British Journal of Economics, Management & Trade
11(2): 1-12, 2016, Article no.BJEMT.20305
ISSN: 2278-098X

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Analysis of Namibian Fishing Product Export Prospects and Diversification: Gravity Model Approach

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Authors' contributions

This work was developed in collaboration by the both authors, who contributed equally to the literature review and writing of the manuscript. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJEMT/2016/20305
Editor(s):
(1) John M. Polimeni, Associate Professor of Economics, Albany College of Pharmacy & Health Sciences, New York, USA.
Reviewers:
(1) Anonymous, Pennsylvania State University Berks Campus, USA.
(2) Zsuzsanna BACSI, University of Pannonia, Hungary.
(3) Yang Weiwei, Beijing University of Technology, China.
Complete Peer review History: http://sciencedomain.org/review-history/12278

Original Research Article

Received 21st July 2015
Accepted 7th September 2015
Published 12th November 2015

ABSTRACT

This study endeavoured to analyse Namibian fish export prospects and level of diversification through using a Gravity Model Approach on cross-sectional data, specifically testing whether a Random Effect or a Fixed Effect Model better suits the model. The B1 dummy variable for local competition was found to be highly elastic and a positive influence on fish consumption in export destinations, as the local fish production drives for high demand. Analysis followed of the distance and days to arrive to the destination, which were found to negatively influence trade, indicating that geographical location for Namibia, as well as economic scale of size, is negatively influencing fish trading owing to the fact that it has higher handling costs and degree of perishability. The study recommends that the Namibian fish sector should handle better the regulatory environment, which includes permits, tariffs and labour laws, and requires consolidation and coordination to achieve economies of scale for transportation. Furthermore, it is important to have consistent improvement in infrastructure.

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Keywords: *Namibia fish; diversification and gravity model approach.*

1. INTRODUCTION

Namibia has achieved and maintained considerable sound economic management, good governance and human rights respect. In addition to this well functional physical infrastructure, a market economy, rich natural resources, and a relatively strong public administration added value to the competitive advantage of the nation [1]. However, social and economic remains the biggest challenge, for example high income inequality (with estimated Gini coefficient at 0.59), high unemployment (with 29% unemployment rate) and high poverty incidence (with estimated rate of 21% of individuals consumption below $1.25/day) [1]. In addition to this, the country is vulnerable to short- and long-term environmental shocks. This due to all major sources of growth depends heavily on Namibia's fragile ecosystem. For example current currency depreciation cannot increase export potential to take advantage as it already operate at full capacity. On the other hand two years of subsequent drought hampered the meat industry heavily. These factors have made job creation difficult, and poverty and inequality remain a challenge to address [2]. In Namibia fishing and fish processing contributed about 3.6% of the country's GDP, while the mining and quarrying industry still remained the highest contributor at 12.4% in 2010 [3].

Since independence, Namibia has been known with good progress of natural resource conservation policy, with 43% of total land under conservation in 2012, and the country's entire 1,570 km coastline enjoying protected [1].

This paper also argues that, to derive maximum benefits from the fisheries sector, there is a need for diversification and increased investment. Thus, this will help to stimulate local economic development and employment. Diversification would also lower the sector's vulnerability to economic shocks that affect the export markets (like the recent financial crisis). Export development by means of market diversification creates trade through unlocking additional supply potential. The exploration and analysis of alternative markets will comprise an in-depth market analysis and supply strategies for the most lucrative export opportunities. This will allow the industry to make wise decisions, as the industry's profit potential is largely determined by how it positions itself in order to take advantage of opportunities and overcome potential threats.

1.1 Namibian Fishery Economic Performance

1.1.1 Output trend

Fisheries are one of the country's main natural resources, given its long shoreline stretching for hundreds of kilometres from South Africa to Angola. The value of fish and fish products production increased significantly between 1990 and 2003. Thereafter, it declined to 2008, but recovered consistently thereafter [4].

The graph in Fig. 1 above shows the percentage change in the value of fish processed onshore- and offshore. There is quite some variability in onshore processing, and from 2007, offshore processing has been increasing. This is a challenge for the government that wishes to increase the number of jobs in the sector, and such jobs cannot be located offshore due to capacity constraints.

