Do Service-oriented Seafood Products Hinder Export Performance? An Insight from Namibia

Ruth Eegunjobi[†]

Abstract

The role of service-oriented seafood products on the export performance of seafood exporting countries is unclear. According to previous studies, the negative or positive effects of service-oriented seafood products on export performance can be attributed to an increase in unprocessed seafood products or increased demand for value addition. This study investigates the implications of service-oriented seafood products on Namibia's seafood export performance and trade potential. The study employed the gravity model of trade estimated with the Eicker-White robust covariance (PPML) technique on aggregated seafood export data from Namibia to 29 trading partners from 2001 to 2019 and further estimated Namibia's processed seafood trade potential. This study's findings indicate that Namibia's comparative advantage in seafood export processing boosts export performance despite trade costs, and that consumer preference for service-oriented seafood products enhances export flow. In addition, the study reveals that while Namibia's trade potential with most African trading partners has been exhausted, trade potential exists with its European trading partners and can be used to guide future trade expansion policy.

Keywords: Comparative advantage; gravity model; international trade; Namibia; Poisson Pseudo-Maximum Likelihood (PPML); seafood exports; trade potential.

JEL Classifications Codes: Q22; Q27.

[†] Department of Economics. The International University of Management Windhoek, Namibia. email: r.eegunjobi@ium.edu.na

1 Introduction

The impact of observable trade costs on export performance is becoming less significant due to declines in the costs of communication and transportation brought about by globalisation and technological advancements (Liu *et al*., 2021). At the same time, the impact of unobserved trade costs is becoming more significant. It has been argued that unobserved trade costs might explain the limitations to export performance in international trade (Deardorff, 2014; Obstfeld and Rogoff, 2000). As an important unobserved trade cost, consumer preference could determine export performance. Consequently, it is essential to concentrate on service-oriented products that satisfy consumer preferences, thereby enhancing export outcomes in global markets. Therefore, the main objective of this study is to investigate the effect of service-oriented seafood products on Namibia's seafood export performance and trade potential. In the seafood trade literature, studies on the determinants of export performance, including the impact of unobserved trade costs, has garnered increasing attention (Cardoso *et al.,* 2013; Shaw and Clarke, 1998; Yousuf *et al.*, 2019). In Namibia and other developing countries, an important unobserved trade cost limiting export performance is consumer seafood preferences (Uddin *et al.*, 2019). Therefore, there is constant pressure on seafood-exporting countries to export service-oriented seafood.

The quest to enhance gains from the seafood trade has given rise to a new line of research focused on consumer preference (Del Giudice *et al.*, 2018; Fabinyi, 2016; Naabi and Bose, 2020; Zander and Feucht, 2018). These studies can be classified into two major themes: (1) Market strategy (by creating awareness to stimulate import demand) and (2) Industrial characteristics (through export processing) (Seung, 2022; Viet *et al.,* 2017). Research on these themes has focused on relative prices and institutions in different contexts rather than on how consumer preference empirically influences export performance and trade potential, thereby limiting the role and importance of industrial upgrading on seafood export performance in global markets. Methodologically, these studies have mostly used value chain analysis and exploratory factor analysis, which have been found to be inefficient in dealing with the impact of service orientated seafood products or consumer preference on export performance. In addition, previous research neglected the study of processed products, thus, insufficiently revealing the influence of industrial upgrading strategies. Furthermore, there is little empirical evidence on the impact of import market consumer preferences on the export performance of processed seafood from seafood dependent developing countries (Zhang and Tveterås, 2019). Therefore, it is essential to investigate the impact of service-oriented seafood products (thereafter processed seafood) on exports in relation to consumer preference to understand the drivers of processed seafood exports. Investigating the link between processed seafood products and consumer preference would enable an understanding of the importance of value addition seafood exports from developing countries.

In recent decades, Namibia has committed to industrial upgrading in the seafood sector. Attempts to enhance the export competitiveness of the sector has led to a decrease in unprocessed seafood as classified under the Harmonised System (HS) under the four-digit exports such as: live fish (0301), fresh whole fish (0302), and frozen whole fish (0303), from 68.2% in 2001 to 20.3% in 2019, a decline of 70.2% over the period (NSA, 2021). However, over the same period, the export of advanced seafood manufactured products such as: chilled or frozen hake fillets (0304); cured and smoked fish and fish meal (0305), prepared and preserved fish (1604), increased by 24.3 %, from 5.6 % to 7.4 %. The changing import market preferences underscores the need to investigate the role of processed seafood in determining export performance and trade potential, thereby

enhancing Namibia's export competitiveness in global markets (Shamshak *et al.*, 2019). To the best of my knowledge, this study is the first to empirically investigate the impact of changing consumer preferences for processed seafood on the export performance and trade potential of Namibia's seafood exports. Therefore, this study provides a better understanding of consumer demand and Namibia's seafood export potential.

In light of the gaps mentioned, this study examines the impact of processed seafood products on Namibia's seafood export performance and trade potential using a panel dataset spanning 2001 to 2019 on product-level export data to 29 countries in a gravity model. In order to incorporate the Multilateral Trade Resistance (MTR), control for endogeneity and missing trade data, the study uses the Eicker-White robust covariance PPML estimation technique. Furthermore, it includes econometric specifications of the gravity model, specifically multilateral trade resistances and country fixed effects, in estimating trade potential, thereby eliminating estimation bias. This study aims to address two main questions: (i) Would service-oriented seafood products enhance export performance of processed seafood exports? and (ii) Do unprocessed seafood products limit the export performance of consumer service-oriented seafood exports? Answering these questions will contribute to the scant extant literature associated with processed seafood and the link between industrial upgrading and consumer seafood preferences, thereby providing relevant information for policymakers in the seafood export sector of developing countries.

This study proceeds as follows: the next section reviews relevant literature on service-oriented seafood in international trade. The third section presents the research methodology and data. This information is followed by the presentation of the empirical results and discussion in the fourth and fifth sections. The sixth section provides the conclusion and policy recommendations.

2. Literature review

2.1 Theoretical Literature

The theoretical literature on international trade postulates that factor endowments determine export performance. According to the Richardo and Heckscher–Ohlin (HO) trade theory, a positive relationship exists between factor endowments – specifically labour and capital and productive efficiency – technology and export performance. This finding implies that relatively available resource endowments and productive efficiency lead to specialisation and export performance. Furthermore, the theory posits that a country will export goods for which it has a comparative advantage and import goods for which it has a relative disadvantage (Leamer, 1996). Developing countries' dependency on factor endowments can lead to a resource 'curse'. In other words, abundant natural resources are likely to prompt exports with little to no value addition. Similarly, defying technological enhancements and industrial upgrading might limit export sophistication and diversification, particularly in developing countries. For instance, low manufacturing value-added might result in import substitution, thereby limiting export performance and competitiveness (Johnson, 2014).

