Seafood Export Performance Effects of Industrial Upgrading: Evidence from Namibia's Industrial Policy

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Abstract

In the reviewed literature, considerable attention has been paid to the relationship between policy intervention and seafood export performance. However, the relationship with respect to an industrial policy targeting the transformation of seafood products within the processing and manufacturing sector has not been investigated as yet. This study attempts to fill this gap. With a balanced panel of 29 countries, this paper investigates the effectiveness of Namibia's industrialisation policy on processed seafood export outcomes spanning the period 2001 to 2019. The study employed the Difference-in-Difference (DID) methodology and the findings confirm the model's applicability and the absence of improved export performance before policy intervention. The DID estimation for the full sample suggests policy intervention enhanced processed seafood export outcomes however, the effect cannot be generalised to all export markets and likewise cannot be applicable to Namibia's export competitiveness in all markets. The empirical findings likewise substantiate that while the intervention enhanced differentiated export outcomes in European markets, regional importers prefer unprocessed seafood. In view of the need to limit the export of unprocessed seafood and enhance the gains from the seafood trade, this study recommends that the intervention should focus on regional market seafood preferences in order to achieve the objectives of the industrialisation policy.

Keywords: Difference – in – Differences; export performance; industrial policy; Namibia; seafood export processing.

JEL Classification Codes: Q22, L52, D78.

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1 Introduction

In recent decades, research on the determinants of seafood export performance in both developed and developing countries has given rise to the role of government intervention to enhance gains from trade. Government intervention plays a critical role in ensuring that the intended objectives of the seafood industry towards economic growth and development are met. Apart from meeting stated objectives, government intervention plays an important function in environmental protection, supports Research and Development (R&D) and innovation (Joo, Seo and Min, 2018; Wang, 2018). Over the past three decades, the quest to enhance gains from trade from both developed and developing seafood exporting countries has prompted extensive research among fishery economists and policymakers into the role of government intervention through several policies enacted in the seafood sector. Such legislation includes fishery conservation, environmental, trade, and managerial policies (inter alia: Fabinyi and Dalabajan, 2011; Greaker, Vormedal and Rosendal, 2020; Reimer and Haynie, 2018). Export processing and manufacturing are important determinants of the gains from the seafood trade. Hence the need for policy intervention targeting technological transformation and production efficiency to ensure the seafood industry's continuous contribution towards countries' economic growth and development.

Over the past three decades, the Namibian government has enacted several policies in the seafood sector to enhance gains from trade. Yet, exports with little value addition and basic export processing are prevalent (MITSMED, 2019). Given the challenge of insufficient value addition to seafood exports facing the seafood industry, the Namibian government initiated the Growth-at-Home strategy which is the implementation roadmap for achieving Namibia's industrialisation as outlined in the industrial policy of 2012. This strategy aims to achieve the following objectives: (i) greater industrial value addition to marine resources; (ii) product diversification to meet market demands and (iii) continued job creation (MTISMED, 2012). Despite the ample discussions of the role of government intervention, empirical studies on the effectiveness of policy intervention on the technological transformation of the seafood sector and export outcomes in developing countries are still scarce.

An evaluation of the effectiveness of Namibia's industrial strategy on seafood export performance provides this paper's theoretical and empirical focus. Theoretically, industrial policy within the context of Namibia's seafood technological transformation is conceptualised, which explains the role of export processing to facilitate value addition and market access. Empirically, product diversification as an intervention for improved market access is discussed. In particular, this paper addresses the following research questions: What is the effect of policy intervention in terms of technological transformation on processed seafood export outcomes? To what extent is policy intervention effective in limiting seafood exports with little value addition and basic export processing for further export re-processing?

The literature highlights two ways in which policies in the seafood sector can affect exports performance: (i) positively, through commoditisation – making it abundant and cheaper, service-oriented – meeting consumer demands and (ii) negatively through excess fleet capacity (Belton, Reardon and Zilberman, 2020; Johansen et al., 2019; Naabi and Bose, 2020; Srinivasan et al., 2012). A few studies have investigated the nexus between policies in the seafood sector and export performance and reported mixed results for example: trade policies (Bellmann, Tipping and Sumaila, 2016; Kumar, Ravinesh, Josef and Chakradhar, 2019; Zhang and Tveteras, 2019),

resource conservation/environmental sustainability (Greaker et al., 2020; Reimer and Haynie, 2018), and managerial policies (Bailey, Bush, Miller and Kochen, 2016; Baker-Medard and Faber, 2020). These contradictory findings could be due to the different country case studies and/or methodologies employed.

