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Effects of the EU's Carding System for IUU Fishing on Its Trading Partners

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ABSTRACT

Purpose: This study investigated the effects of the EU carding system for IUU fishing on its trading partners carded for illegal fishing practices, with the purpose of analyzing the extent to which the carding system affected trade between the EU and third countries identified and penalized for IUU fishing, and to identify factors influencing the likelihood of card removal.

Design/methodology/approach: The study used fishery and aquaculture trade data from 2004 to 2020 from the European Market Observatory for Fisheries and Aquaculture Products on 26 carded countries. Major analytic tools applied in this study include OLS, Panel Random Effect, Logit and Probit Models.

Findings: The study confirmed that being carded by the EU for IUU fishing significantly negatively impacted countries' fishery trade flows, especially in the case of red cards. Furthermore, increases in capture of wild fish and corruption reduced the likelihood of having the card removed.

Research limitations/implications: An important limitation of this study is that it did not account for the influence of other major industry players (such as Japan, USA, China) on the country's overall trade flows. Notwithstanding, it explored how certain variables reduced the likelihood of card removal, finding that countries with higher levels of corruption and fish capture were less likely to have their cards revoked, putting them at a further disadvantage. The findings are especially important in the context of the fishing industry which supports local economies in many developing countries that are usually the target of such coercive measures. Restricted trade flows are especially damaging to small-scale fishers who are often forgotten in the global fight against IUU fishing. This study brings attention to the carding system's potential for trade disruptions and future applications of this sanctioning mechanism should take this under advisement.

Originality/value: Studies of the EU carding system's produced effects remain scarce, with existing ones focusing either on individual countries or on the mechanism's general potential for curbing IUU fishing. Considering the global nature of the fishing industry and the harmful potential of the carding system for vulnerable coastal communities, this study attempted to achieve a broader and more in-depth understanding of the EU carding system's effects by examining all countries that were carded for IUU fishing from the enforcement of the IUU Regulation until 2020.

Keywords: IUU fishing, EU carding system, the IUU Regulation, fishery trade, sanctions

I. Introduction

Fish and fishery products are among the most traded food commodities in the world. The fishing sector is estimated to provide livelihoods for around 820

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million people worldwide, many of whom come from poor marginalized communities (FAO, 2022a). In 2020 alone, global fish production reached about 179 million tons, directly employing about 59 million people (UN, 2022). Developing countries are important actors on the market, with many having their fish exports outnumber all other agricultural products combined (Bellmann, Tipping & Sumaila, 2016). Yet according to FAO (2022b), 90% of assessed marine fish stocks are now fully exploited, overexploited or depleted. The decades-long privatization of fishing rights and commodification of marine resources, along with bad government policies, have resulted in fleet overcapacity and overfishing (Pinkerton & Davis, 2015; Parlee & Foley, 2022). This has not only harmed the marine environment and local fishing communities, but it also contributed to the practice of illegal, unreported and unregulated (IUU) fishing, particularly by large fleets in high seas (Delpuech, Migliaccio & Symes, 2022).

IUU fishing is a persistent and global problem that poses serious threats to the marine environment, coastal communities, ocean sustainability and human security. Not only does it contribute to further overfishing and destruction of marine habitats, it has severe negative effects on food security, especially in countries whose local economies depend on fishing for survival (Lindley, Percy & Techera, 2019; Rosello, 2020). The term encompasses various different violations: "illegal fishing" refers to fishing activities violating domestic or international law, "unreported fishing" refers to unreported or misreported fishing practices that violate domestic or international regulations, and "unregulated fishing" involves undermining the rules and measures of regional organizations managing shared marine resources (FAO, 2001).

Extant literature suggests that over 85% of global commercial stocks may be at risk of IUU fishing (Rosello, 2020). The economic cost of this illegal practice is very high, with studies showing global damage ranging between \$10 and \$23.5 billion annually (Agnew et al., 2009). Between 11 and 26 million tons of fish are caught illegally each year, representing at least 15% of world catches (European

Commission, 2019). Significant declines in catch due to overfishing, along with an increase in operating costs and a shortage of workers, have fostered grueling and exploitative working conditions and increased other illegal practices. IUU fishing is often connected to other types of labor and human rights violations and transnational organized crime, including migrant smuggling, slavery, drug trafficking, money laundering, and tax fraud (Lindley et al., 2019; Liliansa, 2020; Rosello, 2020; UN, 2022).

Various measures have been introduced to combat IUU fishing at both international and local levels. SDG targets 14.4 and 14.6 aim to end IUU fishing and eliminate harmful subsidies, and they have inspired governments, regional fisheries management organizations, intergovernmental organizations, and non-governmental organizations to take action (FAO, 2020). In 2009, the FAO Conference approved the *Agreement on Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing* (PSMA), aimed at preventing illegal catch from entering national and international markets (FAO, 2020).

