042	0	0.902	0	0.137	4.095	20.789	2,205	372	0.249
POL	0.01	0	0.27	0	0.044	4.796	25.755	2,205	230	0.1
PRT	0.044	0	1	0	0.152	4.307	21.833	2,205	409	0.239
SWE	0.098	0	0.702	0	0.098	3.29	15.468	2,205	658	0.129

Note: The three-letter abbreviation shows which country the weight corresponds to. *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom., *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

Table 8: The difference between constant and yearly weights (in absolute terms)

Country	Minimal difference	Mean difference	Median difference	Maximal difference	Percentage of agreements with a difference
BEL	0	0.0044	0.0002	0.2338	0.9746
DEU	0	0.0047	0.0006	0.261	0.9569
DNK	0	0.0205	0.0013	0.8527	0.9575
ESP	0	0.0063	0.0001	0.8469	0.9731
EST	0	0.0061	0.0007	0.1059	0.9816
FIN	<0.00001	0.0147	0.0026	0.1294	1
FRA	0	0.0107	0.0004	0.7379	0.9597
FRO	0.0002	0.0314	0.0139	0.9022	1
GBR	0	0.0112	0.0013	0.7107	0.9694
IRL	0	0.0173	0.0015	0.7306	0.9849
LTU	0	0.0042	0.0015	0.0854	0.9769
LVA	<0.00001	0.0108	0.001	0.0892	1
NLD	0	0.0044	0.0003	0.3299	0.9853
NOR	0.0001	0.06	0.0199	0.9022	1
POL	0	0.0153	0.0037	0.2515	0.9789
PRT	0	0.0079	0.0001	0.8469	0.9683
SWE	0	0.0095	0.001	0.4459	0.9878

Note: The three-letter abbreviation shows which country the weight corresponds to. *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom., *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

Appendix B: Correlation matrix

Table 9: Correlation matrix (constant) country weights

	BEL	DEU	DNK	ESP	EST	FIN	FRA	FRO	GBR	IRL	LTU	LVA	NLD
BEL	1												
DEU	-0.088	1											
DNK	-0.133	-0.049	1										
ESP	-0.129	-0.109	-0.261	1									
EST	-0.045	0.009	-0.068	-0.067	1								
FIN	-0.047	-0.035	-0.064	-0.074	0.129	1							
FRA	0.044	-0.098	-0.354	-0.074	-0.091	-0.106	1						
FRO	-0.055	-0.006	0.023	-0.064	-0.028	-0.03	-0.088	1					
GBR	0.084	-0.062	-0.266	-0.266	-0.108	-0.115	-0.056	-0.014	1				
IRL	0.006	-0.147	-0.249	-0.182	-0.071	-0.076	0.009	-0.011	0.083	1			
LTU	-0.063	0.088	-0.001	-0.057	0.225	0.111	-0.097	-0.039	-0.142	-0.096	1		
LVA	-0.044	-0.004	-0.047	-0.066	0.956	0.043	-0.086	-0.028	-0.105	-0.07	0.272	1	
NLD	0.152	0.049	-0.046	-0.142	-0.052	-0.054	-0.137	0.092	-0.013	0.014	-0.072	-0.051	1
NOR	-0.077	-0.032	0.028	-0.127	-0.047	-0.048	-0.141	0.296	-0.097	-0.126	-0.065	-0.046	-0.016
POL	-0.069	0.247	-0.01	-0.049	0.232	0.111	-0.143	-0.041	-0.153	-0.11	0.855	0.227	-0.079
PRT	-0.085	-0.028	-0.166	0.226	-0.04	-0.047	-0.136	-0.052	-0.176	-0.129	-0.062	-0.042	-0.097
SWE	-0.103	0.096	0.293	-0.18	0.087	0.22	-0.258	-0.038	-0.27	-0.183	0.36	0.096	-0.119