A body of literature has identified factors that could necessitate policy intervention in the seafood sectors of both developed and developing countries. These factors include traceability and ecolabelling (Bailey et al., 2016; Djelantik and Bush, 2020; Gutierrez et al., 2016), total allowable catch (TAC) and fishing effort (McCluney, Anderson and Anderson, 2019; Militz, Kinch, Schoeman and Southgate, 2018; Su,Tang, Chang, Zhu and Chen, 2020) and environmental effects (Henriksson, Banks, Suri, Pratiwi, Fatan and Troell, 2019; Lebdioui, 2019). The results of these studies are contradictory and inconclusive.

Policy effectiveness refers to the extent to which policy tool instruments work together in concert toward a policy goal. Assessing this efficacy has been a focal point of the theoretical literature (Lane, 2022; Noland and Pack, 2003). A large body of literature (inter alia: Bennett, 2021; Cook, Grillos and Andersson, 2019; Okazaki, Onishi and Wakamori, 2021) has contributed to developing methods to empirically assess a policy intervention's effectiveness in both developed and developing countries. The effectiveness of policy intervention has been applied to other topics such as agriculture (Von Hobe, 2021), early childhood education (Nathan, Adams, Trost, Cross, Schipperijn, McLaughlin and Christian, 2022), school bullying (Hall, 2017) and renewable energy (Pitelis, Vasilakos and Chalvatzis, 2020) to mention a few. However, a few studies, including (Bailey et al., 2016; Baker-Medard and Faber, 2020; Bellmann et al., 2016; Chen et al., 2018; Kumar et al., 2019; Reimer and Haynie, 2018; Zhang and Tveteras, 2019) have focused on the effectiveness of policy intervention in the seafood industry. As highlighted above, while there is literature on the relationship between policy intervention in the seafood sector and export performance, little is known about the effectiveness of a policy targeting technological transformation for improved export processing and seafood manufacturing, such as Namibia's industrial policy on processed seafood exports in global markets and limiting trade for export re-processing.

This study differs from other studies in the seafood policy intervention literature because it adopts the DID estimation technique proposed by Angrist and Krueger (1999) to examine the effectiveness of policy intervention. This technique is predicated on a model that disaggregates the dataset into two time periods – before and after the policy intervention and two groups – treatment and control. This separation is important because the effectiveness of a policy intervention cannot be tested by applying other econometric methods such cointegration or unit root tests. Furthermore, in the presence of unobserved country and time-invariant effects, the above methodology helps to avoid correlation with the implementation effect of the policy. The evaluation of the effectiveness of policy intervention requires that in the absence of treatment, the difference between the control and treatment groups are constant over time (Parallel trend assumption) (Kahn-Lang and Lang, 2020). Thus, the non-parametric foundation of the method theoretically provides the foundation for causal inference in economic literature (Lechner, 2011).

The validity of the DID approach is based on the parallel trend assumption. In this approach, the difference between the treatment and control groups in the pre-intervention period should be

constant over time and, if violated, leads to a biased estimation of the causal effect. Although no statistical test is needed for this assumption, Roth (2019); Kahn-Lang and Lang (2020), increasingly point to the importance of a statistically insignificant pre-trend test in order to accept the null hypothesis of parallel trends. In addition, the parallel trends assumption is more effective given small time periods in the analysis of the effectiveness of policy intervention. Therefore, the validity of parallel trend assumption is important but is not an alternative to logical reasoning (Kahn-Lang and Lang, 2020). To ensure the validity of this study's results, demographic characteristics and other factors that could have differently affected each group were included. To enhance logical reasoning, product differentiation was considered to enhance the validity of the results obtained from the DID estimation (i.e. for robustness checks).

To the best of the researcher's knowledge, no study has examined the effectiveness of a policy intervention which targets industrialisation of the seafood sector that uses the DID approach in Namibia, and developing seafood exporting countries. Consequently, this study seeks to fill this gap by investigating the effectiveness of Namibia's industrial policy on processed seafood outcomes in global markets in a balanced panel of 29 seafood importing countries spanning the period 2001 to 2019. The 29 countries are grouped into regional markets, namely: Southern African Development Community (SADC), European and the rest of the World. An additional novel approach in this study is the application of the Placebo treatment recommended by Yan et al. (2018), which applies the DID methodology to the pre-intervention period. In this study, the data is split into two time periods: 2001 to 2013 and 2014 to 2019. The reason for this division is to test for the absence of significant treatment effect before the policy shock. Furthermore, the justification for the regional and European market groupings include: (i) the increasing quest for improved gains from trade necessitates the need to focus on the effectiveness of the policy on export performance not only in European markets but globally; (ii) the DID is useful in identifying similarities and differences between the markets enabling generalisations or specific inferences (Roth et al., 2022) and (iii) it enables an evaluation of the extent to which policy intervention limits unprocessed seafood export outcomes in each market.