1.1.2 Employment

Employment in the fishing industry has increased steadily over time. While a total of 2 784 people were employed in the sector in 1991, in 2011 the sector employed over 13 000 workers. Table 1 below shows the total number of employees in the sector since 2006 [4].

Employment in the sector grew steadily over the years, except for 2008 when there was a decline in employment. The three main subsectors in terms of employment are hake, small pelagic and horse mackerel production. Hake and mackerel production contribute significantly to exports. There are fears that some fish varieties are being overly exploited. The reduction of the number of vessels from nearly 270 in 2006 to below 200 by 2010 partly indicates this. Thus, companies have reduced their capacities in line with the Total Allowable Catch (TAC) changes instituted by the ministry [4].

1.1.3 Value-addition

The fishing sector is very important to the Namibian economy. It has great potential for value-addition. The hake industry has performed well over the years. The value added by the sector has been increasing, and it is used as a good example of what other subsectors can potentially do with respect to value addition. Overall, the fishing sector contribution to GDP remains relatively small, as shown in Table 3 below. Export value has been increasing over time, but the domestic market consumption value remains very low. The main challenge to value-addition is the high perishable and capital-intensive nature of the sector. In addition, the lack of initiative to develop a Namibia fish brand means it has not been possible to break into the high-end of the fish market [1].

Domestic consumption has generally been low in a country known for its beef exports and consumption. The government has been promoting local consumption of fish, and set up the Namibian Fish Consumption Promotion Trust in 2001. The trust's mandate is to ensure affordability and accessibility of fish to Namibians. It conducts awareness and public education campaigns around the country, educating the public about the benefits of consuming fish. To ensure affordability, the trust is allocated a quota every year. This allows it to catch fish, especially horse mackerel and hake, which it sells to the public at cost through its network of fish shops around the country [1].

1.1.4 Revenues

The fishing industry is a major earner of revenue for the government through corporate tax, licence fees and other levies. Of particular importance is the Marine Resources Fund levy which is collected to fund research, training and development in the fishing sector. This helps ensure sustainability and the effective management and exploitation of marine resources [1].

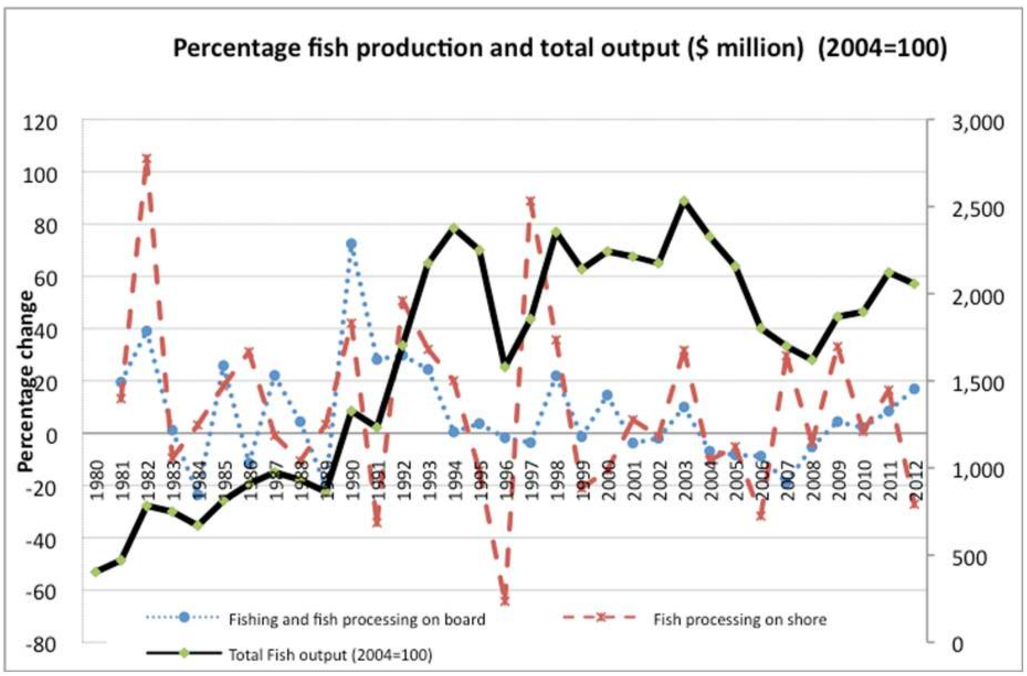

Fig. 1. Fish production volumes and value, 1980-2012
Source: [4]