More recently, the World Trade Organization has agreed to ban harmful subsidies to fishing vessels and operators caught engaging in illegal fishing practices (WTO, 2022). This marks a significant global shift in institutional commitment to solving this problem and it represents a historic achievement for the WTO since it is only the second agreement reached since the organization was founded, and the first to focus on the environment and meet an SDG target (ibid.). However, despite the progress achieved, many problems still persist due to poor coastal management, corruption, lack of regulation enforcement, insufficient monitoring, financial secrecy, and weak intergovernmental cooperation (Elvestad & Kvalvik, 2015; Lee, 2019; Daniels et al., 2022).

Port measures and market instruments have been introduced to address some of these issues (Elvestad & Kvalvik, 2015). Since around 36% of all fisheries' production is traded, market measures can prove very influential (Hosch, 2016). Key examples include catch certification schemes and trade restrictions (ibid.). As

one of the world's largest economies (accounting for 16% of global GDP), the EU majorly influences the global trading system (Eurostat, 2020). It employs both catch certification and trade restrictions. Catch certifications schemes work by reducing financial incentives for illegal products due to the difficulty in selling them (Hosch, 2016). Notwithstanding its potential, the EU's system is paper-based and does not operate a central data registry, and to date, evidence of its impact on trade has been scarce (ibid).

The EU's trade restrictions take the form of a carding system instituted by Council Regulation No. 1005/2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing (IUU Regulation).¹⁾ The IUU Regulation's purpose is to incentivize fish and aquaculture exporting countries to reduce IUU fishing in their waters (Sumaila, 2019). The Regulation entered into force in 2010, applying to all landings and transshipments of EU and third-country fishing vessels in EU ports, as well as all trade of marine fishery products to and from the EU (European Commission, 2021). It stipulates that the EU will issue formal warnings (yellow cards) to countries not cooperating in the fight against IUU fishing, either by not having appropriate policies or by failing to implement them (ibid.).

The EU Regulation applies to all fishing vessels—under any flag and in all maritime waters—engaging in IUU fishing. This includes activities in contravention with the conservation and management measures applicable in the area concerned, such as, *inter alia*, fishing without a license, fishing in a forbidden area, fishing during a closed season, using prohibited gear, not fulfilling reporting obligations, falsifying identity, or obstructing inspection (European Commission, 2021).

The yellow card initiates a formal dialogue between the EU and the carded country, in which the former seeks to provide assistance in addressing the identified problems. Although the card itself is not a trade restriction, its purpose is to act as an incentive to

spark regulation change. Should a country fail to address identified shortcomings, the EU will issue a red card that signifies a complete ban on fish imports from that country (EU IUU Fishing Coalition, 2022). Importantly, the red card also prevents EU vessels from operating in the carded country's waters, which can impact EU export figures because fish caught by an EU vessel outside EU waters are considered an export from that Member State to the country of landing (Popescu & Scholaert, 2021). The cards are removed once the country has made sufficient progress in addressing its identified shortcomings but can be reissued if IUU fishing practices are detected again (EU IUU Fishing Coalition, 2022).

The scheme's overall goal is to create long-lasting, positive changes in marine governance. In addition to economic pressure, the EU's mechanism puts social pressure on the carded country amid international stigma to change local practices and re-establish certain norms. This entails a focus on improving labor conditions and human rights through knowledge sourcing, discussions, and assistance, with the purpose of creating regulatory change (Kadfak & Linke, 2021). This means the EU exerts not just economic coercion, but also normative power, making the carding scheme a "powerful tool of socializing normative values" (ibid., p.7).

The use of economic coercion to elicit countries' compliance with certain demands is not new in international politics. Most literature on economic sanctions focuses on their effectiveness, with many authors arguing that they have no effect or can even produce negative consequences (Hufbauer, Schott & Elliott, 1990; Allen, 2005; Peksen, 2009; Anguelov, 2015; Choi, Kim & Oh, 2017). Moreover, sanctions appear to be more effective against democratic countries compared to authoritarian ones, where regimes can adapt more easily without political consequences, and sanctions have also proven to be more impactful when there are friendly relations in place (Allen, 2005).

Research on the EU carding scheme shows that it has had some positive impact on curbing IUU fishing in targeted countries (Kadfak & Linke, 2021;

1) The full text of the IUU Regulation can be found at <https://eur-lex.europa.eu/eli/reg/2008/1005/oj>

EU IUU Fishing Coalition, 2022). The greatest weakness identified so far is the lack of participation in the sanctions regime from other influential traders like Japan, the US, and China (Sumaila, 2019). Nonetheless, despite being in force for over a decade, studies of the EU carding system's produced effects remain scarce, with existing ones focusing either on individual countries or on the mechanism's general potential for curbing IUU fishing (Sumaila, 2019; Rogers, 2021; Kadfak & Linke, 2021; Wongrak et al., 2021; EU IUU Fishing Coalition, 2022). Moreover, the impact of the sanctions regime on small-scale fisheries is severely under-researched. Unlike large-scale fishing fleets that operate for profit alone, small-scale fisheries exist primarily to provide a livelihood for the local community (Pinkerton, 2017). They have already been negatively impacted by dominant neoliberal practices in the fishing industry which have placed them at a disadvantage, favoring industrial fleets (Pinkerton & Davis, 2015; Knott & Neis, 2017).