2.2 Related Empirical Studies

The importance of consumer preference as a significant unobserved trade cost affecting export performance in the international seafood trade is well documented in the seafood trade literature. Several approaches have been used to measure the effect of meeting consumer preference through

value addition on export performance. For example, Natale *et al.* (2015) used primary production, food consumption, income and Gross domestic Product (GDP) to explore the effect of value addition on global seafood trade. The study found that weak production capabilities, particularly in developing countries, led to inadequate value addition which failed to satisfy customer preferences, thereby encouraging trade for reprocessing. Glavee-Geo and Engelseth (2018) examined the role of relationships on the global exports of Norwegian seafood products. This study finds that processed seafood exports are characterised by buyer-seller relationships and value exchange which transcend transactional approaches to improve export performance.

Other studies (Xie and Zhang, 2017; Zhang and Tveterås, 2019) have employed measures such as the European Union's (EU) Generalised Scheme of Preferences (GSP) to explain the relationship between importer preference and seafood export performance. For example, Zhang and Tveteras (2019) employed duration analysis to examine the export performance of seafood products from developing countries to the EU. The study finds that the GSP scheme enhanced the trade duration for processed seafood products but not unprocessed products. However, this time-invariant[1] approach to enhance market access of seafood exports from developing countries to the EU has been criticised for inherent drawbacks, such as the imposition of limits on export volumes and the inability to estimate a county's export performance in a specific product over time. Thus, a quantifiable time-variant measure of consumer preference on export performance and potential is desirable.

Several studies have highlighted two channels through which value addition can affect export performance: non-trade costs and consumer preference. With regard to the first channel of non-trade cost, Sandaruwan *et al*. (2020) investigated the effects of Non-Tariff Measures on Seafood Exports from Sri Lanka. By using a gravity model of trade, they found that Sanitary and Phytosanitary Measures (SPS), Technical Barriers to Trade (TBT) and Pre-shipment Inspections (PSI) limit export performance. Al-Busaidi *et al.* (2017) used Hazard Analysis and Critical Control Points (HCCP) data to verify the level of implementation of seafood safety and quality requirements of seafood exporters from Oman. Their results suggest that non-compliance constrains trade flows even with pre-requisite programmes in place. Anderson *et al.* (2018) found similar results from their investigation of inadequate seafood commoditisation on global export flows. Martínez-Zarzoso and KAreem (2020) found that Africa's seafood exports are more related to quality and importer preferences than regulatory standards. In contrast to value addition to seafood exports, unprocessed seafood incurs lower costs, reducing processed seafood export performance (Yang *et al.,* 2020). However, Johansen *et al.* (2019) indicated that value addition creates opportunities for employment and specialisation, which positively influences gains from trade. The findings from these studies imply that while compliance and commoditisation enhance processed seafood products' export performance, lower non-trade costs for unprocessed products limit the export performance of processed seafood.

Regarding the second channel, by which importer preference affects export performance, Carlucci *et al*. (2015) assessed consumer purchasing behaviour towards seafood products in a review of 49 studies from developed countries. This review indicated that the degree of export processing reflects consumer preference for healthy, high-quality and 'fresh-like' products, leading to a higher willingness to pay, thereby improving export performance. However, Esmaeilian *et al.* (2021)

[1] Does not change over time

found that high levels of processing could lead to a loss of nutritional value and naturalness, leading to a decline in demand. Consequently, a preference for mildly processed seafood with good shelf-life enhances import demand. In line with these results, Dey *et al.* (2008) found a negative impact on exports resulting from the preference for unprocessed frozen seafood in Asian markets. Therefore, the effect of processed seafood on export performance is contingent on whether demand for unprocessed or processed seafood through non-trade costs or importer preference prevails. Changing import preferences towards processed seafood and a plethora of processing technologies leaves room for further discussions. Teweldemedhin and Chiripanhura (2015) found that export opportunities for Namibia's seafood exports exist in global markets, therefore, the need to prioritise consumer preferences and infrastructure upgrading efforts.

Industrial upgrading in the seafood processing sector is essential for meeting consumer seafood preferences. The more the industrial sector seeks to enhance manufacturing skills from simple to more complicated tasks, the more likely the industry can increase its share of value-added exports and economic growth (Gereffi, 1999; Pietrobelli and Rabellotti, 2006). Of central interest to this study is the role of industrial upgrading in determining comparative advantage. Comparative advantage is the ability to produce a specific product or service at a lower cost than trading partners and is regarded widely as the main factor underlying international trade flows between countries. In the trade literature, a distinction has been made between the sources of comparative advantage. Classical economists consider an abundance of factor endowments, specifically labour and capital, while the neoclassicals place greater importance on specialisation and technology because of its ability to exploit international differences (Salvatore, 2013). The Revealed Comparative advantage (RCA) approach has been criticised because of a lack of consensus on the appropriate way to calculate the RCA index and the inability to differentiate between factors influencing trade flows (Leromain and Orefice, 2014). Nonetheless, the RCA enables a better understanding of the impact of the industrial upgrading initiatives on export performance in the Namibia seafood industry.

In terms of methodology, extant studies from Namibia and other developing countries (Bose *et al.*, 2019; Khan *et al.*, 2022; Nisar *et al.*, 2020; Teweldemedhin and Chiripanhura, 2015, 2016; Yousuf, 2019) have not used an econometric approach to investigate the effect of export processing as a comparative advantage and consumer preference on export performance and trade potential. Against this background, this study extends the current body of knowledge by revealing the importance of consumer preference, non-trade costs, comparative advantage and export processing from a trade perspective of a seafood export-dependent country facing changing consumer demands in global markets.