Table 1. Breakdown of employment in the fisheries sector

Fisheries	2006	2007	2008	2009	2010	2011
Hake	7055	6701	6176	8956	--	--
Monk	235	236	239	350	--	--
Crab	53	58	50	81	--	--
Rock Lobster	369	342	342	455	--	--
Large Pelagic	878	688	740	593	--	--
Small Pelagic	2244	3247	3037	1361	--	--
Horse Mackerel	748	672	848	1029	--	--
Total crew	11 582	11 944	11 432	12825	12913	13000

Source: [4]

Table 2. Number of licensed vessels by fishery, 2006 – 2010

Fishery	2006	2007	2008	2009
Small pelagic	16	9	11	10
Demersal Trawlers	78	87	91	71
Long liners	39	30	18	18
Midwater	10	13	10	9
Deepwater	4	2	0	0
Large pelagic	65	67	88	48
Line fish	15	15	15	15
Crab	2	2	3	3
Rock lobster	18	32	31	29
Monk	22	20	25	16
Total	269	277	292	219

Source: [4]

Table 4 above shows a positive trend in the value of revenue realised by the ministry. Quota fees mainly drive the trend, although by-catch fees have been declining over time. As noted above, the Marine Resources Fund levy was set up to fund research and training that is specific to the fishing industry. Some fishing associations are concerned that the levy is too costly for them, while others are concerned that the quality of personnel trained for the sector is rather poor.

2. LITERATURE REVIEW

Researchers have suggested that developing countries' trade policies for development should be based on import substitution. Contrary to this, [5] study shows that growth prospects for developing countries are greatly enhanced through an export-oriented trade regime [5].

During the past three decades open economies have grown much at a far faster rate than closed economies with high protection. In addition fact, some of the economies that have followed import substitution policies experienced economic crisis and collapsed during the 1980s and 1990s [5]. Studies on open -economy growth show that the trade features that best foster economic growth are technology and investment.

The technology category has been supported mainly by [6-8,5], who highlight four benefits:

- An enlarged international market provides technological spillover effects;
- Economies categorised as open markets have led to an economy -of -scale advantage~~,~~ by encouraging research and development in the sector;
- An enlarged international market provides greater productivity from the adoption of new technology over time; and
- An open market avoids replication of research and development efforts.

The second investment category, however, argues that investment is the main link between trade and growth. [9] present three reasons to explain why investment fosters trade:

- The traded sector is more capital intensive than the non-traded sector;
- The production of investment goods uses imported intermediates; and
- Competition in the international market regarding machinery and capital equipment lowers the price of capital.

The empirical evidence on trade and industrial growth has two distinct strands. The first and perhaps largest body of research is based on cross-country studies (e.g. [10,11,6,12]. These studies have focused either on the direct impact of trade to industrial growth (the first three studies) or on total factor productivity (the last two studies) but all of these studies reach the broad conclusion that increased trade has a positive impact on agricultural industrial growth eventually lead to national economic growth. These studies have since been critically reviewed by [13,14], who has called their results into question.

The critique comprises the following elements: Firstly, is it really a meaningful question to ask whether outcomes or liberal trade policy help economic growth? Failure to specify the mechanism through which exports and imports affect growth, and measurement problems. Secondly, there are difficulties either in measuring trade policy or in picking up other effects (such as macroeconomic stability) [10]. Moreover, [11,12] questioned the robustness accuracy of using dummies to represent the effects of macroeconomic stability as alternative specifications.