The findings of this study show the effectiveness of the policy intervention for the full sample and the presence of a common trend in both the control and treatment groups prior to policy intervention. This outcome implies that Namibia's processed seafood exports are affected by the policy intervention, which influences Namibia's export performance and global market competitiveness. These results also reveal that the effectiveness of policy intervention cannot be generalised across all markets.

The rest of this paper is organised as follows: the next section presents the background of seafood export processing and the industrial policy in Namibia. Sections 3 and 4 present and report on the materials, methods, empirical results, and discussion while Section 5 concludes.

2. Background on Seafood Export Processing and the Industrial Policy in Namibia

Namibia's marine sector is the third-largest on the African continent (Benkenstein, 2014). The 1,500-kilometer coastline is situated in the Benguela Current system, which has an Exclusive Economic Zone (EEZ) of 564,700 km^2 and approximately 20 commercially exploited species. Currently, only *Merluccius capensis* (shallow-water hake), *Merluccius paradoxus* (deep-water hake), and *Trachurus capensis* (horse mackerel) are the main seafood export species. Namibia's

marine fisheries contribute approximately 4% annually to GDP and accounts for over 20% of Namibia's export earnings, thus, making seafood exports the second largest export category after commodity exports (NSA, 2021). The seafood sector is the third largest employer in Namibia, after the mining and agriculture sectors, with approximately 15,000 direct employees at various stages along the value chain.

Before independence, Namibia's fish stocks were overexploited with little value addition to exports. (Sherbourne, 2017). However, after independence in 1990, National Development Plans (NDPs) were initiated to foster faster and sustainable economic growth and development by focusing on all aspects of the economy. National development planning identifies four strategic areas which include manufacturing, logistics, tourism and mining. Manufacturing which involves the processing of raw material to products with greater value addition, is vital for sustained economic growth. Therefore, the development of the fishery sector was entrenched in the National development plans (NDPs). The marine-resource exploitation and manufacturing sub-sectors process fish for both local and international export markets.

Given the international scope of exports, export competitiveness is essential for the economic development and growth of seafood-dependent economies. However, most developing countries' seafood sectors have been and continue to be challenged by insufficient export processing capacities, innovation, weak institutions, limitations to traceability, stock depletion and unsanitary conditions (Asche, Garlock, Anderson, Bush, Smith, Anderson and Vannuccini, 2018; Bose et al. 2019; Hammarlund and Andersson, 2019; Nguyen, Nang, Lebailly and Azadi, 2019). Challenges to competitive exports, therefore, are a point for concern.

Over the past three decades, the Namibian government enacted several policies through the Ministry of Fisheries and Marine Resources (MFMR) to promote the export-led growth and competitiveness of the seafood industry. For example, the first policy was outlined in a White Paper titled *Towards Responsible Development of the Fisheries Sector* in December 1991 (MFMR 1991). The policy aims to: (i) rebuild fish stocks and control resource exploitation; (ii) establish effective monitoring and surveillance mechanisms; and (iii) establish a thriving fishing industry that would add value to the resource and empower the Namibian public. The policy emphasised the need for Namibianisation of the sector through affirmative action policies designed to promote participation and ownership of fish resources by formerly disadvantaged Namibians.

By 1992, the Namibian government passed the Sea Fisheries Act (Republic of Namibia, 1992). This Act was to ensure the realisation of the objectives stated in the White Paper of 1991. The Sea Fisheries Act established the institutional framework for fishing sector administration and management, including non-transferable quota rights, TAC, data collection and marine resource research quotas that are assigned based on job creation and corporate social responsibility, which includes adherence to government standards, rules and regulations. The rights granted are valid for seven to twenty years, depending on the goals and objectives of the Act, such as ownership, investment levels and fishing experience. For example, in hake fishing, the initial quota indicated that approximately 60% of the authorised quota must be landed ashore for processing, while the remaining 40% could be frozen and exported directly from sea. However, because wet landing onshore is critical to creating and retaining onshore jobs, the 60:40 policy was changed to 70:30 in order to increase value-added activities and job creation.