The uniform handling of IUU fishing practices on the global level has meant that small-scale fishers are now taking another heavy blow to their already vulnerable existence. As they fall outside the scope of reporting and regulatory frameworks reserved for industrial fleets, and usually come from developing countries with weaker regulation, small-scale fishers are often unable to comply with the imposed IUU requirements, despite fishing legally (Song et al., 2020; Cisneros-Montemayor et al., 2022). Additionally, since the WTO Agreement uses unspecific language around the subsidization of fisher incomes, beneficial subsidies that keep self-employed fishers alive during lean seasons are now also potentially under threat (Jarrett & Gilbert, 2020; Cisneros-Montemayor et al., 2022). For these reasons, it is important to analyze and fully understand the impacts of sanctions mechanisms on trade flows and what they mean for a country's economy, especially in the context of the fishing industry where more than half of the total global export value comes from developing countries (Bellmann et al., 2016).

To that end, this study attempted to achieve a broader and more in-depth understanding of the EU

carding mechanism by examining all countries that were carded for IUU fishing from the enforcement of the IUU Regulation until 2020. The purpose was to analyze the extent to which the carding system impacted trade between the EU and third countries identified and penalized for IUU fishing, and to identify factors influencing the likelihood of card removal, which would help revitalize local fishing communities. Although many studies of international trade have frequently applied gravity models in their analyses, this study purposefully avoided it because of the specificities of the fishing industry. Unlike other commodities, wild fish are not geographically confined to any single area, and industrial fleets extract their resources in high seas, thousands of miles away from national borders. Therefore, the size of countries and the distances between them have little impact on fish trade since everyone operates outside of their area most of the time, especially in the context of IUU fishing (Daniels et al., 2022). Moreover, fish products are regularly transshipped on high seas after capture, vessels can be registered in many different countries, and owners of large fleets are rarely tied to them geographically (or at all) (ibid.).

Instead, the study used the OLS regression model (under assumptions of parameter linearity, random sampling, absence of multicollinearity, and error homoskedasticity) to have the best possible unbiased estimators of real values. It also used the panel random effects model as a robustness check for the time series data. Finally, because it also wanted to check what factors kept the cards in place, the study employed logit and probit models, using card presence as an ordinal dependent variable. The next section provides further explanations of the used data and methodology, followed by the results of the analyses and their interpretation, with a discussion of potential implications and limitations in the conclusion.

II. Data and Methodology

The study analyzed panel data for the trade of fishery and aquaculture products between the EU and 26 countries carded for IUU fishing between 2004 (the last largest expansion of the EU) and 2020. The analyzed countries included Belize, Cambodia, Comoros, Curaçao, Ecuador, Fiji, Ghana, Guinea, Kiribati, Liberia, Panama, Papua New Guinea, the Philippines, the Republic of Korea, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Sierra Leone, the Solomon Islands, Sri Lanka, Taiwan, Thailand, Togo, Trinidad and Tobago, Tuvalu, Vanuatu, and Vietnam. Of the 26 countries, 10 have been unsuccessful in having their cards removed.²⁾ Table 1 displays descriptive statistics for the continuous variables (discrete variables are not included).

The main dependent variable was the total trade flow of fishery and aquaculture products (in kilograms) for each country. Data were obtained from the European Market Observatory for Fisheries and Aquaculture Products, a consolidated database of aggregated and harmonized data on fisheries and aquaculture trade supported by the European Commission.

The main independent variable was the EU card status obtained from the EU IUU Fishing Coalition

database. While all the countries analyzed were carded for IUU fishing at some point in time, the discrete variable used here indicated the country's card status as of 2020. Countries whose cards were removed (green) were marked with 1, countries with yellow cards were marked with 2, and countries with red cards were marked with 3. The analysis focused on the effects of card issuance, removal, or reissuance on countries' trade flows over time. The hypothesis was that being carded for IUU fishing would negatively affect the total trade flows of fishery and aquaculture products between a carded country and the EU.

Special attention was paid to this card issuance variable, and binary dummy variables were created as alternatives. The first approach was to divide this variable into being carded (yellow and red) or not carded (green).³⁾ This approach was used either as an alternative to the original variable or as a dependent variable in the follow-up analyses assessing the likelihood of being carded. The second approach was to create a series of dummy variables (green vs. non-green, yellow vs. non-yellow, and red vs. non-red) to identify any specific differences. These two alternatives tested the hypothesis of the carding system's negative impact on trade flows.