3. Methodology

3.1 Variables and data sources

In this study, the choice of variables is motivated by the need to assess the sensitivity of consumer preference for processed seafood to seafood trade flows. The gravity model of trade (Natale *et al.*, 2015; Asche *et al.*, 2020) is estimated to investigate the relationship between the variables of interest (i.e. bilateral distance, economic potential, language, RCA and congruity) at country-by-country data. This is because the gravity model approach takes into account the heterogeneous nature of panel data. The export competitiveness of a country in exporting a certain good or service requires an estimation of RCA index, which determines a country's relative advantage or disadvantage in exporting a certain class of goods (Ketels, 2010). Therefore, the need to estimate

the RCA index becomes a paramount issue. Estimations were conducted with a panel of 29 seafood-importing countries from 2001 to 2019, as displayed in Table A.1 of the appendix to this study. The choice of the dataset covers the period of industrial upgrading in the industry and includes products that have undergone a level of export processing. Export data was aggregated at the 6-digit Harmonised System (HS) codes (see Table A.5 of the appendix). The choice of countries is limited to the availability of export data.

Table 1:Variable description and data source

Variables	Description	Proxy	Data Source
X_{ijt}	Exports expressed in millions of US$ at current prices from country *i* to *j*	Exports of processed seafood	WDI, 2020
Y_{it}, Y_{jt}	Real GDP in millions of US$ of exporter and importer at time *t*	GDP	WDI, 2020
D_{ij}	Bilateral distance between exporter *i* and importer country *j* capitals	Distance	CEPII, 2020
Lan_{ij}	Dummy variable. Takes the value of 1 if exporter shares same official language with importer and 0 otherwise.	Common language	Computed from CEPII,2020
Cst_{ij}	Dummy variable. Takes the value of 1 if importer has a coastline and 0 otherwise	Common coastline	Computed from CEPII, 2020
RCA_{ij}	Dummy variable. Takes the value of 1 if the exporter has a comparative advantage and 0 otherwise.	Revealed comparative advantage index	Computed from ITC, 2020
PRF_{ij}	Dummy variable. Takes the value of 1 if importer prefers unprocessed seafood and 0 otherwise.	Importer's preference	Computed from ITC, 2020
XD_{iz}	To control for the MRT	Exporter -time dummy	Computed from WDI, 2020
ID_{it}	To control for the MRT	Importer -time dummy	Computed from WDI, 2020

Note: (CEPII) Centre d'Etudes Prospectives et d'Informations Internationales database (http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele.asp); WDI (World development indicators World Bank); (https://databank.worldbank.org/source/world-development-indicators); ITC (International Trade Centre trade statistics database) (https://www.trademap.org).

Comparative advantage is measured by assessing the share of processed seafood exports to total global exports in importing markets. A dummy variable is used to represent countries wherein Namibia has a comparative advantage. The list of seafood exporting countries considered in estimating the RCA index is displayed in Table A.2 of the appendix. A summary of the dataset, including the variables, sources, and descriptions, is displayed in Table 1.

3.2 Capturing the revealed comparative advantage

To capture Namibia's relative trade performance and export competitiveness of processed seafood exports in import markets, the RCA index was computed. The RCA measures an individual country's relative trade performance for a particular product and is defined as the ratio of a country's exports of a specific product to its total exports relative to the ratio of exports by exporters of the same product in total exports of exporting countries. Thus, the RCA measures a country's comparative advantage or disadvantage in exporting a commodity. The RCA index is expressed in Equation (1) as:

$$RCA_{ijt} = \frac{Z_{ijt}}{Z_{it}} \Big/ \frac{Z_{wj}}{Z_w} \quad (1)$$

where Z_{ijt} represents Namibia's export volume of processed seafood j[2] at time t and Z_{it} is the total export value of Namibia at time t. The total export value of processed seafood j from the nine exporting countries is expressed as Z_{wj} while Z_w is the total export flow of the nine exporting countries of product j at time t. Since the result cannot be compared on both sides of 1, the index is made symmetric as follows:

$$\frac{(RCA_{ijt}+1)}{(RCA_{ijt}-1)} \quad (2)$$

This calculation ensures that the value ranges between -1 to +1. If $RCA_{ijt} > 0$, Namibia has a comparative advantage in the export of processed seafood among the exporting countries. In contrast, if $RCA_{ijt} < 0$, a comparative disadvantage exists. Equation (2) is the Revealed Symmetric Comparative Advantage (RSCA) index.

3.3 Empirical model specification

Based on the gravity model framework proposed by Anderson and Van Wincoop (2003) and the PPML estimation approach of Santos and Tenreyro (2006), the predicted trade values were estimated. The gravity model predicts that exports of a product r from country i (exporter) to country j (importer) at time t positively relates to the country's economic levels (Y_{it} and Y_{jt}) and negatively with the geographical distance (D_{ij}) between them. This concept can be expressed as:

$$X_{ijrt} = \alpha_0 {Y_{it}}^{\alpha 1} {Y_{jt}}^{\alpha 2} {D_{ij}}^{\gamma} \quad (3)$$

By taking the natural logarithm and augmenting Equation (3) with Lan_{ij}, a dummy variable for a common language, and (Cst_{ij}), a dummy variable for the presence of a coastline, the linear form of Equation (3) yields:

$$\ln(X_{ijrt}) = \alpha_0 + \alpha_1 \ln(Y_{it}) + \alpha_2 \ln(Y_{jt}) + \alpha_3 \ln(D_{ij}) + \alpha_4 Lan_{ij} + \alpha_5 Cst_{ij} + \varepsilon_{ijt} \quad (4)$$

[2] Processed seafood according to the product classifications obtained from (https://www.trademap.org). Processed seafood export volume is the sum of all product classifications exported. Product classifications list in appendix.

Where lnX_{ijrt} is the natural logarithm of exports and α_0 is the intercept. α_1 to α_5 represents the parameters to be estimated while ε_{ijt} is the error term. Given the growing importance of processed seafood on export performance, the RSCA index between trading partners *i* and *j* at time *t* (RCA_{ijt}) was incorporated. This augmentation yields Equation (5) as follows:

$$\ln(X_{ijrt}) = \alpha_0 + \alpha_1 \ln(Y_{it}) + \alpha_2 \ln(Y_{jt}) + \alpha_3 \ln(D_{ij}) + \alpha_4 Lan_{ij} + \alpha_5 Cst_{ij} + \alpha_6 RCA_{ijt} + \varepsilon_{ijt} \quad (5)$$

