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Quantifying the Effect of Non-Tariff Measures and Food Safety Standards on India's Fish and Fishery Products' Exports

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QUANTIFYING THE EFFECT OF NON-TARIFF MEASURES AND FOOD SAFETY STANDARDS ON INDIA'S FISH AND FISHERY PRODUCTS' EXPORTS

Veena Renjini K K[1]

Abstract

Global food trade, especially in the processed form like ready-to-eat items, tends to increase with an increase in global income with more demand emanating from the developed world. However, to trade with the developed world, national standards need to be elevated to international standards. It would also save the trade-image of the country. Under a multilateral trading system with a progressive reduction in tariffs, Non-Tariff Measures (NTMs) appear overwhelming. The issue here is that although India's fishery sector enjoys a comparative advantage, blessed as it has been with its natural factor endowment, the food safety standards and other requirements imposed by the importing countries are major impediments to its growth. International trade in the fisheries sector is dominated by A, B and C classification of NTMs including SPS, TBT and Pre-Shipment inspections. In bilateral trade relations, it is reflected in the across-the-border rejection of consignments. This calls for a scrutiny of the underlying causes hampering the compliance challenge. Using the inventory method of frequency indexing and a gravity exercise for quantifying trade effects, this study brings forth the trade restrictive nature of NTMs.

Keywords: Comparative Advantage, Non-Tariff Measures, Frequency Index, Gravity Model, Random Effects Model.

JEL No: **F13&F14**

Introduction

Progressive reduction in tariffs and quantitative restrictions on trade have shifted attention to the impact of TBTs, which, while not having the restriction of trade as a primary objective, can act as an impediment to the international flow of goods and services (Skies, 1995). India enjoys a comparative advantage in both production and export of various species of fish; the fishery sector occupies a niche among agricultural products. However, in view of fish being a food item with most of its products entering the international market in some processed form, it is imperative that the products satisfy both product and process standards. Therefore, these products, with a comparative advantage created by the underlying economic factors, are very often affected by the food safety standards (in terms of compliance) and other environmental policies of the importer country. An evaluation of the persistence of Non-Tariff Measures (NTMs) shows that most of the fish and fishery products are affected by SPS, TBT and Pre-Shipment Inspections. These three measures are together called technical measures as per UNCTAD classification. When trade is constrained by food safety and quality constraints, the issue can be addressed only if national standards are elevated to international standards. The main drawback associated with NTBs and NTMs is the uncertainty that surrounds them which, in turn, restricts capacity

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utilisation and further investment. It is the case with fishery sector exports from India that one item itself is subject to multiple NTMs and its spillover on trade is interactive. A country-wise comparative analysis of the relative rejection rate of fish and fishery products is classified as high in India with regard to EU and medium with regard to USA (UNCTAD, 2013). Thus, the convolution of trade flows in the fishery sector throws up avenues for the researcher in terms of estimating the trade effects of these standards.

In the context of bilateral trade relations, the impact of trade standards may be reflected, prima facie, in the rejection of consignments on crossing the border. A scrutiny of the underlying trends and patterns of rejections exposes a real compliance challenge for developing countries with regard to fishery sector and its exports. The non-conformity to international standards results in the failure of consignments crossing borders. Intuitive analysis reveals problems across markets, products and areas of compliance. Food safety standards like volume restraining measures act as NTBs to trade. Health and environmental safety precautions are a major concern in the context of developed countries with the outcry for these precautions leading to the tuning of production techniques and commodities as per their requirements with far reaching implications for market access and trade.

Therefore, this paper examines and tries to quantify the NTMs persisting in the sector and to understand the trade effect it creates, relying on the methodology of frequency indexing and a gravity equation in a panel data framework. A brief introduction highlights the issues associated with the percolation of NTMs in the fisheries sector while Sections I and II present a review of theoretical and empirical literature. The third section presents a brief discussion of the methodology adopted by the study with a specification of variables and data sources. The fourth section explains the prerequisites of the importing country, the rules, regulations and directives that restrict the entry of food items followed by a brief discussion of the rationale behind the border rejections. The fifth section quantifies the NTMs prevailing in the fisheries sector and tries to estimate their impact on its trade. The last section concludes with findings and a discussion of the results.