The 1992 Act was amended and replaced by the Marine Resources Act 27 of 2000. (Republic of Namibia, 1992). The Marine Resource Act aimed to regulate the exploitation of marine resources. The Act governed the allocation of fishing quotas, the licensing of fishing activities, and the issuance of fishing rights. Furthermore, the Act governs the non-commercial use of marine resources (for example, recreational activities), conservation measures (for example, trawling and mesh measuring), and fishing seasons for various species. The regulations accompanying the Act detail the compliance and management procedures, as well as the applicable offences and penalties. The 2004 Marine Resources Policy (MFMR) was another step toward better managing Namibia's marine resources. The policy addresses issues concerning the development of marine sector resources as well as the implementation, monitoring, and control of resource use. This policy's regulatory framework is constantly adjusted to meet government objectives while preserving the viability of the country's fishing companies.

The primary objective of the industrial policy of 2012 is to support industrial upgrading in the primary export sectors, such as the seafood sector, in order to transition the economy away from a reliance on the export of raw products to service-oriented products, thereby enhancing export competitiveness and economic growth. Therefore, the industrial policy is an example of a policy intervention that targets industrial upgrading in the primary export sector of Namibia's seafood sector. The industrial policy focuses on four priority action areas: (i) provide support towards processing horse mackerel for export to the regional markets, specifically SADC, and domestic consumption towards school nutritional feeding programmes; (ii) support export processing by subsidising the cost of imported materials; (iii) enable firms to obtain EU certification as well as the eco-labelling for hake exports; and (iv) enable firms to gain access into African markets using trade facilitation, market research and trade promotion. Namibia's industrial policy is aimed at achieving higher levels of manufactured seafood products but the question remains as to whether the industrial policy is effective in enhancing processed seafood outcomes in global markets. Therefore, this paper empirically investigates the effectiveness of the industrial policy on processed seafood outcomes.

3. Materials and methods

3.1 Data and variable description

This paper uses annual data of Namibia's processed and unprocessed seafood export values (in metric tons) to global markets sourced from the UNCOMTRADE database for a balanced panel of 29 importing countries spanning the period 2001 to 2019. The UNCOMTRADE database contains seafood export data for the three export species[1] at the Harmonised System Code (HS) 6-digit. The HS codes is recognised as the main and reliable data source for seafood exports. Processed seafood exports represent exports which have undergone a level of value addition. A product is considered processed if it is in a ready-to-cook or ready-to-eat form and unprocessed if ungutted and frozen whole (FAO, 2014). In this paper, unprocessed exports with HS codes 030254, 030245, 030355, 030374, 030366, and 030378 represent the control group, while processed exports with HS codes 030474, 030479, and 160415 represent the treatment group.

Data on export volumes is aggregated based on importer preferences in global markets and is used as a proxy for market preferences in this study and reflects demand for Namibian products.

[1] *Merluccius capensis* (shallow-water hake), *Merluccius paradoxus* (deep-water hake), and *Trachurus capensis* (horse mackerel).

Processed seafood is exported in different forms to European and regional markets, hence, export quantity is used as a proxy for product differentiation. Data on population and income per capita income was sourced from the World Development Indicators (WDI) database, while data on fish production was obtained from the FAO FishSTAT capture production database in metric tons. The study period is determined by the availability of data. The exports are further split into two groups – regional and European. The list of countries used for this study and export classifications can be found in the study's appendix. Variable names, descriptions and data sources are presented in Table 1.

3.2 Difference - in - Differences

In this section, the DID methodology proposed by (Angrist and Krueger,1999) is adopted to examine the effectiveness of Namibia's industrial policy targeting technological transformation and improved market access on processed seafood export outcomes as a proxy for export performance. The model relies on the parallel trend assumption to examine the effectiveness of policy intervention and is predicated on two conditions: (i) the DID method is valid when given two time periods and two groups, and there are no changes in both the treatment and control groups prior to policy intervention; and (ii) each group's results – treatment and control – should differ by a fixed amount in every period and exhibit a common set of period-specific changes (Alshubiri et al., 2020).

Since Card and Krueger (1984) introduced the approach in project evaluation studies in, the DID model has been widely employed in policy intervention studies such as environmental conservation and trade to evaluate the effectiveness of policy intervention. For example, Yi, Bai, Yang, Li and Wang (2020) used the DID model to study the effectiveness of China's carbon policy on carbon emission reductions. The approach compares the effect of an exogenous' shock' on the treatment and control groups to determine the extent of changes caused by the carbon policy. The non-parametric foundation of the method theoretically provides the foundation for causal inference in economic literature (Lechner, 2011). Furthermore, Angrist and Pischke (1999) explain that compared to cross-sectional data, the DID approach estimated by panel data enables the comparison of pre-treatment outcomes, which is impossible to perform with cross-sectional data.