Shamshak *et al.* (2019) suggest a linear relationship exists between consumer preferences and export performance. To capture the preference for processed seafood, Equation (5) is augmented with Prf_{ij} , a dummy variable taking the value of 1 if unprocessed seafood dominates imports and 0 otherwise. These transactions result in Equation (6):

$$\ln(X_{ijt}) = \alpha + \alpha_1 \ln(Y_{it}) + \alpha_2 \ln(Y_{jt}) + \alpha_3 \ln(D_{ij}) + \alpha_4 Lan_{ij} + \alpha_5 Cst_{ij} + \alpha_6 RCA_{ijt} + \alpha_7 Prf_{ij} + \varepsilon_{ij} \quad (6)$$

There is a need to control for unobserved trade barriers that cause trade friction between trading partners and unobserved heterogeneity. In controlling for the MTR in panel data, Olivero and Yotov (2012) suggest the inclusion of exporter and importer time-fixed effects. Furthermore, Fally (2015) shows that the inclusion of exporter and importer time-fixed effects in PPML estimation is theory consistent. Based upon the work of Olivero and Yotov (2012), Equation (6) was augmented with time-varying exporter and importer fixed effects to control for the MTR as follows:

$$X_{ijt} = \alpha_0 + \alpha_1 \ln(Y_{it}) + \alpha_2 \ln(Y_{jt}) + \alpha_3 \ln(D_{ij}) + \alpha_4 Lan_{ij} + \alpha_5 Cst_{ij} + \alpha_6 RCA_{ijt} + \alpha_7 Prf_{ij} + \theta_z XD_{it} + \tau_t ID_{jt} + \mu_{ij} + \epsilon_{ij} + \epsilon_{ijt} \quad (7)$$

In Equation (7), θ_z and τ_t are the coefficients of exporter-importer time effect dummies and ϵ_{ijt} is the error term. Equation (7) is estimated using the PPML approach because it addresses omitted or missing data values that could bias estimates (Santos and Tenreyro, 2006). Additionally, it is preferred to the Ordinary Least Squares (OLS) estimator to control for heteroskedasticity inherent in trade data (MartíŔnez-Zarzoso, 2013). Moreover, the PPML estimator includes MTR to account for unobserved country effects and control for endogeneity among the explanatory variables.

3.4 Estimation strategy

Research on the determinants of export performance has accentuated trade costs and consumer preference as channels through which the export performance of seafood products are determined (Seung, 2022; Zhang and Tveterås, 2019). To estimate the effect of processed seafood on export performance and to capture the channel of trade costs, this study uses the gravity model of international trade (Anderson and Van Wincoop, 2003). This study uses processed seafood exports from Namibia as the consumer preference measure for exports and the RCA index to identify Namibia's comparative advantage or disadvantage through which export processing can affect export performance.

The estimation strategy involves three steps. First, Namibia's comparative advantage in processed seafood export is captured using the RCA index. This index reflects the relative disadvantage or

advantage of a country's product export, as evidenced by trade flows. The second step consists of controlling for the MTR with country-pair fixed effects and importer-exporter time fixed effects. Furthermore, the study used various methods for robustness checks, including the ordinary least squares (OLS). In line with Fally (2015), the inclusion of country-pair fixed and importer-exporter time fixed effects was proxied by dummies controls for the MTR and endogeneity related to trade data. In the third step, the predicted coefficients obtained from the gravity model are compared with actual trade values in 2019 to determine the trade potential of processed seafood exports for Namibia with each of its 29 trading partners. The trade potential as the ratio of predicted to actual trade flows is specified in Equation (8):

$$EP_{NAM,i,j,2019} = \left(\hat{E}_{NAM} \Big/ E_{NAM,2019}\right) \quad (8)$$

Where $\hat{E}$ is the estimated trade value for Namibia and E the actual trade flow. If trade potential ($EP_{NAM,i,j}$) is >1 there exists a trade potential indicating export flow can increase. On the other hand, if ($EP_{NAM,i,j}$) is < 1, trade potential has been achieved, and export flows can be improved by changing other aspects of the economy.

4. Results

4.1 Descriptive statistics

This study highlights an increase in processed seafood exports over the study period. As presented in Table A.1 of the appendix, the sample consists of sixteen high-income countries and 13 low-income countries in the sample of 29 importing countries. In Table 2, the difference between the mean importer GDP (US$23 970 million) and exporter of GDP (US$22 890 million) demonstrates the well-established preferences for processed seafood by high-income countries. Furthermore, Namibia's GDP is higher than the 13 low-income countries, indicating a capacity to export. The minimum and maximum importer values of US$ 13 800 and US$30 690 million, respectively, indicate a wide variability among the seafood importers.

Table 2: Descriptive statistics

Variable	Mean	Minimum	Maximum	Standard deviation	Observations
X_{ijt}	16.29	13.71	18.08	0.77	522
Y_{it}	22.89	21.90	23.32	2.43	551
Y_{jt}	23.97	13.80	30.69	0.42	551
D_{ij}	8.34	6.83	9.42	0.76	551
Lan_{ij}	0.48	0	1	0.50	551
Cst_{ij}	0.86	0	1	0.34	551
Prf_{ij}	0.93	0	1	0.25	551
RCA_{ijt}	0.96	0	1	0.18	551

Source: Author computations.

4.2: Revealed comparative advantage and export performance

After having presented the variability between high and low-income importers in section 2.4.1, the export competitiveness of the main seafood exporting countries between 2001 and 2019 is estimated using the RSCA index (hereafter RCA). The Statista database identifies leading exporting countries of fish and fishery products worldwide[3]. The countries are presented in Table A.2 of the appendix and together, these countries represent approximately 88% of the world fish and fishery products. The results are shown in Table 3. The results reveal that over the study period (2001 to 2019), all the countries experienced a rise in the RCA index with values greater than 0. India and Thailand, on the other hand, had declining trends in their export competitiveness. However, while the EU and Norway have the highest export competitiveness in recent years, Namibia's comparative advantage is much higher in comparison to most developing countries.

Figure 1 depicts the ratio of Namibia's processed exports to total exports from 2001 to 2019. A visual inspection indicates an increase in the ratio from 0.18% to 0.48% during this period. However, the ratio peaked in 2010, followed by sharp declines in 2012 and 2014 as processed seafood export revenue declined.