1. Non-Tariff Barriers and Non-Tariff Measures: A Distinction

UNCTAD makes use of NTBs and NTMs with a line of distinction. The term "measures" takes in all the instruments that may be used as barriers. As per UNCTAD classification, NTMs are more product-specific, whereas NTBs are imposed according to a tariff line. NTMs are the policy-related trade costs incurred from production to final consumers excluding tariffs (UNCTAD, 2013). Although, Beghin and Bureau (2001) argue that both these terms are synonymous in that they explain the trade-off involved in trade restrictiveness. The present paper follows the classification UNCTAD attached to Appendix A.

It is increasingly recognised that NTMs have significant potential of impeding trade through the imposition of compliance costs and difference in compliance capacity (Maskus and Wilson, 2001). These measures are technical barriers; the question is what constitutes a technical barrier to trade. Broadly, TBTs are embedded in the broader concept of NTBs that Hillman (1991) defines as all restrictions, other than traditional customs duties, which distort international trade. In many cases, the terms NTB and TBT are used interchangeably (Beghin and Bureau, 2001), although the former includes some traditional trade barriers such as quantitative restrictions which are not covered here.

1.1. The Percolation of NTMs in Restricting Fisheries Sector's Trade

An investigation into the trade restrictive factors reveals that the incidence of NTMs dominates the fisheries sector's trade. As per UNCTAD classification of NTMs, the chapters being A, B and C respectively which encompass SPS, TBT and Pre-Shipment Inspection and Other Formalities – the technical measures. Most of the precautions that are to be considered while trading with EU countries (which duplicates as NTMs) include geographical restrictions on eligibility (A120), special authorisation for SPS reasons (A140), tolerance limit for residues (A120), labeling requirements (A310), packaging requirements (A330), hygienic requirements (A400), microbiological criteria (A410), storage and transport conditions (A640), testing requirement (A820), certification requirement (A830), inspection requirement (A840), traceability information requirement (A850), other TBTs, pre-shipment inspection requirements etc. These measures are essentially trade and food safety standards and it has been much debated and researched (Robert & Unnevehr, 2005) within the WTO forum with an increased emphasis on SPS measures. However, the apprehension centers on the ability and aptitude of developing countries to cope with the stringent SPS requirement (Henson and Loader, 2001). The sunk-cost associated with elevating the SPS apparatus has different interpretations among the WTO members. It requires pertinent action from government in aiding and boosting the sector in the face of food safety risks and other animal and plant health risks, product quality etc. These restrictions and distortions in the international market constrain a country's ability to expand exports from a sector that enjoys comparative advantage.

2. Related Literature

The tarrification process initiated at the WTO forum since the Uruguay Round might have shown the way for governments to rely on technical barriers[2] (TBs), more particularly the sanitary and phytosanitary[3] (SPS) barriers, to protect producers and the sector. Since it is subject to quantification issues and is highly qualitative in nature, a comparison with other trade barriers becomes difficult. However, the following theoretical framework evaluates the trade barriers that are more severe than tariffs.

2.1. A Theoretical Review of literature

Under free trade, specialisation based on the concept of comparative advantage leads to gains from trade for producers as well as for consumers, protection in any form leads to a loss of consumers' and producers' surplus. However, it is important to note that the Pareto Optimality Assumption of trade conditionalities is an imaginary situation and that a country's own policies and those of its partners do deviate from free trade.

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[2] Technical barriers are defined as import standards or regulations that reflect a country's concern and valuation with respect to safety, health, food quality, and the environment.

[3] SPS measures are related to food safety and animal and plant health; food standards of definition, measurement, and quality; and environmental or natural resource conservation measures (ibid). The members were given freedom to determine their own level of protection based on a sound scientific base and to go for even a zero-risk tolerance level.