The second strand in the empirical research comprises intra-country studies based on either plant or industry level (see e.g. Harrison, 1994 cited in [15]. The results of this strand indicate that the causal link between trade and TFP is less evident in the data. For example, Johansen (1988) cited in [15] suggests that while efficiency and trade orientation are correlated, the causation appears to run from the former to the

Table 3. Value added and its distribution

Value of production (N$ million)	2006	2007	2008	2009	2010	2011	2012
Landed value	3 146	3 772	4 290	5 087	3 749		
Final Value	3 985	4 843	5 084	4 789	4 060		
Value of exports	3 883	4 711	4 935	4 637	3 927		
Domestic market	102	132	149.6	152	133		
Contribution to GDP (2004=100)	3.84 %	3.44 %	3.17 %	3.70 %	3.53 %	3.74 %	3.45 %

Source: [1]

Table 4. State Revenue from the marine fishing industry, 2005-2010 (N$'000, current value)

Fees	2006	2007	2008	2009	2010	2011
Quota fees	68 299	107 218	59 255	68 800	78 500	120 947
Marine resources fund levy	12 446	12 561	12 075	18 733	19 228	14 497
By-catch fees	11 199	9 639	10 837	8 410	15 972	6 964
License fees	93	91	85	86	82	79
Total revenue	92 037	129 509	82 253	96 029	113 782	142 487

Source: [1]

latter in the sense that efficient firms tend to self-select export markets rather than openness, leading to increased efficiency. One of the few papers that examine the empirical relationship between trade and growth from a time-series perspective is Coe and Moghadam's [15] cited in study on France. They found a robust long-run relationship among growth, factor inputs~~,~~ and openness (which is intended to capture the effects of TFP).

The lack of a strong theoretical framework for trade liberalisation and TFP and the puzzling empirical evidence is a call for further research. Therefore, this study examines the determinants for Namibia fish export pooled cross -sectional and time -series analysis.

3. METHODOLOGICAL AND DATA APPLICATIONS

3.1 Data Source

3.1.1 Data description

Data source was from the Ministry of Fishery and Marine Resource (MFMR) for 2009 – 2013 cross-sectional data applications, which is possible available from MFMR. In addition to this United Nations Conference on Trade and Development (UNCTAD) panel and cross-sectional dataset on frozen mackerel and frozen fillets (HS0303) and (HS304) respectively, across thirty specific products data. Given the panel nature of the data, it is more efficient to apply panel data econometrics so as to fully exploit the time and cross-sectional elements of the data.

3.2 Methodological Application

Vido and Prentice [16] examined the impact of using value and distance as proxy variables for quantities shipped and transport costs, respectively; and they compared statistical variation of other sources of variation between value and quantities. Using [16] instead of using Ordinary Least Square (OLS), the study preferred to using "Random effect" since the nature of data was panel or cross-sectional data.

With panel/cross-sectional time series data, the most commonly estimated models are fixed effects and random effects models. However, to choose between a fixed effects and a random effects model, the following considerations were important [17]:

i. Nature of the variables omission: (a) if there are no variables, but in case if there are omitted variables and are uncorrelated with the explanatory variables that are in the model – then a random effects model is the best to use. It produces unbiased estimates of the coefficients, uses all the data available, and produces the smallest standard errors. And (b), if there are omitted variables, and these variables are correlated with the variables in the model, the fixed effects models then provide a means for controlling for omitted variable bias. The omitted variables which have effects on the subject at one time, will also have the same effects at a later time; hence, their effects will be constant, or "fixed" [18].

ii. Random effect assumes that the individual specific is a random variable that is uncorrelated with the explanatory variables of all past, current and future time periods of the same individual [19].

  The standard form of the test, called the "Wald test", is used to test linear hypotheses that can be represented by a single matrix. If one wishes to test a non-linear hypothesis of the form, that testing the effect of dummy variables is the same or not. That is random effect testing against hypothesis that is each and every will have the same effect; if this found to be true instead of using random effect it would be fixed effect.