[3] (https://www.statista.com/)

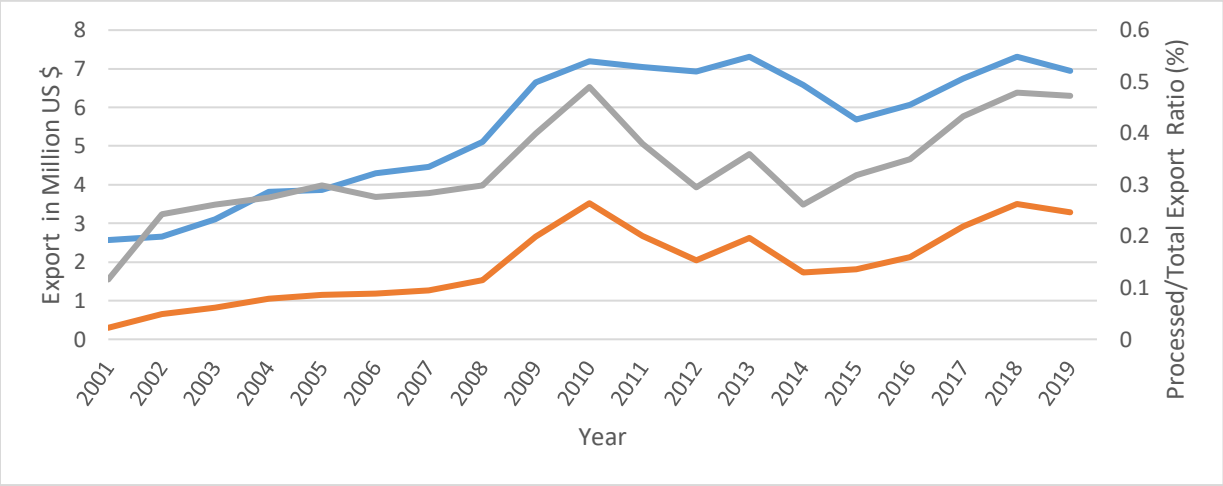

Figure 1: Trends in seafood exports and ratio (2001 - 2019).
Source: Author's computation with data from ITC trade map statistics

Regarding Namibia's processed seafood share in individual import markets (see Table A.3 of the appendix), Namibia's processed seafood exports are mainly exported to Spain and Germany, while exports to Mozambique and Zimbabwe are relatively low. The results reveal a poor demand for processed seafood in African markets, as indicated by the low export share of Namibia's exports. This result suggests that low-income countries prefer unprocessed seafood.

Table 2: RSCA indices for main seafood exporters (2001-2019)

Year	Chile	China	EU	India	Indonesia	Namibia	Norway	Thailand	Vietnam
2001	0	0.44	1.09	0.43	0.09	0.21	1.59	0.21	0.05
2002	0.13	0.43	1.26	0.67	0.11	0.24	1.41	0.2	0.16
2003	0.17	0.46	1.2	0.5	0.15	0.3	1.37	0.3	0.21
2004	0.21	0.42	1.66	0.41	0.16	0.34	1.17	0.31	0.42
2005	0.17	0.31	1.76	0.61	0.15	0.34	1.02	0.33	0.5
2006	0.2	0.28	1.77	0.49	0.14	0.43	0.81	0.36	0.63
2007	0.24	0.2	1.84	0.56	0.11	0.49	0.66	0.35	0.77
2008	0.26	0.21	1.85	0.57	0.15	0.61	0.79	0.36	0.78
2009	0.25	0.28	1.92	0.68	0.26	0.73	1.31	0.4	0.72
2010	0.29	0.26	1.95	0.77	0.36	0.81	1.5	0.42	0.66
2011	0.33	0.24	1.98	0.78	0.41	1.04	2.07	0.46	0.85
2012	0.37	0.21	1.8	0.86	0.42	1.03	1.99	0.44	0.84
2013	0.42	0.57	1.89	0.82	0.56	1.12	2.04	0.48	0.88
2014	0.45	0.63	2.06	0.72	0.55	1.44	2.16	0.49	0.97
2015	0.46	0.63	2.24	0.66	0.63	1.56	2.38	0.5	0.96
2016	0.48	0.59	2.66	0.62	0.73	1.6	2.43	0.52	0.92
2017	0.5	0.65	2.62	0.43	0.84	1.78	2.56	0.43	1.01
2018	0.54	0.52	2.91	0.45	0.95	1.81	2.57	0.45	1.07
2019	0.72	0.57	2.95	0.42	0.96	1.99	2.64	0.8	1.09

Source: Author computations from ITC trade statistics (https://www.trademap.org).

Table 4 presents the percentage share of seafood exports by leading seafood exporters. While Norwegian exports dominate global seafood exports with a market share of approximately 72%, Namibia's market share has risen significantly during the period 2001 to 2019, from 10.54% before the policy intervention in 2001 to 31.11% after the policy intervention in 2014.

Table 3: Market share seafood exporters% (2001-2019)

Year	Chile	EU	India	Indonesia	Indonesia	Namibia	Norway	Thailand	Vietnam
2001	1.19	2.04	8.79	2.69	4.17	10.54	72.05	1.00	2.54
2002	1.35	3.31	8.86	3.18	4.91	13.16	66.65	1.22	3.89
2003	1.91	3.91	8.63	0.00	7.21	12.54	66.88	2.00	3.82
2004	2.27	4.00	10.08	1.32	7.51	12.36	60.06	2.20	4.40
2005	2.25	5.8	8.25	0.53	6.99	8.68	55.69	3.01	5.60
2006	2.63	5.2	7.4	0.39	6.70	12.75	46.32	3.01	5.80
2007	2.62	7.00	4.59	0.55	4.60	14.29	34.48	4.01	6.87
2008	3.47	7.02	2.09	0.8	0.84	15.45	16.95	4.02	8.37
2009	9.95	7.4	3.79	0.04	1.98	36.62	46.69	4.32	7.91
2010	8.08	8.3	4.41	0.13	0.41	25.77	60.37	4.81	7.83
2011	8.75	9.9	4.53	0.23	0.87	21.33	63.44	5.2	8.85
2012	7.26	9.8	14.47	0.27	2.84	29.7	43.02	5.96	8.37
2013	7.36	10.00	13.93	0.20	1.99	35.9	38.42	5.01	9.2
2014	6.84	11.03	13.22	0.22	1.28	31.11	45.31	5.3	9.97
2015	6.55	11.06	12.54	2.11	1.01	33.03	39.46	6.01	9.25
2016	6.51	12.05	12.63	3.57	1.60	33.32	36.97	6.50	10.34
2017	4.95	13.04	11.03	3.12	2.09	36.71	33.45	7.50	10.61
2018	6.06	12.00	12.24	4.46	2.67	42.34	32.22	9.51	11.00
2019	5.21	13.01	8.74	1.26	3.23	24.26	47.76	10.01	12.52

Source: Author computations from ITC trade statistics, 2020.