	NOR	POL	PRT	SWE
NOR	1			
POL	-0.069	1		
PRT	-0.089	-0.053	1	
SWE	0.051	0.366	-0.114	1

Appendix C: Year and species fixed effects

Table 10: Year fixed effects, r_{zst}

Explanatory variables	Not grouping (1)	Grouping 2 (2)	Grouping 3 (3)
2002	-0.102	-0.11	-0.11
	(0.084)	(0.083)	(0.083)
2003	-0.048	-0.055	-0.056
	(0.085)	(0.085)	(0.085)
2004	-0.044	-0.047	-0.047
	(0.085)	(0.084)	(0.084)
2005	-0.061	-0.064	-0.064
	(0.083)	(0.082)	(0.082)
2006	-0.145*	-0.148*	-0.148*
	(0.084)	(0.084)	(0.084)
2007	-0.183**	-0.186**	-0.186**
	(0.083)	(0.084)	(0.082)
2008	-0.146*	-0.151*	-0.15*
	(0.083)	(0.082)	(0.083)
2009	-0.066	-0.071	-0.071
	(0.083)	(0.081)	(0.081)
2010	-0.113	-0.114	-0.113
	(0.08)	(0.08)	(0.08)
2011	-0.149**	-0.155*	-0.154*
	(0.084)	(0.083)	(0.083)
2012	-0.147*	-0.153*	-0.152*
	(0.08)	(0.079)	(0.079)
2013	-0.039	-0.042	-0.041
	(0.075)	(0.074)	(0.074)
2014	-0.075	-0.079	-0.078
	(0.074)	(0.073)	(0.073)
2015	-0.151**	-0.156**	-0.155**
	(0.073)	(0.072)	(0.072)
2016	-0.144**	-0.149**	-0.148**
	(0.073)	(0.072)	(0.072)
2017	-0.157**	-0.161**	-0.161**
	(0.073)	(0.072)	(0.072)
2018	-0.195***	-0.199***	-0.198***
	(0.074)	(0.072)	(0.073)
2019	-0.191**	-0.196***	-0.196***
	(0.754)	(0.074)	(0.074)
2020	-0.215***	-0.221***	-0.221***
	(0.076)	(0.075)	(0.075)
Observations	1,936	1,936	1,936
Adjusted R^2	0.535	0.535	0.535

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.

Table 11: Species fixed effects, r_{zst}

Explanatory variables	Not grouping (1)	Grouping 2 (2)	Grouping 3 (3)
Anchovy	0.476***	0.386***	0.386***
	(0.167)	(0.113)	(0.113)
Anglerfish	0.316**	0.24***	0.24***
	(0.145)	(0.091)	(0.091)
Atlantic salmon	0.348*	0.326**	0.295**
	(0.183)	(0.145)	(0.145)
Black scabbardfish	-0.381**	-0.425***	-0.426***
	(0.162)	(0.127)	(0.127)
Blue ling	0.114	0.038	0.038
	(0.226)	(0.199)	(0.199)
Blue whiting	0.611***	0.524***	0.525***
	(0.141)	(0.085)	(0.085)
Boarfish	-0.096	-0.167	-0.168
	(0.221)	(0.193)	(0.193)
Cod	0.383***	0.307***	0.306***
	(0.138)	(0.086)	(0.086)
Common sole	0.316**	0.247***	0.247***
	(0.144)	(0.093)	(0.093)
Dab and flounder	0.76***	0.688***	0.685***
	(0.258)	(0.234)	(0.234)
Deep-sea sharks	0.155	0.133	0.133
	(0.218)	(0.216)	(0.216)
Greater forkbeard	0.574***	0.495***	0.493***
	(0.167)	(0.126)	(0.126)
Greater silver smelt	0.486***	0.408***	0.407***
	(0.18)	(0.144)	(0.144)
Haddock	0.242*	0.172*	0.171*
	(0.146)	(0.098)	(0.098)
Hake	0.332**	0.25***	0.251***
	(0.145)	(0.09)	(0.09)
Herring	0.166	0.112	0.104
	(0.138)	(0.086)	(0.09)
Horse mackerel	0.222	0.143	0.143
	(0.149)	(0.098)	(0.098)
Lemon sole and witch flounder	0.271	0.2	0.199
	(0.235)	(0.208)	(0.208)
Ling	0.499***	0.423***	0.423***
	(0.151)	(0.105)	(0.105)
Mackerel	0.348**	0.262***	0.264***
	(0.144)	(0.088)	(0.088)
Megrims	0.505***	0.426***	0.425***
	(0.143)	(0.082)	(0.082)
Northern prawn	0.055	-0.003	-0.007
	(0.172)	(0.139)	(0.14)
Norway lobster	0.219	0.154*	0.153*
	(0.14)	(0.088)	(0.088)
Norway pout	0.119	0.026	0.032
	(0.196)	(0.164)	(0.164)
Orange roughy	0.148	0.08	0.079
	(0.167)	(0.127)	(0.127)
Plaice	0.301**	0.236***	0.236***
	(0.141)	(0.089)	(0.089)