  Random effect assumes that the regressors including a constant are not perfectly collinear, and that all regressors (but the constant) have non-zero variance, with not too many extreme values [19]. In addition to this, it is assumed that the individual-specific is a random variable that is uncorrelated with the explanatory variables of all past, current and future time periods of the same individual.

  The Hausman test can be also used to differentiate between a fixed effects model and a random effects model in panel data. In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while under the alternative Fixed effects (FE) is at least consistent and thus preferred [17].

In this study, the model is derived from Prentice et al. (1998) (cited in [16]). It is the simplest form of the gravity model (as cited in [16]). It has been applied to the category of lentils shipped exclusively in containers, which was used as a test commodity and applied in [20], and which we have also applied in this study:

$$\ln Qijt = \alpha + \beta 1 \ln Dijt + \beta 2 \ln Yjt + \delta 1 B1jt + \delta 2 B2jt + \delta 3 B3jt + \delta 4 B4jt + eijt \quad (1)$$

$$\ln Vijt = \alpha + \beta 1 \ln Dijt + \beta 2 \ln Yjt + \delta 1 B1jt + \delta 2 B2jt + \delta 3 B3jt + \delta 4 B4jt + eijt \ldots\ldots .. \quad (2)$$

Qijt is the quantity of fish exports from origin ***"i"*** to country of destination ***"j"*** in time ***"t"*** in terms of container loads, from Namibia to different countries worldwide, obtained from the UNCTAD. ***Vijt*** is the value of fish exports expressed in constant US dollars.

Dijt is the ocean distance (in nautical miles) from the port of Walvis Bay to the nearest port of entry, as found at http://www.sea-distances.org/ Transportation cost as a proxy in this study was captured using ocean distance to the ports and number of days to arrive the destination. Although transport cost is influenced by distance, accessibility, packaging, weight, and perishability, value of the product and economy of scale also affect the computation. However, due to limited information, the impedance factors we have applied/considered in this study were only distance itself and the number of days which goods take to arrive to the destination. In addition, the following assumptions were also considered (i) for neighbouring countries, it was assumed that land transportation system would be applied, (ii) for landlocked countries, ocean distance to the next port, plus land transport to the capital city, was considered, and (iii) no assumptions were made as to transit time, or the time elapsed between the transport of goods and their ultimate sale, and (iv) the number of days for the sea transit were estimated using 10 nautical miles per day.

Yjt is defined as the importing countries' income (Gross Domestic Product – GDP) in constant US dollars, as obtained from the [1].

A dummy variable, ***B1***, is used to identify competing fish production in importing countries, which is assumed for all the coastline countries. The dummy variable was set to unity if the importing country produced fish domestically, and zero otherwise, as it had been applied in [16]. This model uses two dummy variables to distinguish high-volume, relational trade linkages, from low-volume spot market trade flows.

Discussions with exporters revealed that they enjoy long-term relationships with some markets, while other markets may only emerge at random when some local shortage appears. The former markets are consistent importers and import disproportionately large volumes. The "spot market" regions have relatively small volumes and do not import every year.

B2 identifies those markets that consistently import, which in this study are considered as being those countries which have imported fish from Namibia every year for five years, irrespective of actual volumes; and it is set to unity if countries import every year, and zero otherwise. ***B3*** distinguishes large importers from small importers; those countries importing more than 1% take one, otherwise zero. ***B4*** distinguishes rich countries from poor countries; it was set to unity if the importing country is a member of the Organisation for Economic Cooperation and Development (OECD), and zero otherwise. The above dummy variable approach best explains the diverse platform of global fish trade, in a similar way as it had been applied to lentil trade by [16].

4. EMPIRICAL FINDING OF GRAVITY MODEL

Table 5 below presents the results for "***Random Effect***" for aggregated pooled all fish commodities (products) that Namibia is exporting, which are further disaggregated to specific products. These include fish, frozen & whole (HS product code 303) and fish fillets and pieces, fresh, chilled or frozen (HS product code 304). The highlighted yellow shows the test for "***Random effect".*** As on Table 5 both ***"correlated random effects – hausman test" and "wald test***" shows it is significant at 1% suggesting applying "***Random effect"*** is right.