Before estimating the determinants of processed seafood exports, some inferences must be drawn from the correlation matrix in Table 5. The results show that processed seafood export performance positively correlates with most control variables except for the preference for unprocessed seafood products. This is in line with economic theory and evidence (Ekonomou and Boziaris, 2021; Boziaris, 2014; Ozogul, 2019). It is interesting to note that a positive correlation exists between distance and processed seafood exports. This implies that Namibia's comparative advantage tends to increase the demand for processed seafood in European markets, despite the trade distance.

Table 4: Correlation Matrix

Series	X_{ijt}	Y_{it}	Y_{jt}	D_{ij}	Lan_{ij}	Cst_{ij}	PRF_{ij}	RCA_{ij}
X_{ijt}	1							
Y_{it}	0.646***	1						
Y_{it}	0.187***	0.187***	1					
D_{ij}	0.010**	0.010**	0.389***	1				
Lan_{ij}	0.131***	-0.000	0.073*	-0.267***	1			
Cst_{ij}	0.094	-0.000	0.182***	0.564***	-0.414***	1		
PRF_{ij}	-0.022	-0.000	0.0113**	0.370***	-0.281***	0.680***	1	
RCA_{ij}	0.146***	-0.000	-0.075**	-0.136**	0.182***	-0.075**	-0.051	1

Note: *p<0.1, **p<0.05, ***p<0.01. Source: Author computations, 2022.

4.3 Determinants of processed seafood exports

Table 6 presents the outcome of the PPML estimations. Models 1 and 2 present the results of estimating Equation (7) with exporter and importer time-varying fixed effects separately to control for the MTR. These results reveal the impact of observed and unobserved time-varying multilateral resistances on exports, as well as the positive impact of Namibia's RCA on exports. There is a statistically insignificant effect of distance on exports, while common language and the presence of a coastline, exporter and importer GDP exhibit positive signs. Model 3, estimated with exporter fixed effects, shows statistically significant coefficients in the PPML regressions. This result implies that export flow responds positively to RCA and other gravity determinants. Results shown in Model 4 estimated with importer fixed effects indicate that importer preferences and distance could possibly predict improved export performance. When considering different estimators, Table A.4 of the appendix shows a variation in the number of observations between the OLS and PPML estimates.

Table 5: Gravity estimates for exports using the PPML estimator

Variables	(Model 1) PPML	(Model 2) PPML	(Model 3) PPML	(Model 4) PPML
Y_{it}	1.06*** (0.11)	1.22*** (0.26)	1.23*** (0.08)	1.24*** (0.05)
Y_{ij}	0.05*** (0.01)	0.06** (0.01)	0.049*** (0.01)	0.01 (0.02)
D_{ij}	-0.01 (0.04)	-0.001 (0.04)	-0.01 (0.04)	0.44*** (0.07)
RCA_{ijt}	0.79*** (0.08)	0.75*** (0.06)	0.79*** (0.11)	
Cst_{ij}	0.24*** (0.07)	0.24*** (0.06)	0.24*** (0.77)	-0.42*** (0.06)
Lan_{ij}	0.18*** (0.52)	0.14*** (0.05)	0.18*** (0.06)	- 0.58*** (0.76)
Prf_{ij}	-0.02 (0.07)	-0.09 (0.07)	-0.02 (0.87)	0.38*** (0.55)
R^2	0.48	0.43	0.37	0.70
Constant	-9.87*** (2.5)	-13.88*** (1.65)	-13.87*** (1.79)	-15.18*** (1.38)
RESET	2.10	2.17	2.84	
Observations	551	551	551	551
Type of effect	Exporter-time fixed effects	Importer-time fixed effects	Exporter fixed effects	Importer fixed effects

Note: values in parenthesis are the standard errors of regression coefficients; *p<0.1, **p<0.05, ***p<0.01

4.4 Trade potential

Consumer preferences vary due to different consumer demands and the extent of value addition (Van Loo *et al.* 2020). Given the presence of active trade agreements and negligible trade restrictions between trading partners, the trade potential is estimated. The results depicted in Table 7 indicate the trade potential, accounting for both country and time-fixed effects. Models I and II display countries with values larger than 1 and less than 1 respectively. Results vary significantly, indicating that country effects play a substantial role in model specification and determination of Namibia's trade potential in processed seafood.

Table 6: Trade potential

Model I (Exporter-time and Importer-time)				Model II (Exporter-time, Importer-time and country fixed effects)			
Values > 1		Values < 1		Values > 1		Values < 1	
Country	Trade potential	Country	Trade potential	Country	Trade potential	Country	Trade potential
Botswana	1.64	Angola	0.67	Angola	1.67	Botswana	0.52
Australia	2.73	Republic of Congo	0.86	Republic of Congo	1.84	Ghana	0.70
Ghana	1.95	China	0.82	Australia	2.01	Kenya	0.66
France	1.62	USA	0.51	China	3.72	Malawi	0.87
Netherlands	1.82	Denmark	0.84	USA	1.15	Netherlands	0.73
Portugal	1.68	UAE	0.80	Denmark	3.71	Mozambique	0.50
Seychelles	1.18	Germany	0.68	France	1.84	Nigeria	0.66
UK	1.78	Kenya	0.94	Germany	1.72	Seychelles	0.38
		Malawi	0.76	Italy	1.88	Tanzania	0.57
		Italy	0.82	South Africa	1.90	Zambia	0.68
		Democratic republic of Congo	0.66	Portugal	1.68	Lebanon	0.17
		Mozambique	0.36	Spain	1.98	Zimbabwe	0.14
		Zimbabwe	0.61	United Kingdom	2.61	Democratic Republic of Congo	0.71
		South Africa	0.72	Jordan	1.80		
		Spain	0.82	United Arab Emirates	1.48		
		Nigeria	0.52	Mauritius	1.17		
		Tanzania	0.71				
		Zambia	0.53				
		Jordan	0.67				
		Lebanon	0.55				
		Mauritius	0.97				

Source: Author estimates.