Pollack	1.056***	0.976***	0.976***
	(0.161)	(0.112)	(0.112)
Porbeagle	0.215	0.138	0.139
	(0.286)	(0.265)	(0.265)
Red seabream	0.335**	0.267**	0.267**
	(0.169)	(0.133)	(0.133)
Redfish	0.299	0.186	0.182
	(0.194)	(0.162)	(0.162)
Roundnose grenadier	0.241	0.126	0.129
	(0.161)	(0.117)	(0.117)
Saithe	0.327**	0.251**	0.249**
	(0.159)	(0.115)	(0.115)
Sandeel	0.017	-0.059	-0.054
	(0.216)	(0.195)	(0.196)
Sole	0.549**	0.483**	0.483**
	(0.214)	(0.189)	(0.189)
Sprat	0.214	0.114	0.112
	(0.174)	(0.135)	(0.135)
Spurdog /dogfish	0.088	0.058	0.05
	(0.171)	(0.127)	(0.13)
Turbot and brill	0.326	0.259	0.258
	(0.243)	(0.218)	(0.218)
Tusk	-5.729***	-5.807***	-5.81***
	(0.199)	(0.176)	(0.177)
Whiting	0.896***	0.824***	0.823***
	(0.146)	(0.095)	(0.095)
Observations	1,936	1,936	1,936
Adjusted R^2	0.535	0.535	0.535

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses.