Table 6 below presents an analysis of HS product code 0305 (for fish, cured or smoked and fish meal fit for human consumption). Because of the limited observation for HS product code 0305, which leads to lack of variability (heterogeneity) among the observations, a non-parametric estimation (that is, a weighted least square analysis) was a necessary method, or right estimator, to use.

Disaggregation of Namibian exports to Harmonized Commodity Description and Coding System (HS) product codes provides an opportunity to examine the effect of product differentiation. Although Namibia exports different fish products, only HS products 303, 304 and 305 are found to be exported to more than ten countries, which is relevant for statistical analysis purposes.

4.1 Transportation Costs

Since transportation costs make up a significant component of the final cost of the delivered product, as indicated in [16], and accounted for 60 %, we would have expected high elasticity. The two proxies of transport cost (distance and number of days to arrive) in this study were found to be significant at aggregated level, at 5 % in both quantity and value level analysis (distance and number of days to arrive) cases. Whereas, at specific product level it is significant at 10 % for both variable cases, the elasticity was found to be more than two, implying that the impact of transport is very high in influencing trade with partner countries. Differentiated goods in monopolistic competition and homogeneous goods with bilateral imports are more sensitive to distance and number of days to destinations. Therefore, (i) the geographical location of Namibia as regards trading partners, (ii) the capacity of local fishing companies to fill economic scale to transport, and (iii) the fishing quota permits required for Namibians have only limited the export capacity of Namibia. Only those companies which fish and process in the ocean, and export, become more profitable, owing to the apprehensive market and the economy of scale required to export their products. For example, an interview with the Namibian Tuna and Hake Longlining Association (NTHLA) noted that the main challenge facing its members is the high cost of operations, particularly because the majority of the vessels that operate in the sector are foreign-owned, mainly by South African companies. Of the seven locally owned vessels, only two were seaworthy. The significant dependence on South African vessels shows the vulnerability of the sector in the sense that if no vessels were to come from South Africa, then there would be no longline fishing. Many of the quota owners cannot put together enough money to buy their own vessels, and financial institutions are sceptical of lending the required large amounts of money to the operators. In addition, the operations of the sector are threatened by seismic activities of oil explorers.

4.2 Income Effect

Disposable income reflects both the size of human population and the per capita income to represent potential market size. Across the different products traded, the effects of the importers' GDPs are positive and statistically significant (although it was found not significant in 0303 value product base analysis). However, the estimated coefficient was found to be inelastic in all cases, with less than 0.50 responses. These results suggest that fish exports are inelastic to changes in foreign incomes. This may be because fish comprise a protein-rich, staple food source for many of the world's population, and also that it is time-sensitive with a high demand. Therefore, regardless of income, fish as main dietary source of food is not much influenced by income level.

Table 5. Pooled cross-sectional (2009 to 2013) for all pooled fish product and product-specific product using random effect