Other independent variables included GDP per capita (World Bank and IMF data); agriculture,

Table 1. Descriptive statistics for continuous variables

Variable	Obs	Mean	Std. dev.	Min	Max
Total trade flow in kg (log)	411	14.34656	3.848683	0	19.74413
GDP per capita (log)	442	8.041392	1.213294	5.585635	10.417
Agriculture, forestry and fishing as % of GDP	400	17.43818	14.45205	0.1550077	66.03273
Control of corruption (estimate)	425	-0.27905	0.591074	-1.31589	1.156046
Total fishery and aquaculture production in t (log)	435	11.93115	2.068125	6.474724	15.89951
Capture in t (log)	435	11.77296	1.879865	6.471635	15.05114

Notes: Variables marked with (log) are log-transformed. Agriculture was not log-transformed as it comprises percentages with small values.

2) At the time of writing, Cambodia, Comoros, Ecuador, Liberia, Panama, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Sierra Leone, Trinidad and Tobago, and Vietnam are still carded. Cameroon received a yellow card for the first time in 2021 but is not included in this study. Ghana was also reissued a yellow card in 2021, but this is not reflected here as the effects of these yellow cards cannot be measured properly yet.

3) Among the 26 countries, 10 are either yellow or red, and 16 are green, so, re-grouping the three categories into two (yellow + red vs. green) should be a natural breakdown, as well.

forestry and fishing as a value-added percentage of GDP (World Bank data); control of corruption estimates (World Bank data); total fishery and aquaculture production (in tons) including all quantities farmed, caught and landed for food and feed purposes but excluding discards (FAO's FishStatJ v4.02.04 data); capture (in tons) including all quantities caught and landed for food and feed purposes but excluding discards (FAO's FishStatJ v4.02.04 data); and global freedom scores (1 = free, 2 = partly free, 3 = not free) (Freedom House data).

It was expected that the GDP per capita variable would have a positive sign (countries with higher income would have higher trade flows). The rationale for using this variable was the fact that a country should be vulnerable to economic coercion for trade sanctions to be effective, as less developed countries tend to feel more pressure when trade bans are imposed on them (Allen, 2005). Second, the importance of the agricultural sector in a country's overall GDP was deemed relevant for assessing the impact of sanctions on the fishing industry. The expectation was that sanctions for fishing would be more effective when more revenue came from fishing (Rogers, 2021). Additionally, when agriculture accounted for a higher proportion of the GDP, this would negatively impact fishery trade because of the fishing industry's higher importance for the country, making this variable's expected sign negative. The index for control of corruption captured perceptions of the extent to which public power was exercised for private gain, which contributed to bad governance and less transparency. Similarly, the global freedom score was used as a proxy for the level of democracy (as this was proven difficult to measure), which was important because previous studies had showed that sanctions were more effective in democratic countries than in authoritarian ones (Allen, 2005).

Total fishery and aquaculture production included fish, crustaceans, mollusks, aquatic mammals, other aquatic animals, residues, and plants taken for commercial, industrial, recreational, and subsistence purposes from inland, brackish, and marine waters. Data included all quantities farmed (including from

mariculture), caught, and landed for both food and feed purposes but excluded discards. Similarly, total capture covered all quantities caught and landed from all waters, excluding farmed products and discards. Both datasets were used because regulating the capture of wild fish was seen as important for sustainability and environmental protection, and overfishing can have a permanent negative impact on both food security and marine habitats.⁴⁾

Finally, whether a country was party to FAO's Agreement on Port State Measures (1 = yes, 0 = no) was used as a dummy variable assuming that parties to the agreement would be more inclined to fight against IUU fishing. Taking all these variables into consideration, the following equation was formulated:

$$Y_{it} = \beta_0 + \beta_1(Card_i) + \beta_2(GDP\ per\ capita_{it}) + \beta_3(AGRI_{it}) + \beta_4(prod_{it}) + \beta_5(CAPT_{it}) + \beta_6(COR_{it}) + \beta_7(FREE_i) + \beta_8(PSMA_i) + \epsilon_{it} \quad (1)$$

where Y_{it} indicates the value of total trade flows in fishery products for country i in year t . Explanatory variables include $Card$ (the original variable, indicating green, yellow, and red cards, as well as its alternative binary dummy variables), the log value of *GDP per capita*, agriculture's proportion of GDP (*AGRI*), the log value of total fishery production (*PROD*), the log value of total capture (*CAPT*), corruption estimates (*COR*), freedom score (*FREE*), participation in the Agreement on Port State Measures (*PSMA*), and ϵ_{it} for residuals. The time-invariant variables do not have t in the subscript.