5. Discussion

Over the past decade, there has been a significant increase in Namibia's seafood processed export revenue, however, the extent to which customer preferences for processed seafood exports enhances export performance and trade potential is unknown. The aim of this study, therefore, is to examine the impact of processed seafood on Namibia's processed seafood export flow and trade potential. The results suggest that on the one hand, Namibia's comparative advantage in seafood export processing enhances export flow. On the other hand, the preference for unprocessed seafood

products in African has a muting effect on Namibia's export performance in African markets, because export potential for processed seafood lies in European markets. Distance does not appear to impede export flow, suggesting that import demand appears to be driven by importer preferences. The following section discusses these findings in greater detail.
Descriptive statistics show variability in import demands. This disparity can be attributed to the variability in importer GDP, consequently influencing consumer import demand. Of the 29 trading partners, 16 are high-income countries, while 13 are low-income countries. This fact suggests that Namibia's export performance for processed seafood is driven by high-income countries with a preference for processed seafood. This finding is consistent with those of other researchers (Anderson *et al.*, 2018; Carlucci *et al.*, 2015; Natale *et al.*, 2015; Zhang and Tveterås, 2019) that stress the importance of GDP, commoditisation and value addition as determinants of international seafood exports in developed countries. The results of these studies imply that seafood exporting companies and countries must build capacity, innovate and diversify exports to meet import demands and ensure sustained export flow.

An important task of this particular study was to estimate Namibia's RCA in seafood processed seafood products. Based on the empirical results recorded in section 2.4.2, Namibia has an increasingly substantial comparative advantage. This finding implies that Namibia's processed seafood exports can enhance the contribution of export revenue towards economic growth and development. This outcome was expected based on Namibia's investment in industrial upgrading in the seafood sector and is corroborated by the findings of Zhang and Tveterås (2019) relating to the impact of value addition and globalisation of the trade duration of processed seafood products from developing countries. Furthermore, processed seafood products appear to have a more significant impact on export performance than un-processed seafood products. This suggests that export processing is key to meeting consumer preferences for sustained export flow.

The gravity model results indicate that distance has no statistically significant effect on the trading costs of Namibian seafood exporters. Although this result is unexpected and contrary to Natale's (2015) findings, Namibian seafood products attract demand in international markets. Namibia's seafood export data[4] revealed higher exports of processed seafood to European countries, such as Italy, Spain and Portugal. This finding suggests that Namibia's export potential lies in European markets. This study reveals the importance of the MTR and exporter-importer fixed effects in model specification in contrast to Teweldemedhin and Chiripanhura (2016)'s estimation of Namibian seafood export potential due to the fact that these researchers failed to include these two components in their estimations. The inclusion of exporter-fixed effects in this study suggests that export flow responds positively to RCA and other gravitational drivers and importer-fixed effects results suggest that importer preferences may predict improved export performance.

The findings of this study revealed differences in the number of observations between the OLS and PPML estimates for different estimators. Based on the Ramsey Regression Equation Specification Error Test (RESET), Equation (7) is correctly specified and superior to the OLS estimates, accounting for missing data as evidenced by the difference in observations. The coefficients of the OLS estimates are very different from the PPML estimates, therefore, suggesting that heteroskedasticity is present and the OLS estimates are unreliable. Among the determinants, comparative advantage is one of the most important factors influencing exports, a

[4] (https://comtrade.un.org/data/)

fact that is consistent with Supongpan *et al.*'s (2013) finding that comparative advantage drives export competitiveness in the seafood industry. The OLS estimates indicate that comparative advantage in export processing increases exports by 66% ($e^{0.58} - 1$). When compared with the PPML estimates, which account for missing data or zero trade values, results show that comparative advantage increases exports by 81% ($e^{0.79} - 1$) while importer preferences explain 54 % ($e^{0.38} - 1$) of processed seafood export flow. Therefore, proper model specification is vital in determining processed seafood exports.

Table 7 demonstrates that country effects in Model II boost estimates of the trade potential for processed seafood products. This fact may be related to country-specific variables that drive consumer demand (Fabinyi, 2016; Zander and Feucht, 2018). Higher trade potentials are consistent with Erokhin *et al.*'s (2021) conclusion that nations with higher economic levels, such as Australia, Spain, Denmark, and the United Kingdom, have increased demand for processed seafood. Countries in Model II (see Table 7) with values greater than 1, therefore, can maximise Namibia's processed seafood performance. In addition, this table indicates that trade potential with the majority of African countries is less than 1, mainly due to African customers' preference for unprocessed seafood (Chiripanhura and Teweldemedhin, 2016). Bronnmann *et al.* (2020) reported large-scale unprocessed marine fish exports to African nations, consistent with Teweldemedhin and Chiripanhuru's (2015) findings. While the results suggest that processed seafood exports to African countries have a muting effect on export performance, processed seafood exports to Europe will increase due to consumers' preference for these products.

6. Conclusion

Considerable empirical research has been conducted on the relationship between value addition and seafood export performance. This study investigates the impact of processed seafood on Namibia's export flow and trade potential using a gravity model estimated with the PPML method and product-level export data for the years 2001 to 2019. The aim of this study was to explore the influence of industrial upgrading, proxied by the RCA and other determinants, on the consumer preference for processed seafood outcomes and whether unprocessed export products limit the preference for processed seafood export performance.

The empirical results revealed the following: (i) RCA enhances processed seafood export outcomes; (ii) consumer preference for processed seafood can boost Namibia's export performance and competitiveness; (ii) processed seafood export flow is not constrained by distance through consumer preferences, confirming that value addition enhances consumer preference; (iii) processed seafood exports to African countries has a muting effect on Namibia's export flow except for South Africa and Mauritius, implying that the preference for unprocessed seafood could limit export performance in African markets; and (iv) there is heterogeneity in the trade potential of processed seafood products, and opportunities to expand trade lie with developed countries such as Denmark, Germany and the United Kingdom. In addition, estimation differences exist in the effects of processed seafood products on export flow, which is more significant when country pair fixed effects are excluded.

The empirical findings recording in this study add to the body of knowledge on the impact of industrial upgrading on export performance through consumer preference channels. Seafood exporting companies can leverage on Namibia's comparative advantage in producing and

exporting service-oriented seafood to markets with higher trade potentials, with the aim of enhancing Namibia's export competitiveness and economic growth. Furthermore, it provides policy insights for developing seafood exporting countries (such as Namibia) to increase investment in industrial upgrading, building export processing capacity for sustained export revenue and economic growth.