Variable	All commodities				0303. Product code				0304. Product code			
	Quan		Value		Quantity		Value		Quantity		Value	
	Coeff	**P-V**	**Coeff.**	**P-V**	**Coeff.**	**P-V**	**Coeff.**	**P-V**	**Coeff.**	**P-V**	**Coeff.**	**P-V**
C	16.36	0.00	17.12	0.00	17.08	0.00	21.88	0.00	22.24	0.01	16.50	0.12
	4.26		(4.46)		(5.09)		(6.18)		(7.92)		(10.68)	
DIS	(1.61)	0.02	(1.86)	0.02	(1.57)	0.07	(2.45)	0.02	(2.68)	0.05	(1.76)	0.06
	(0.71)		(0.80)		(0.85)		(1.06)		(1.33)		(1.76)	
DAYS	(1.28)	0.04	(1.46)	0.04	(1.23)	0.10	(1.65)	0.07	(2.00)	0.09	(1.30)	0.10
	(0.63)		(0.70)		(0.73)		(0.92)		(1.18)		(1.60)	
GDPC	0.30	0.00	0.14	0.04	0.39	0.00	0.12	0.37	0.31	0.08	0.25	0.00
	(0.09)		(0.09)		(0.11)		(0.13)		(0.18)		(0.17)	
B1	2.09	0.00	2.05	0.00	2.68	0.00	2.02	0.00	2.31	0.00	2.92	0.10
	(2.09)		(0.23)		(0.28)		(0.31)		(0.41)		(0.43)	
B2	0.22	0.59	(0.04)	0.92	0.53	0.27	(0.21)	0.69	0.59	0.52	0.57	0.51
	(0.22)		(0.42)		(0.48)		(0.53)		(0.92)		(0.16)	
B3	0.55	0.01	0.28	0.2	0.48	0.05	0.35	0.23	1.83	0.00	0.24	0.59
	(0.55)		(0.22)		(0.26)		(0.29)		(0.38)		(0.45)	
B4	0.23	0.32	0.52	0.04	(0.07)	0.79	0.60	0.07	0.07	0.88	1.10	0.03
	(0.23)		(0.25)		(0.24)		(0.33)		(0.46)		(0.50)	
R-squared	0.23		0.20		0.35		0.23		0.34		0.32	
Adjusted R-squared	0.22		0.19		0.31		0.21		0.31		0.28	
Prob (F-statistic)	0.00		0.00		0.00		0.00		0.00		0.00	
Durbin-Watson stat	1.73		1.66		2.42		1.65		1.58		1.52	
Observation	445		425		254		222		133		137	
Correlated random effects – Hausman test												
Cross-section random	**0.00**		**0.00**		**0.00**		**0.00**		**0.00**		**0.00**	
Wald test												
F-statistic	0.0000		0.0000		0.0000		0.0002		0.0092		0.0005	
Chi-square	0.0000		0.0000		0.0000		0.0001		0.0073		0.0003	

Product code 0303: Fish, frozen, whole, Product code 0304: Fish fillets and pieces, fresh, chilled or frozen
Product code 0305: Fish, cured or smoked, and fish meal fit for human consumption

Table 6. Weighted least squares analysis

Variable	305.00			
	Quantity		Value	
	Coefficient	P-value	Coefficient	P-value
C	12.70	0.24	12.45	0.16
	(10.62)		(8.80)	
DIS	-1.97	0.24	-1.84	0.19
	(1.66)		(1.40)	
DAYS	1.68	0.301	1.59	0.24
	(1.61)		(1.36)	
GDPC	**0.519**	**0.0**	**0.43**	**0.016**
	(0.18)		(0.17)	
B1	**1.00**	**0.0**	**1.25**	**0.003**
	(0.38)		(0.40)	
B2	(0.68)	0.448	-0.06	0.91
	(0.89)		(0.70)	
B3	(0.72)	0.1	-0.57	0.21
	(0.45)		(0.46)	
B4	(0.94)	0.072	-0.16	0.11
	(0.51)		(0.47)	
R-squared	0.61		0.61	
Adjusted R-squared	0.37		0.37	
Prob (F-statistic)	0.01		0.00	
Observation	58		65	

For example, a report from [20] shows that fish consumption has undergone major changes over the past four decades. World apparent per capita fish consumption has been increasing steadily, from an average of 9.9 kg in the 1960s to 11.5 kg in the 1970s, 12.5 kg in the 1980s, 14.4 kg in the 1990s, and reaching 16.4 kg in 2005. However, this increase has not been uniform across regions. In the last three decades, per capita fish supply has remained almost static in Sub-Saharan Africa. In contrast, it has risen dramatically in East Asia (mainly in China) and in the Near East/North Africa region. China has accounted for most of the world growth; its estimated share of world fish production increased from 21 per cent in 1994 to 35 per cent in 2005, when Chinese per capita fish supply was about 26.1 kg. If China is excluded, per capita fish supply is about 14.0 kg, slightly higher than the average values of the mid-1990s, and lower than the maximum levels registered in the 1980s (14.6 kg). Preliminary estimates for 2006 indicated a slight increase in global per capita fish supply to about 16.7 kg [20].