Table 1: Variable, description and data sources

Variables	Proxy	Description	Source
Y_{ijt}	Seafood exports	Total values of exports from country *i* to *j* in year *t*, expressed in metric tons.	UNCOMTRADE
K_{jt}	Per capita income	Real GDP per capita of importer country in time *t*.	WDI
Pop_{jt}	Population	Total population of importer country in year time.	WDI
MRT_{ijt}	Market preference dummy	Takes the value of 1 if products are exported to European markets and zero otherwise.	UNCOMTRADE
INT_{ijt}	Product differentiation dummy	Takes the value of 1 if differentiated – individually packed products are higher and zero otherwise.	UNCOMTRADE
EXP_{ijt}	Value addition	Takes the value of 1 if exports are unprocessed and zero otherwise.	UNCOMTRADE
REG_{ijt}	Regional market preferences	Takes the value of 1 if unprocessed exports are higher and zero otherwise.	UNCOMTRADE
$PROD_{jt}$	Domestic production	Total domestic capture on importer *j* at time *t*.	FAO

Note: WDI (World development indicators World Bank) data is available at: https://databank.worldbank.org/source/world-development-indicators; UNCOMTRADE data is available at: https://www.uncomtrade.org/databases; FAO Food and Agriculture Organization) FishSTAT data is available at: https://www.fao.org/fishery/statistics-query/en/capture/capture_quantity

3.3 Fixed Effect Dummy Variable

To eliminate endogeneity inherent in panel data estimation, it is essential to incorporate fixed effects in the model. Endogeneity arises due to missing data or simultaneous causality in the dependent and independent variables. Different approaches in literature have been proposed to solve the endogeneity problem and adequately specify the model. For example, country effects or bilateral dummy variables have been preferred in cross-sectional data when data is missing, however, the inclusion of fixed time effects in panel data estimation effectively eliminates estimation bias (Ghazvini et al., 2020). Alshubiri et al. (2020) argued that a failure to include fixed time effects reverses causality between exports and seafood production. In this study, both time-fixed effects and country/regional fixed effects are added to the model to control the unobserved country-fixed and time-fixed effects and avoid correlation between the implementation effect of the policy due to regional and time differences.

3.4 The Model

Unprocessed seafood exports are selected as the control group and processed exports as the treatment group to identify the impact of the industrialisation policy on Namibia's global seafood outcomes. The following DID model is specified to estimate the effect of the policy intervention on global export outcomes as:

$$Y_{ijt} = \alpha_0 + \alpha_1 EXP_{ijt} + \alpha_2 post2013_{it} + \alpha_3 EXP_{ijt} * post2013_{it} + \alpha_4 X_{it} + \alpha_5 \delta + U_{it} + \varepsilon_{it} \quad (1)$$

The outcome variable Y_{ijt} is a measure of the export outcome for country *i* to *j* at time *t*. EXP_{ijt} is a binary variable that indicates whether Namibia's exports are processed or unprocessed. It is equal to 1 if Namibia's exports are processed and 0 otherwise. $Post2013_{it}$ is a binary variable indicating whether Namibia's seafood exports are affected by the policy shock, therefore, $EXP_{it} * post2013_{it}$ is the DID estimator, which measures the implementation effect of policy. The parameter of interest α_3 captures the impact of the policy on the outcome variable – processed export performance – for the full sample. Vector of control variables, namely population and per capita income, are represented by X_{it}. Equation (1), therefore, captures the industrial upgrading effect of the industrialisation policy on seafood export performance for the full sample.

To separate the effect of the impact on regional and international market access, the study estimates the following regression model to capture market access effects of the policy intervention:

$$Y_{ijt} = \alpha_0 + \beta_1 MRT_{ijt} + \beta_2 post2013_{it} + \beta_3 MRT_{ijt} * post2013_{it} + \alpha\beta_4 X_{it} + \alpha\beta_5 \delta + U_{it} + \varepsilon_{it} \quad (2)$$

MRT_{ijt} is a binary variable indicating whether Namibia's products are exported to European or regional markets. It is equal to 1 if exports are destined for European markets and 0 otherwise. $Post2013_{it}$ is used to reflect the process of policy implementation, therefore $MRT_{ijt} * post2013_{it}$ is the DID estimator which measures the implementation effect of the policy. The parameter of interest β_3 in Equation (2) captures the effect of the policy shock on market access. It is possible that importer's preferences are not due to value addition. In this case, export performance estimates would be biased by the importer's preferences. The estimates are evaluated to establish whether they are biased or not using unprocessed exports. REG_{ijt} is the binary variable capturing unprocessed exports equals 1 if unprocessed exports are preferred and 0 otherwise. The outcome variable Y_{ijt} in Equation (3) is a measure of the export performance outcome for regional exports at time *t as:*

$$Y_{ijt} = \alpha_0 + \alpha_1 REG_{ijt} + \alpha_2 post2013_{it} + \alpha_3 REG_{ijt} * post2013_{it} + \alpha_4 X_{it} + \alpha_5 \delta + U_{it} + \varepsilon_{it} \quad (3)$$