Appendix D: TAC and ICES advice for the five largest fish species

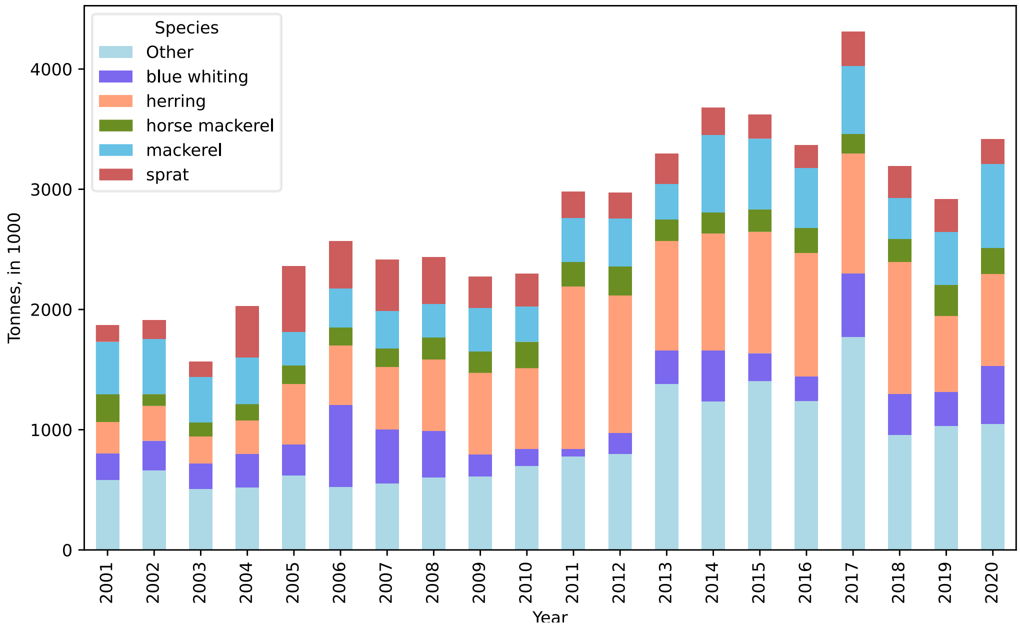

Figure 4: ICES advice by species and year

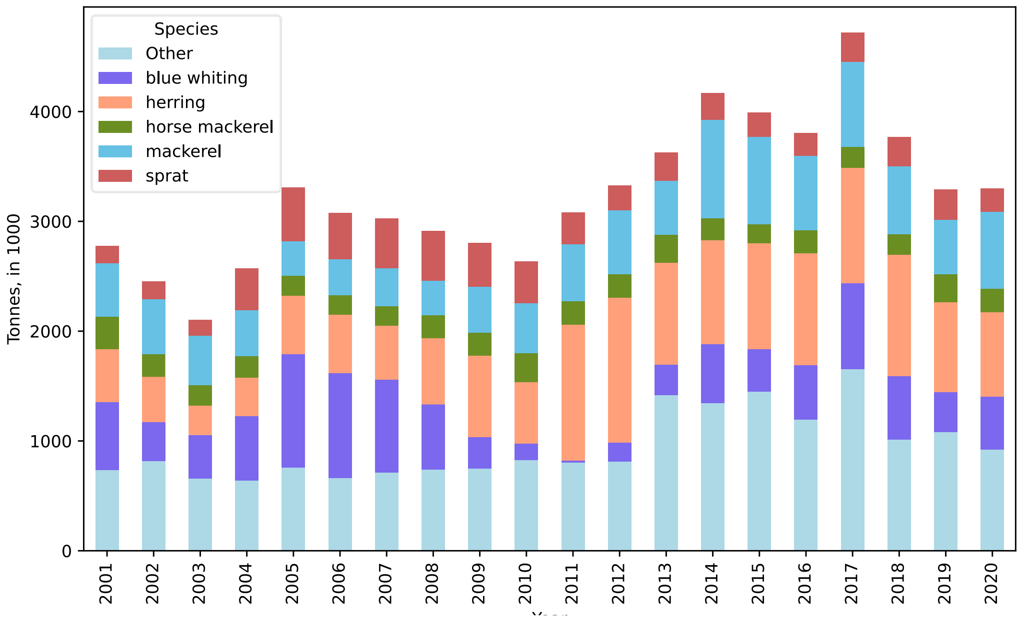

Figure 5: TAC by species and year

Appendix E: Other regressions

Table 13: OLS, r_{zst}

Explanatory variables	No grouping (1)	Grouping 2 (2)	Grouping 3 (3)
BEL	-0.018 (0.205)	-0.051 (0.206)	-0.049 (0.206)
DEU	-1.224*** (0.158)	-1.175*** (0.154)	-1.175*** (0.154)
DNK	0.242*** (0.052)	-	0.238*** (0.05)
ESP	0.345*** (0.067)	-	-
EST	-1.16 (1.392)	-	-
FIN	0.195 (0.165)	0.101 (0.151)	-
FRA	0.018 (0.058)	0.068 (0.057)	0.068 (0.057)
FRO	1.953* (1.626)	3.164* (1.634)	3.106* (1.635)
GBR	0.203*** (0.058)	0.214*** (0.058)	0.213*** (0.058)
IRL	0.535*** (0.088)	0.529*** (0.089)	0.53*** (0.089)
LTU	-4.552 (4.289)	-	-
LVA	1.142 (1.205)	-	-
NLD	0.191 (0.137)	0.196 (0.138)	0.191 (0.138)
NOR	0.172 (0.114)	0.161 (0.114)	0.168 (0.114)
POL	1.883** (0.758)	-	-
PRT	0.37*** (0.105)	-	-
SWE	0.064 (0.212)	-	-
EST + LVA	-	-0.211 (0.18)	-0.206 (0.18)
LTU + POL	-	0.99*** (0.332)	1.077*** (0.344)
ESP + PRT	-	0.551*** (0.1)	0.551*** (0.1)
SWE + DNK	-	0.218*** (0.044)	-
SWE + FIN	-	-	0.099 (0.107)
Year & Species Fixed Effects	No	No	No
Observations	1,936	1,936	1,936
Adjusted R^2	0.103	0.09	0.09

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weight for different countries in each agreement, the three-letter abbreviation shows which country the weight corresponds to. *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom, *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

Table 13: Year fixed-effects model, r_{zst}

Explanatory variables	No grouping (1)	Grouping 2 (2)	Grouping 3 (3)
BEL	0.167 (0.216)	-0.168 (0.211)	-0.165 (0.211)
DEU	-1.007*** (0.175)	-1.283*** (0.163)	-1.283*** (0.162)
DNK	0.492*** (0.092)	-	0.147** (0.071)
ESP	0.585*** (0.1)	-	-
EST	-0.886 (1.392)	-	-
FIN	0.449** (0.181)	0.018 (0.158)	-
FRA	0.271*** (0.096)	-0.038 (0.083)	-0.038 (0.083)
FRO	2.701* (1.635)	2.651 (1.647)	2.597 (1.648)
GBR	0.463*** (0.096)	0.127 (0.077)	0.126 (0.077)
IRL	0.756*** (0.116)	0.413*** (0.102)	0.415*** (0.102)
LTU	-4.939 (4.293)	-	-
LVA	1.392 (1.204)	-	-
NLD	0.453*** (0.157)	0.11 (0.148)	0.106 (0.148)
NOR	0.419*** (0.137)	0.068 (0.125)	0.074 (0.125)
POL	2.303*** (0.765)	-	-
PRT	0.642*** (0.131)	-	-
SWE	0.288 (0.224)	-	-
EST + LVA	-	-0.239 (0.181)	-0.233 (0.181)
LTU + POL	-	0.899*** (0.339)	0.987*** (0.351)
ESP + PRT	-	0.424*** (0.127)	0.425*** (0.127)
SWE + DNK	-	0.126* (0.067)	-
SWE + FIN	-	-	0.011 (0.118)
Year FE	Yes	Yes	Yes
Species FE	No	No	No