Moreover, the study focused on how some of these variables could affect the likelihood of card removal (getting a green card). Higher levels of corruption and less freedom, along with higher GDP per capita, should have decreased the likelihood of card removal because they offset the impact of economic sanctions, making it less likely that the country would submit

4) Overfishing here means overexploitation of fish stocks that are caught faster than they can reproduce.

to economic coercion. Given that a binary variable was used as a dependent variable, the following equation was analyzed based on logit and probit models, together with several control variables from the previous analyses.

$$\begin{aligned} Card_i = & \beta_0 + \beta_1(CAP_i) \\ & + \beta_2(GDP \text{ per capita}_{it}) + \beta_3(COR_{it}) \\ & + \beta_4(FREE_i) + \beta_5(PSMA_i) + \epsilon_{it} \quad (2) \end{aligned}$$

III. Results

Table 2 shows the OLS regression results. The hypothesis that being carded for IUU fishing would negatively impact fishery and aquaculture trade flows was supported by all models. For every unit of increase in card status, trade *decreased* between 1.8% and 2.5%, with results for this variable remaining consistently significant (Models 1-6), even when accounting for other variables that may have reduced the impact of being carded, such as higher GDP or lower significance of the agricultural sector for the country. As expected, the effect of GDP per capita was

Table 2. OLS regression model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Card	-2.457*** (0.215)	-2.226*** (0.241)	-2.169*** (0.224)	-1.785*** (0.225)	-1.781*** (0.230)	-1.842*** (0.206)			
GDP per cap (log)		0.543*** (0.113)	0.606*** (0.116)	0.231** (0.103)			0.748*** (0.120)		
Agriculture/ GDP		-0.025*** (0.009)	-0.092*** (0.013)	-0.050*** (0.012)	-0.052*** (0.012)	-0.046*** (0.011)	-0.096*** (0.014)	-0.057*** (0.013)	-0.054*** (0.011)
Corruption			-3.274*** (0.326)	-2.229*** (0.318)	-2.148*** (0.308)	-3.044*** (0.308)	-3.341*** (0.345)	-2.075*** (0.328)	-1.955*** (0.299)
Production (log)				4.771*** (0.728)	4.632*** (0.712)	4.484*** (0.692)		4.313*** (0.774)	3.153*** (0.609)
Capture (log)				-4.288*** (0.848)	-4.087*** (0.822)	-3.880*** (0.789)		-3.642*** (0.900)	-2.384*** (0.714)
Freedom restrict						-1.098*** (0.194)			
PSMA						1.886*** (0.441)			
Card (Binary)							-1.996*** (0.368)	-1.241*** (0.333)	
Yellow card									0.269 (0.261)
Red card									-4.733*** (0.427)
Constant	18.089*** (0.368)	13.863*** (1.078)	13.373*** (1.034)	8.752*** (1.462)	9.922*** (1.521)	9.255*** (1.495)	9.776*** (0.951)	6.311*** (1.567)	5.308*** (1.325)

Notes: ***, **, and * respectively denote significance levels at 1%, 5%, and 10%. The dependent variable is the log-transformed trade flow data for fishery and aquaculture products. Variables marked with (log) are log-transformed. The White heteroskedasticity-consistent standard errors are in parentheses. Models 7 to 9 use alternative variables for Card, as mentioned previously. Green card is dropped from Model 9 due to multicollinearity. Agriculture is measured as a percentage of GDP. Freedom restrict denotes a restriction of freedom.

significant and positive across models (2, 3, 4, and 7), indicating that for every 1% increase in GDP per capita, trade flows increased by 0.2% to 0.7%. This showed that development strengthened trade security, offsetting the impact of sanctions.

The results also supported the prediction that a higher proportion of GDP represented by the agricultural sector would entail a more negative impact if the country was carded for IUU fishing. Across models, the agriculture variable remained significant and negative: for every 1% increase in the proportion of national GDP represented by the agricultural sector, fishery trade decreased by 0.025% to 0.096%. Corruption and authoritarianism had a similar impact; for every unit of increase in corruption, trade decreased by 1.95% to 3.97% (Models 3-9), and for every unit of increase in freedom restrictions, trade decreased by more than 1% (Model 6). Finally, as shown in Model 6, whether a country had signed the Agreement on Port State Measures also had a significant impact, with trade increasing by 1.89% in participating countries.

The variables of total fishery production and capture presented an interesting case as they were both significant across the models, but with opposite impacts. For every unit of increase in total fishery and aquaculture production, trade increased by 3.15% to 4.77%, but trade decreased by 2.38% to 4.29% as capture amounts increased. This can be explained by the fact that total production included fish from farmed sources, while capture referred to the harvesting of wild resources that negatively impacted the marine environment, in turn negatively affecting trade patterns in the context of the IUU fishing regulation.

The last three columns of the table show the results of sensitivity tests used to confirm the robustness of the preliminary findings that the carding system works, effectively reducing trade flows from the carded countries. Models 7 and 8 show results based on the alternative binary dummy (carded vs. not carded), which were significant and negative (-1.996 and -1.241). Either a yellow or red card was effective in reducing trade flows with the EU. The last column, in which a series of dummy variables⁵⁾ assessed card

differences, contains an important finding: while the effect of yellow cards did not differ significantly from that of green ones, red cards significantly reduced trade flows. Moreover, the coefficients were -4.733, larger than any other ones (in absolute values) in the same category. Although receiving cards (either yellow or red) effectively reduced trade flows, red cards were particularly effective, suggesting that implementing punishment (red) conveyed a stronger signal in markets than a warning (yellow).