To capture the effectiveness of policy intervention on export performance outcomes in European markets at time *t*. INT_{it} is a binary variable that indicates the preference for individually packed products. It is equal to 1 if individually packed and 0 otherwise. $Post2013_{it}$ is a binary variable indicating whether Namibia's seafood exports are affected by the policy. The parameter of interest ϕ_3 captures the effect due to the policy on differentiated export outcomes and is given as:

$$Y_{ijt} = \alpha_0 + \alpha_1 INT_{ijt} + \alpha_2 post2013_{it} + \phi_3 INT_{ijt} * post2013_{it} + \alpha_4 X_{it} + \alpha_5 \delta + U_{it} + \varepsilon_{it} \quad (4)$$

The fixed time effect U_{it} captures differences across the years of the study, and the inclusion of the importer's fixed effects captures preferential differences across importers. The idiosyncratic error term is captured by ε_{it}.

3.5 Estimation Techniques

Equation (1) will produce estimates of the impact of policy intervention $EXP_{it} * post2013_{it}$ on Y_{ijt} exports provided that unobserved differences between control and treatment groups' characteristics are controlled. This study estimates an Ordinary Least Squares (OLS) regression model with panel fixed effects to account for possible unobserved heterogeneity. Although fixed effects are included in the regressions, a parallel trend test is performed to ascertain the model's applicability. A crucial basis for the applicability of the DID approach is to ensure that both treatment and control groups share a common trend before policy shock (Alshubiri et al., 2020). Therefore, Equation (1) is estimated using Placebo treatments.

Placebo treatment assigns policy intervention to exports that were not processed in one period and compares the outcomes to exports also not processed in a previous period. The processed and unprocessed exports are compared before policy intervention using export data between 2001 and 2013. Observations between 2001 to 2008 provides data for the control group, and observations between 2010 and 2013 form the treatment group. The year 2009 is omitted to avoid misspecification error. If there are parallel trends before policy implementation, it is anticipated that the export performance of processed seafood exports will be better than for unprocessed exports. However, if results yield insignificant estimates, then export outcomes are the result of policy intervention.

4.Results and discussion

4.1 Descriptive statistics

The summary statistics on the export performance outcomes of the pre and post-intervention periods are presented in Table 2. The data is disaggregated into the pre- and post-intervention periods to obtain the summary statistics for both groups. Before the policy implementation, there was no significant difference in export between the control and treatment groups. However, after the industry implemented the policy, the export performance of the treatment group was significantly higher than the control group. After policy intervention, processed exports (treatment

group) averaged at 26.87 metric tons, while unprocessed exports (control group) averaged at 20.57 metric tons.

Table 2: Summary statistics before and after policy intervention.

		Before 2014		After 2014	
Variables		**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Y_{ijt}	Control	15.75	0.74	20.57	0.79
	Treatment	14.65	0.74	26.87	0.51
Pop_{jt}	Control	16.75	1.78	16.73	0.78
	Treatment	16.65	1.78	18.12	5.7
$PROD_{jt}$	Control	11.99	1.93	12.83	1.70
	Treatment	11.99	1.93	12.83	1.70
K_{jt}	Control	7.16	2.23	7.16	2.06
	Treatment	7.16	2.23	7.16	2.06
	Observations	377	377	174	174

Source: Author estimates.

4.2 Difference – in - Differences Panel Analysis

Table 3 presents the results of Equation (1) using Placebo treatments. As discussed in the Methodology section above, the basis for the applicability of the DID approach is to assess the effectiveness of policy intervention, for the purpose of establishing whether both treatment and control groups present common trends before policy intervention. Therefore, both treatment and control groups need to share a common trend before the policy shock. If processed seafood export performance is higher than unprocessed seafood for other reasons than the policy shock, the results would be invalid. The results of the Placebo test indicate a statistically insignificant result of 0.09, therefore, no evidence of improved export performance before the policy shock was found. Hence, the DID model can be applied to evaluate the impact of the policy intervention.