Observations	1,936	1,936	1,936
Adjusted R^2	0.108	0.091	0.092

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weight for different countries in each agreement, the three-letter abbreviation shows which country the weight corresponds to. *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom, *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

Table 12: Species fixed-effects model, r_{zst}

Explanatory variables	No grouping (1)	Grouping 2 (2)	Grouping 3 (3)
BEL	-0.3 (0.22)	-0.159 (0.188)	-0.16 (0.188)
DEU	-0.647*** (0.217)	-0.443** (0.179)	-0.435** (0.179)
DNK	-0.092 (0.134)	-	0.066 (0.065)
ESP	-0.184 (0.141)	-	-
EST	-1.559 (1.064)	-	-
FIN	-0.008 (0.192)	0.056 (0.145)	-
FRA	-0.204 (0.137)	-0.069 (0.076)	-0.07 (0.076)
FRO	2.185* (1.316)	2.444* (1.307)	2.431* (1.308)
GBR	-0.048 (0.136)	0.086 (0.07)	0.089 (0.07)
IRL	0.286* (0.148)	0.419*** (0.092)	0.422*** (0.093)
LTU	-4.485 (3.485)	-	-
LVA	1.295 (0.92)	-	-
NLD	-0.197 (0.178)	-0.076 (0.135)	-0.072 (0.136)
NOR	-0.249 (0.16)	-0.098 (0.108)	-0.097 (0.108)
POL	1.004* (0.583)	-	-
PRT	0.3** (0.141)	-	-
SWE	0.117 (0.224)	-	-
EST + LVA	-	-0.097 (0.142)	-0.088 (0.142)
LTU + POL	-	0.525* (0.292)	0.488 (0.302)
ESP + PRT	-	0.395*** (0.109)	0.395*** (0.109)
SWE + DNK	-	0.076 (0.062)	-
SWE + FIN	-	-	0.117 (0.116)

Year FE	No	No	No
Species FE	Yes	Yes	Yes
Observations	1,936	1,936	1,936
Adjusted R^2	0.534	0.533	0.533

Notes: ***, **, and * indicate significant p-values at the 1 %, 5 %, and 10 % level, respectively. Standard errors are presented in parentheses. The explanatory variables are the weight for different countries in each agreement, the three-letter abbreviation shows which country the weight corresponds to. *BEL* = Belgium, *DEU* = Germany, *DNK* = Denmark, *ESP* = Spain, *EST* = Estonia, *FIN* = Finland, *FRA* = France., *FRO* = Faroe Islands, *GBR* = United Kingdom, *IRL* = Ireland, *LTU* = Lithuania, *LVA* = Latvia, *NLD* = Netherlands, *NOR* = Norway, *POL* = Poland, *PRT* = Portugal, and *SWE* = Sweden.

Table 13: VIF, Grouping 1, different models

Country weight	OLS	Year FE	Species FE	Year & Species FE
BEL	1.13	1.26	2.51	2.55
DEU	1.18	1.46	4.34	4.41
DNK	1.24	3.94	15.89	16.91
ESP	1.18	2.66	10.13	10.72
FIN	1.12	1.38	3.04	3.14
FRA	1,21	3.38	13.08	13.87
FRO	1.16	1.18	1.46	1.49
GBR	1.22	3.34	13.13	13.95
IRL	1.14	2	6.16	6.47
NLD	1.13	1.5	3.68	3.82
NOR	1.18	1.72	4.46	4.7
PRT	1.14	1.79	3.96	4.24
SWE	1.66	1.87	3.56	3.62
EST + LVA	1.08	1.3	2.34	2.42
LTU + POL	1.46	1.54	2.35	2.41
Average	1.22	2.02	6.01	6.31

Note: The country weights, w_{csz} , are represented by the three-letter abbreviation according to ISO 3166 alpha 3, where BEL = Belgium, DEU = Germany, DNK = Denmark, ESP = Spain, EST = Estonia, FIN = Finland, FRA = France., FRO = the Faroe Islands, GBR = the United Kingdom, IRL = Ireland, LTU = Lithuania, LVA = Latvia, NLD = Netherlands, NOR = Norway, POL = Poland, PRT = Portugal, SWE = Sweden, EST + LVA = Estonia paired with Latvia, LTU + POL = Lithuania paired with Poland, ESP + PRT = Spain paired with Portugal, DNK + SWE = Denmark paired with Sweden, and FIN + SWE = Finland paired with Sweden.