Table 3 shows the results based on the panel random effect analysis, which served as a robustness check. These results were basically consistent with the previous ones, and the carding variables' effects were significant and negative, reaffirming the hypothesis that the carding system would effectively reduce trade flows. Moreover, the last column suggests that red cards were particularly effective. Other variables' effects remained in the same direction. Although some lost significance, production and capture had a positive impact (2.48%-2.73%) and a negative impact (1.99-2.19%), respectively, confirming the previous findings. The agricultural sector's significance was also reaffirmed.

Lastly, logit and probit analyses (based on Equation 2) provided interesting additional insights, as shown in Table 4. A binary dummy variable of being carded or not was used as an alternative to measure the determinants of the likelihood of being carded. Following the previous analyses' logic, the focus was placed on specific variables potentially offsetting the impact of economic coercion and hindering the elimination of IUU fishing. For example, the study aimed to determine whether an increase in wild catch would decrease the likelihood of card removal. Strikingly, all models supported this prediction, with statistically significant effects. As another example, the study tested whether economic strength, as measured by GDP per capita, would reduce the importance of cards and thus prevent their removal. This variable's effect was not significant, however,

5) Green vs. non-green, yellow vs. non-yellow, and red vs. non-red with the "green" dummy as a default, which was automatically dropped from the analyses due to multicollinearity.

Table 3. Panel random effects model

	(1)	(2)	(3)	(4)
Card	-2.120** (0.849)	-1.877*** (0.669)		
Lag of agriculture		-0.026** (0.013)	-0.026** (0.013)	-0.025* (0.013)
Lag of corruption		0.192 (0.432)	0.179 (0.443)	0.027 (0.428)
Lag of production (log)		2.480*** (0.924)	2.653*** (0.985)	2.731*** (0.976)
Lag of capture (log)		-1.992** (0.944)	-2.143** (0.992)	-2.193** (1.005)
Freedom restrictions		0.837 (0.832)		
PSMA		1.771 (1.533)		
Card (Binary)			-1.083 (1.309)	
Yellow card				0.426 (1.230)
Red card				-4.690*** (0.955)
Constant	17.218*** (1.562)	8.437*** (2.684)	8.428*** (2.277)	8.038*** (2.114)

Notes: ***, **, and * respectively denote significance levels at 1%, 5%, and 10%. Fixed effects are not employed due to time-invariant variables. The dependent variable is the log-transformed trade flow data for fishery and aquaculture products. The White heteroskedasticity-consistent standard errors are in parentheses. Variables marked with (log) are log-transformed. Lag indicates values lagged by 1 year to avoid endogeneity issues.

Table 4. Logit and probit models

	Logit (1)	Logit (2)	Probit (1)	Probit (2)
Capture (log)	-0.203*** (0.058)	-0.438*** (0.067)	-0.125*** (0.035)	-0.273*** (0.040)
GDP per capita (log)	-0.075 (0.093)	0.156 (0.100)	-0.050 (0.056)	0.102* (0.061)
Corruption		-0.948*** (0.272)		-0.558*** (0.158)
Freedom restriction		-0.133 (0.217)		-0.049 (0.131)
PSMA		2.345*** (0.300)		1.435*** (0.170)
Constant	2.527*** (0.769)	1.631* (0.972)	1.583*** (0.483)	0.953* (0.568)

Notes: ***, **, and * respectively denote significance levels at 1%, 5%, and 10%. The dependent variable is the presence or absence of an EU card. Variables marked with (log) are log-transformed. PSMA is a dummy variable.

except in the second probit model. The corruption variable remained significant across all models, showing that corruption reduced the likelihood of card removal. Participation in the PSMA also had a positive, significant effect on the likelihood of card removal.

IV. Conclusion

The findings of this study suggest that the EU carding system has had a significant impact on the trade of fishery and aquaculture products with targeted countries. The results show a significant decrease in trade with countries that have received either a yellow or red card. The red card is especially important, as it signifies a complete ban on fishery trade and fishing activities by EU vessels in that country's waters, and of EU imports from vessels flagged to the carded country. This shows that market measures can be used to mitigate illegal activities in the fishing industry that impact not only the marine environment and sustainability but also labor practices and human rights issues. At the same time, despite a decrease in trade with the EU, many of these countries have not made efforts to improve their situation and remain carded for IUU fishing. For this reason, the study also explored how certain variables could have reduced the likelihood of card removal, finding that countries with higher levels of corruption and fish capture were less likely to have had their cards revoked.