Table 3: Evidence in support of the DID estimation (Placebo treatment)

Variable	Placebo
$EXP_{ijt} * post2013_{it}$	0.09
	(0.23)
EXP (treatment)	0.68
	(0.58)
Post 2013	1.42***
	(0.19)
Pop_{it}	3.73***
	(0.65)
$PROD_{jt}$	0.80***
	(1.79)
K_{jt}	-0.04
	(0.03)
R^2	0.78
Time fixed effects	√
Importer fixed effects	√
Observations	348

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

The DID test in Table 4 reveal that there is significant evidence of the effectiveness of policy intervention for the full sample. The p-value of the treatment effect is significant at 1%, with the treatment having a positive coefficient. Since the result is significant, signifying the effectiveness

of policy intervention, further tests were conducted to establish the effectiveness after the inclusion of control variables. Table 5 presents the results of the panel DID methodology for export outcomes for the full sample. Models I and II present the results representing processed seafood export outcomes and market access in global and regional markets. Models III and IV present policy intervention results on importer preferences in regional and international markets.

Table 4: Estimating the D-in-D estimator

Before	
Control	2.825
Treated	3.071
Diff (T-C)	0.246
P – value	0.805
After	
Control	26.467
Treated	31.167
Diff (T-C)	4.700
p-value	0.001***
Diff – in – Diff	4.454
p-value	0.012**

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

The results of Model I show that policy intervention enhanced the export outcomes of processed seafood. The results imply that policy intervention increased processed exports by 3.92%, making it more valuable than unprocessed exports in global markets. Model II shows the impact of policy intervention on regional and international market access outcomes. The coefficient is positive and significant, meaning that processed seafood is 2.61% more competitive in international than regional markets. The market access results suggest that processed seafood export is more valued globally except in SADC markets. This fact highlights the importance of the Growth-at-Home strategy and export processing on Namibia's processed seafood export outcomes.

With regard to the other control variables, the results indicate that the importers' population significantly affects processed seafood outcomes. In contrast, the effect of Per capita income, which is a measure of purchasing power, appears insignificant. This finding implies that processed seafood exports are valued irrespective of the importing countries' wealth level. Importers' domestic seafood production has a significant positive impact on Namibia's processed export outcomes. This finding supports the view that Namibia's processed seafood products may be more valuable than importers' domestic capture and is consistent with the studies of Zhang and Tveteras (2019).

Table 5: The effect of the industrial policy on export performance

Variables	Model I	Model II	Model III	Model IV
$EXP_{it} * post2013_{it}$	3.92***	2.61*	1.72	3.81*
	(1.46)	(1.13)	(2.63)	(1.60)
EXP (treatment)	2.83	7.91***	4.93*	-31.94
	(3.09)	(2.18)	(2.97)	(27.71)
Post 2013	20.52***	14.33***	17.35***	15.89***
	(1.22)	(0.78)	(1.33)	(1.63)
Pop_{jt}	14.65***	19.15***	20.33	13.92**
	(3.22)	(3.10)	(4.84)	(11.96)
$PROD_{jt}$	1.02*	2.83***	2.20***	5.80***
	(0.59)	(0.48)	(0.60)	(1.11)
K_{jt}	0.06	0.03	-2.34*	0.04
	(0.21)	(0.15)	(1.03)	(0.10)
R^2	0.76	0.85	0.85	0.88
Observations	551	342	190	152
Time 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

The international market access outcomes might be biased due to a preference for unprocessed seafood exports, such as fresh and ungutted products. Therefore, for robustness check, Equation (3) is estimated using unprocessed exports. The results are presented in Model III of Table 5. The results show no evidence of biased outcomes. This finding implies that the industrial policy does affect regional exports of unprocessed seafood. The results in Model IV show that the industrial

policy enhanced the preference for packed seafood in European markets. These results imply that international importers prefer seafood packed in the forms such as: individual specifications of skin-on/off fillets or pin bone in/out; glazed hake steaks (with or without skin); frozen whole or dried; canned in different sauces; powdered fish soup for horse mackerel.

The preference for differentiated products can be traced to the industrial policy Growth-at-Home strategy, which focuses on industrial manufacturing and value addition and aims to develop value chains based on raw materials in Namibia. Although the policy targets value addition, its main objective is to limit the export growth of unprocessed seafood and increase gains from trade. Yet, even though this is the case, there are still unprocessed seafood exports. This practice could be why the Namibia seafood sector still faces constraints its export performance and competitiveness.

In Table 5, importers' population as a control variable is significant in European markets and insignificant in regional markets. This result suggests the preference for unprocessed seafood products in regional markets as compared to that of processed products in European markets. Processed seafood is generally more expensive, making it unaffordable in regional markets. Furthermore, given the low economic potential of regional importers as compared to European importers, unprocessed seafood exports tend to perform better in regional markets.