For policy implications: (1) Unprocessed seafood exports negatively affect Namibia's export competitiveness and threaten export revenue. Hence, the government should lend more support to investment in Industrial upgrading and export processing to minimise the export of unprocessed seafood products. (2) In response to the rising consumer demand for processed seafood products, industrial upgrading could be used to strengthen comparative advantage, enabling products to meet consumer preferences. Contrary to Teweldemedhin and Chiripanhura (2016)'s finding that distance, economic size and perishability negatively affects Namibian seafood export performance, the preference for Service-oriented seafood products in European markets could boost Namibia's export competitiveness. This is a welcome idea given the aim of the industrial policy is to boost export revenue for sustained economic growth. In the interest of this goal, processed seafood products are essential to meet consumer preferences, thereby enhancing trade gains. To enhance consumer preference, further studies can focus on the impact of branding on consumer preference. Furthermore, future research could examine the trade potential for Namibian unprocessed seafood exports to African markets in order to identify sources of improved export flow based on consumer preference.

Appendix

Table A.1: List of countries included in the sample

Angola	China	France	United Arab Emirates	South Africa	Seychelles	Jordan	The Democratic Republic of Congo
Botswana	United States	Germany	Italy	Portugal	Tanzania	Lebanon	
Republic of Congo	Ghana	Kenya	Netherlands	Spain	United Kingdom	Mauritius	
Australia	Denmark	Malawi	Mozambique	Nigeria	Zambia	Zimbabwe	

Table A.2: List of countries included in the RCA index computation

EU	India	Norway
China	Thailand	Indonesia
Chile	Namibia	Vietnam

Table A.3: Namibia's processed seafood share in individual import markets

Year	Spain	South Africa	Zambia	Italy	France	Mozambique	Portugal	Australia	Zimbabwe	Netherlands	Germany
2000	14.73	0.09	0.01	11.92	21.90	0.00	4.78	6.14	0.00	8.32	32.11
2001	17.08	0.07	0.00	10.87	20.43	0.00	4.13	5.01	0.04	7.68	34.69
2002	16.29	0.08	0.00	11.15	19.94	0.00	4.56	5.72	0.03	6.40	35.83
2003	18.05	0.20	0.02	10.74	20.55	0.02	5.25	5.66	0.00	7.04	32.46
2004	18.54	0.25	0.02	11.07	21.13	0.00	4.81	5.47	0.02	7.44	31.25
2005	16.29	0.16	0.02	11.04	20.58	0.00	4.78	5.19	0.00	8.31	31.25
2006	16.56	0.34	0.02	10.35	19.89	0.00	4.51	4.72	0.04	10.11	33.62
2007	33.84	0.49	0.20	15.59	12.33	0.01	24.10	0.64	0.14	7.84	33.44
2008	32.14	0.69	0.14	16.37	10.72	0.02	22.50	0.74	0.25	9.93	4.82
2009	29.22	1.33	0.10	16.71	11.56	0.02	22.07	0.81	0.24	10.98	6.50
2010	23.54	7.12	0.15	16.30	12.15	0.00	18.75	0.84	0.99	13.38	6.96
2011	20.27	6.36	0.25	16.21	12.93	0.01	15.81	0.73	0.92	19.59	6.77
2012	26.44	4.10	0.44	16.66	15.14	0.00	8.86	2.72	0.49	15.55	6.90
2013	27.20	3.97	0.97	18.22	14.18	0.00	8.93	2.53	0.52	14.08	9.61
2014	28.95	3.53	2.30	16.55	13.64	0.00	8.58	2.22	0.65	14.25	9.39
2015	29.35	3.87	4.63	16.58	13.06	0.00	8.47	2.40	0.75	12.53	9.33
2016	31.94	3.36	0.00	18.32	13.44	0.00	8.50	2.37	0.70	12.81	8.36
2017	28.88	3.70	5.52	15.76	13.81	1.38	8.08	2.45	0.70	11.90	8.57

Source: Author estimates

Table A.4: Gravity model estimate using different estimators.

Variables	(1) OLS ln*x*	(2) OLS ln*x*	(3) PPML *x*	(4) PPML *x*	(5) PPML *x*	(6) PPML *x*	(7) PPML *x*	(8) PPML *x*
Exporter GDP	1.17*** (0.01)	1.20*** (0.03)	1.23*** (0.08)	1.24*** (0.05)	1.06*** (0.11)	1.91*** (0.25)	0.96*** (0.13)	1.27*** (0.08)
Importer GDP	0.04*** (0.06)	-0.003 (0.0)	0.49*** (0.01)	0.01 (0.02)	0.05*** (0.01)	0.06** (0.01)	0.09*** (0.02)	0.083*** (0.05)
Distance	-0.014 (0.04)	0.53*** (0.052)	-0.01 (0.04)	0.44*** (0.07)	-0.01 (0.04)	-0.004 (0.04)	1.87*** (0.11)	-1.15 (0.11)
RSCA index	0.58*** (0.14)	1.99*** (0.01)	0.79*** (0.11)		0.79*** (0.08)	0.77*** (0.05)	0.55*** (0.09)	0.48*** (0.06)
Contiguity	0.23* (0.11)	-0.45*** (0.06)	0.24*** (0.77)	-0.42*** (0.06)	0.24*** (0.07)	0.24*** (0.06)	0.22*** (0.07)	0.28*** (0.09)
Common language	0.19*** (0.6)	-0.67*** (006)	0.18*** (0.06)	- 0.58*** (0.76)	0.18*** (0.52)	0.14*** (0.05)	0.34*** (0.05)	0.26*** (0.06)
Preferences	-0.18 (0.13)	0.40*** (0.96)	-0.02 (0.87)	0.38*** (0.55)	-0.02 (0.07)	-0.09 (0.66)	-0.02 (0.07)	-0.12 (0.7)
R^2	0.47	0.87	0.37	0.70	0.48	0.52	0.64	0.53
Constant	- 12.14*** (0.40)	-16.39	- 13.87*** (1.79)		-9.87*** (2.5)	- 30.46*** (5.73)	-9.83*** (2.86)	- 14.22*** (1.11)
Observations	522	522	551	551	551	551	456	435
Type of effect	Exporter FE	Importer FE	Exporter FE	Importer FE	Exporter -time	Importer -time	Exporter -time	Importer -time

Note: values in parenthesis are the standard errors of regression coefficients; *p<0.1, **p<0.05, ***p<0.01.
Source: Author estimates.

Table A.5: Seafood export classification and export HS codes

Product	HS (6 digit) code
Fillets - fresh, chilled or frozen	030474 , 030479
Prepared or preserved	160415

Source: International Trade Centre (ITC) Trade statistics.

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