An important limitation of this study is that it did not account for the influence of other major industry players (such as Japan, USA, China) on the country's overall trade flows, which could potentially explain the noticeable difference in efforts between countries to change their carding status. This aligns with Sumaila's (2019) argument, holding that until other major fish traders impose a similar sanction system, the EU's carding scheme alone will not be sufficient to completely deter illegal fishing practices. Notwithstanding these limitations, this study provides empirical grounds for the argument that trade

sanctions in themselves can produce the intended effect, if applied properly. The mere fact that some countries show a definite drop in trade flows just from EU restrictions alone, shows that even unilateral sanctions can have significant economic consequences. It is important to understand this potential, especially in light of the ever-increasing restrictive IUU fishing countermeasures that are being implemented globally. Their disruptive impact must be understood thoroughly because they have the potential not just to undermine IUU fishing but to simultaneously threaten the existence of the most vulnerable actors in the industry.

References

- Agnew, D. J., Pearce J., Pramod G., Peatman T., Watson R., Beddington J. R., & Pitcher, T. J. (2009). Estimating the Worldwide Extent of Illegal Fishing. *PLoS ONE*, 4(2), e4570. doi: 10.1371/journal.pone.0004570
- Allen, S. H. (2005). The Determinants of Economic Sanctions Success and Failure. *International Interactions*, 31(2), 117-138. doi: 10.1080/03050620590950097
- Angelov, N. (2015). *Economic Sanctions vs. Soft Power: Lessons from North Korea, Myanmar, and the Middle East*. New York: Palgrave Macmillan.
- Bellmann, C., Tipping, A., & Sumaila, R. (2016). Global trade in fish and fishery products: An overview. *Marine Policy*, 69, 181-188. doi: 10.1016/j.marpol.2015.12.019
- Cisneros-Montemayor, A., Sinan, H., Nguyen, T., Da Rocha, J., Sumaila, R., Skerritt, D., ..., Bailey, M. (2022). A constructive critique of the World Trade Organization draft agreement on harmful fisheries subsidies. *Marine Policy*, 135, 104872. doi: 10.1016/j.marpol.2021.104872
- Choi, J., Kim H., & Oh, J. (2017). Effectiveness of Economic Sanctions against North Korea and Role of China: Empirical Approach. *Global Business & Finance Review* 22(2), 8-15. doi: 10.17549/gbfr.2017.22.2.8
- Daniels, A., Kohonen M., Gutman N., & Thiam, M. (2022). *Fishy networks: Uncovering the companies and individuals behind illegal fishing globally*. Financial Transparency Coalition. <https://financialtransparency.org/wp-content/uploads/2022/10/FTC-fishy-Network-OCT-2022-Final.pdf>
- Delpeuch, C., Migliaccio, E., & Symes, W. (2022). Eliminating government support to illegal, unreported and unregulated fishing. *OECD Food, Agriculture and Fisheries Papers*, No. 178. Paris: OECD Publishing. doi: 10.1787/f09ab3a0-en
- Elvestad, C., & Kvalvik, I. (2015). Implementing the EU-IUU Regulation: Enhancing Flag State Performance Through