The domestic production variables carry positive signs and theoretically have the expected signs of land-locked seafood importing countries. An increase in domestic capture by regional importing countries results in a 2.20% increase in unprocessed exports. Interestingly, European importers' demand for processed seafood increases the export performance by 5.80%. These results suggest that while regional importers demand unprocessed seafood due to its intrinsic value, European importers prefer seafood products in a ready-to-eat and ready-to-cook state. There is some evidence suggesting that importers' per capita increases the export performance of processed seafood. Therefore, this study argues that processed exports should be concentrated in European markets due to the need to improve trade gains, limiting the growth of unprocessed exports for export re-processing.

Table 6 presents the DID estimation results for processed seafood outcomes in regional and European markets. These results show a negative impact in regional markets but a positive on European markets. This result further suggests that, as indicated previously in this study, regional importers prefer unprocessed seafood. For robustness checks, a sensitivity analysis is conducted and the results are presented in Table 7. Given that approximately 62% of the importing countries in the study are from the SADC region and European markets. The estimates for the full sample could be sensitive to the removal of European and regional markets from the analysis. Therefore, the study used a sample restricted to all importers except European and regional importers. The empirical results indicate that policy intervention enhances the export performance of processed seafood by 17.63 % at a 1% level of statistical significance. Therefore, these results are not sensitive to the removal of European and regional importers. In other words, the results are robust to the removal of European and regional markets.

Table 6: The effect of the Industrial policy in regional and international markets

Variables	Regional Effect	International Effect
$EXP_{ijt} * post2013_{it}$	-0.72*	0.50***
EXP (treatment)	1.58***	-23.26***
Post 2013	0.52*	-0.12
Pop_{it}	3.04***	9.35***
$PROD_{ij}$	0.13	0.82***
K_{jt}	0.27	0.01
R^2	0.57	0.83
Observations	190	152
Time 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

Table 7: Sensitivity analysis

Variable	$EXP_{ijt} * post2013_{it}$	EXP (treatment)	Post 2013	Pop_{it}	$PROD_{ij}$	K_{jt}	R^2	Obs	Time fixed effects	Importer fixed effects
Placebo	17.63***	21.02*	26.95***	0.34	-0.67	-0.54	0.81	209	√	√
	(2.75)	(12.3)	(2.22)	(4.67)	(0.93)	(0.40)				

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

5 Conclusions

A number of studies in the empirical literature have focused on the relationship between several policy interventions and export performance in the seafood sector. These studies have reported mixed results of the effectiveness of a policy intervention on export performance. However, there is a dearth of information on the effectiveness of a policy intervention which targets industrial upgrading for improved export performance and market access. With a balanced panel of 29 seafood-importing countries spanning the period 2001 to 2019, this study investigated the effectiveness of Namibia's industrial policy targeting technological transformation and improved market access on processed seafood outcomes in global markets. Also, the study examined the extent to which the policy intervention is effective in limiting seafood exports with little value addition and basic export processing for further export re-processing.

The Placebo results test provided evidence of the absence of an improved export performance before policy intervention. The results of the DID estimator for the effect of policy intervention for the full sample suggested that technological transformation enhanced the processed market

outcomes through consumer preference channels. The results in regional and international markets reveal that processed seafood export is more valued globally than in SADC markets. This result suggests that the objectives of the Growth-at-Home strategy of the industrial policy are not fully met for the study period.

The key findings from the DID results are as follows: (i) the industrial policy is effective in enhancing processed seafood outcomes in global markets, however, it is more effective in European than regional markets; (ii) while the technological transformation policy enhanced the export of differentiated products in European markets, regional (SADC) importers preferred unprocessed seafood exports; (iii) importers' economic potential significantly enhances processed seafood export outcomes; (iv) Namibia's processed seafood products are more valued than importer domestic capture and (v) the export outcome in European markets indicates that the policy is effective in limiting unprocessed seafood for reprocessing.

The results of this paper suggest that the effect of the policy intervention on processed seafood outcomes cannot be generalised in all export markets and, likewise, is not applicable to Namibia's export competitiveness in all markets. The preference for products with low-value addition and basic processing in regional markets implies that regional market preferences are characterised by low economic potential, which determines the preference for low-value-added products that are relatively cheaper. The empirical findings further confirmed that after the policy shock, the export trends for processed and unprocessed seafood for the control and treatment groups diverged and could be the reason behind the faster growth of processed seafood and the fall in unprocessed seafood products and the resultant impact on export performance and revenue. The findings from the product differentiation imply that policy intervention opened-up new markets, especially in European countries. Since, the technological transformation policy is effective in mitigating the previously high levels of unprocessed products for export re-processing, policy makers and the seafood industry should focus on potential gains from the trade and invest in industrial upgrading to enhance the export competitiveness of Namibian seafood exports.

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Appendix

List of selected countries

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