The global increase in fish consumption tallies with trends in food consumption in general. Per capita food consumption has been rising over the last few decades. Nutritional standards have shown positive long-term trends, with worldwide increases in the average global calorie supply per person and in the quantity of protein per person. However, many countries continue to face food shortages and nutrient inadequacies, and major inequalities exist in access to food, mainly owing to very weak economic growth and rapid population expansion [17].

4.3 Dummy Variables

The competitive dummy variable (B1) was intended to capture the effects of competing domestic supply sources. It is statistically significant and positive in all regressions. The positive elasticity suggests that fish producing countries have a higher propensity to consume fish than countries with no local production. When local production does not satisfy domestic demand, fish must be purchased from international markets. Furthermore, as indicated above the demand for fish is increasing as a result of population growth, urbanisation and economic growth. As a result, the demand shows high elasticity, implying that increasing competitiveness at local level means an increased promotion of fish that might equally benefit both exporters and local producers. The dummy variable for importers (B2) was found to be not significant. Large Importer (B3) was intended to distinguish the larger import markets from the smaller ones. However, either being bigger importer or small importer does not make much difference as the estimated coefficient shows it mixed results at aggregate level in terms of influencing the export capacity. That implying that size of export is dependent on value. The B4, denoting rich countries (OECD countries) which found to be not significant to influence the magnitude of export capacity.

In Table 6 below, only the income effect and dummy variable for rich county importers were found to be significant, but this does not necessarily mean the international trade dynamics, rather that the statistically required data observation influenced the results.

5. CONCLUSIONS AND RECOMMENDATIONS

Both the distance and days to arrive and the income elasticity of Namibian fish exports were found to be high and negative, as expected. This indicates that geographical location for Namibia and economic scale of size are influencing the fish trading. The stronger negative effect of distance on products is consistent with the fact that fish products are the most expensive to transport because they have higher handling costs, given their degree of perishability. As indicated in [21], perishable goods face three types of costs; physical shipping costs, time related costs, and the costs of unfamiliarity (clearing at the destination).

With regard to reducing transport costs for Namibian fish, it is most important to have improved communication systems which allow for better coordination in the region in order to provide an advantage of economy of scale in fish bulk transportation, to reduce spoilage and allow the substitution of cheaper ocean shipping routes, and to negate government-to-government inefficient inspection and customs services.

While income growth and trade liberalisation around the world are generally believed to be key determinants in the expansion of global food and agricultural trade, advances in technology that have lowered transportation and communication costs have also contributed to this expansion. As a result, in this study GDP per capita was found to be significant and to positively influence the demand for Namibian fish, depending on different countries' preference or habit of diet for specific food. However, the general response as regards elasticity for food items is inelastic, which represents the portion of income already allocated for food items and constitutes an important element of their daily expenditure. The finding of this study implies that, inasmuch as the Namibia fish industry could increase its export capacity, income level would not influence the demand for fish.

Surprisingly, the findings of this study show that the impact dummy (B1) for local competition is highly elastic and positively related. The estimated coefficients for the log of B1 for all fish product major categories range from 2 to 2.9, which means that when the local supply drives to increase demand by 1 per cent, the local demand for Namibian fish will increase by around 2 per cent, clearly indicating that there is high demand for the fish product.

The complex regulatory environment which is reflected, for example, in the issue of fishing permits for the production side and in the regulation of local transportation, reduces the competitiveness of the fishing industry. Regulations in Namibia regarding export tariffs, labour laws, security and safety all impose additional transport costs.

Economies of scale are among the critical issues for success in international trade, and since the Namibian economy is small, it is very important to consolidate the transport route and also any other commodities transport. Furthermore, it is also important to consider regional coordination with other fish producing countries in the region so as to complement one another along the supply chain, rather than competing with them for the available markets.

When considering infrastructure, it is noted that the efficiency and capacity of transport modes and terminals have a direct impact on transport costs. The Namibian port infrastructure requires consistent maintenance and improvement, as poor infrastructure results in higher transport costs, delays and negative economic consequences. More developed transport systems tend to have lower transport costs, since they are more reliable and can handle more movement.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/12278