- Trade Measures. *Ocean Development & International Law*, 46(3), 241-255. doi: 10.1080/00908320.2015.1054745
- European Commission. (2019). *Commission lifts "yellow card" from Thailand for its actions against illegal fishing*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/IP_19_61
- European Commission. (2021). *Illegal, Unreported and Unregulated (IUU) fishing in general and in Cameroon*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_646
- EU IUU Fishing Coalition. (2022). *Driving improvements in fisheries governance globally: Impact of the EU IUU carding scheme on Belize, Guinea, Solomon Islands and Thailand*. Retrieved from <http://www.iuuwatch.eu/2022/03/driving-improvements-in-fisheries-governance-globally-impact-of-the-eu-iuu-carding-scheme-on-belize-guinea-solomon-islands-and-thailand/>
- Eurostat. (2020). *The 2017 results of the International Comparison Program: China, US and EU are the largest economies in the world*. Retrieved from https://ec.europa.eu/eurostat/documents/portlet_file_entry/2995521/2-19052020-BP-EN.pdf/bb14f7f9-fc26-8aa1-60d4-7c2b509dda8e
- Food and Agriculture Organization. (2001). *International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing*. Rome. Retrieved from <https://www.fao.org/documents/card/en/c/71be21c9-8406-5f66-ac68-1e74604464e7>
- Food and Agriculture Organization. (2020). *The State of the World Fisheries and Aquaculture 2020*. Rome: FAO Fisheries and Aquaculture Department. Retrieved from <https://www.fao.org/documents/card/en/c/ca9229en/>
- Food and Agriculture Organization. (2022a). *Fisheries and Aquaculture*. Retrieved from <https://www.fao.org/rural-employment/agricultural-sub-sectors/fisheries-and-aquaculture/en/>
- Food and Agriculture Organization. (2022b). *The State of World Fisheries and Aquaculture 2022*. Retrieved from <https://www.fao.org/publications/sofia/2022/en/>
- Hosch, G. (2016). *Trade Measures to Combat IUU Fishing: Comparative Analysis of Unilateral and Multilateral Approaches*. Geneva: International Centre for Trade and Sustainable Development. https://www.researchgate.net/publication/309013233_Trade_Measures_to_Combat_IUU_Fishing_Comparative_Analysis_of_Unilateral_and_Multilateral_Approaches
- Hufbauer, G., Schott, J., & Elliott, K. (1990). *Economic Sanctions Reconsidered: History and Current Policy*. Washington, DC: Institute for International Economics.
- Jarrett, I., & Gilbert, R. (2020). *Fisheries Subsidies Reform Could Reduce Overfishing and Illegal Fishing Case Studies Find*. The Pew Charitable Trusts. <https://www.pewtrusts.org/en/research-and-analysis/articles/2020/07/22/fisheries-subsidies-reform-could-reduce-overfishing-and-illegal-fishing-case-studies-find>
- Kadfak, A., & Linke, S. (2021). More than just a carding system: Labour implications of the EU's illegal, unreported and unregulated (IUU) fishing policy in Thailand. *Marine Policy*, 127, 104445. doi: 10.1016/j.marpol.2021.104445
- Knott, C., & Neis, B. (2017). Privatization, financialization and ocean grabbing in New Brunswick herring fisheries and salmon aquaculture. *Marine Policy*, 80, 10-18. doi: 10.1016/j.marpol.2016.10.022
- Lee, J. (2019). Subsidies for Illegal Activities?—Reframing IUU Fishing from the Law Enforcement Perspective. *Journal of International Economic Law*, 22(3), 417-438. doi: 10.1093/jiel/jgz017
- Liliansa, D. (2020). Market-Based Measures Against Illegal, Unreported and Unregulated Fishing in Indonesian Waters. In M.C. Ribeiro, F. L. Bastos, & T. Henriksen (Eds.), *Global Challenges and the Law of the Sea* (pp. 121-144). Springer Cham.
- Lindley, J., Percy, S., & Techera, E. (2019). Illegal fishing and Australian security. *Australian Journal of International Affairs*, 73(1), 82-99. doi: 10.1080/10357718.2018.1548561
- Parlee, C., & Foley, P. (2022). Neo-liberal or not? Creeping enclosures and openings in the making of fisheries governance. *Maritime Studies*, 21, 281-295. doi: 10.1007/s40152-021-00255-w
- Peksen, D. (2009). Better or Worse? The Effect of Economic Sanctions on Human Rights. *Journal of Peace Research*, 46(1), 59-77. doi: 10.1177/0022343308098404
- Pinkerton, E., & Davis, R. (2015). Neoliberalism and the politics of enclosure in North American small-scale fisheries. *Marine Policy*, 61, 303-312. doi: 10.1016/j.marpol.2015.03.025
- Pinkerton, E. (2017). Hegemony and resistance: Disturbing patterns and hopeful signs in the impact of neoliberal policies on small-scale fisheries around the world. *Marine Policy*, 80, 1-9. doi: 10.1016/j.marpol.2016.11.012
- Popescu, I., & Scholaert, F. (2021). EU-UK relations in fisheries. European Parliamentary Research Service. [https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689341/EPRS_IDA\(2021\)689341_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/689341/EPRS_IDA(2021)689341_EN.pdf)
- Rogers, K. (2021). *Examining the impact of the European Union's carding scheme to combat Illegal, Unreported, and Unregulated fishing on the Republic of Panama's seafood trade*. UC San Diego Capstone Project. <https://escholarship.org/uc/item/18m2394g>
- Rosello, M. (2020). Illegal, Unreported and Unregulated (IUU) Fishing as a Maritime Security Concern. In L. Otto (Ed.), *Global Challenges in Maritime Security* (pp. 33-47). Springer Cham.
- Song, A., Scholtens, J., Barclay, K., Bush, S., Fabinyi, M., Adhuri, D., & Haughton, M. (2020). Collateral damage? Small-scale fisheries in the global fight against IUU fishing. *Fish and Fisheries*, 21, 831-843. doi: 10.1111/faf.12462
- Sumaila, U. R. (2019). A Carding System as an Approach to Increasing the Economic Risk of Engaging in IUU Fishing? *Frontiers in Marine Science*, 6(34), 1-9. doi: 10.3389/fmars.2019.00034
- United Nations. (2022). Interactive dialogue 4: Making fisheries sustainable and providing access for small-scale artisanal

- fishers to marine resources and markets. *Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development*. https://sdgs.un.org/sites/default/files/2022-05/ID_4_Fisheries.pdf
- Wongrak, G., Hur, N., Pyo, I., & Kim, J. (2021). The Impact of the EU IUU Regulation on the Sustainability of the Thai Fishing Industry. *Sustainability*, 13(12), 6814. doi: 10.3390/su13126814
- World Trade Organization. (2022). Implementing the WTO Agreement on Fisheries Subsidies. Retrieved from https://www.wto.org/english/res_e/booksp_e/implementfishagreement22_e.pdf