Any trade barrier operates through one or more of the following ways: (i) it limits the quantity of imports; (ii) it increases the cost of getting imports into the market; (iii) it creates an element of uncertainty under which imports are permitted. As discussed, the standards persisting in the fisheries sector, the technical and product standards, import licensing and other customs procedures etc., – have their effects by way of curtailing quantity, increasing the cost, inflating the price and uncertainty. Stringent regulations can be a safety net for domestic producers though hardly contributing positively to government revenue. The standards can bring about a net gain in the overall wellbeing to the extent of protecting health and safety. However, governments could masquerade precious protectionism in righteous attire (Pugel, 2008).

2.2. An Empirical Review of Literature

Jaffee and Henson (2004) inferred the value of rejected consignments to examine the loss incurred that distorts trade. Calvin and Krissoff (1998) tried to measure the TB tariff equivalents for Fuji apples and trade and welfare effects associated with removal of trade barriers in the context of US-Japan apple trade and the allied dispute. Based on a partial equilibrium model developed by it, the study measures the trade and welfare impacts of reduction in trade barriers by way of estimating a tariff rate equivalent as part of measuring the magnitude of TBs with a price-edge approach. The analysis concludes that TBs existing in Japan are more likely to be more significant than tariffs in deterring trade.

Swann *et al* (1996) and Moenius (1999), while reviewing the various economic hypotheses with respect to trade and standards, found that practically any hypothesis has support. Swann *et al* (1996) regressed British net exports and imports over the period 1985-1991 on counts of voluntary national and international standards of the United Kingdom and Germany and discovered that British national standards tended to raise both imports and exports.

Wilson and Otsuki (2003) while analysing the trade-off involved in food safety precautions and agricultural trade, tried to understand how international standards set for food safety impacted export prospects of the less developed countries. The paper estimated the effect of differing aflatoxin standards on exports from 21 countries with respect to 15 importing countries, while arguing that instead of going in for divergent national standards, world trade would increase with an international standard.

In March 1999 Henson and Loader (2000) estimated the impact of SPS measures on the ability of developing countries to access the market domain of developed countries, especially the EU, based on primary data from low and middle income countries, as classified by the World Bank (1998), that happen to be members of the WTO and CODEX Alimentarius. The authors, while drawing qualitative statements, conclude that SPS measures are the real trade barriers.

Wilson and Otsuki (2003) and Henson *et al* (2005) estimated that US$557,000 per plant (1.7 per cent of the total export value to the EU based on a field survey) was required to ensure HACCP facility for Indian fish products. The spread of product related environmental standards across foreign markets adversely affected India's exports (Chaturvedi & Nagpal, 2003). On the contrary, Kumar *et al* (1988) found that tariffs in the developed market economies did not pose a serious barrier to India's exports. The gains associated with market access under WTO negotiations may be eroding as a result of

NTMs (Kumar and Kumar, 2003) because the lifting of tariff barriers has been frequently accompanied by the introduction of new and less direct barriers in the form of technical regulations and standards.

3. Data Source, Description of the Variables and Methodology

3.1. Data Source and Description of the Variables

The dependent variables for all the models are the export values of a given commodity or commodity group from India to an importing country. The classification of commodities on the HS 1992 system provides data from 1995 while the export related data are sourced from the UNCOMTRADE. The commodity groups included in the study are fish and aquatic products (03). The commodity group effects are analysed at 6-digit level. The period covered by the study is from 1995 to 2012.

The importing country's gross domestic product is incorporated for capturing the purchasing power and the demand effect sourced from the UNCTAD statistical abstract database. The bilateral distance between India and each importing country is assessed from the CEPII database and is the geographical distance between the capital cities of the two countries. The values of Maximum Residue Limits (cadmium, mercury and lead) are mainly from the database of Food and Drug Administration of the Department of Agriculture of the United States (USFDA), the CODEX database, Europa, different country-specific reports that provide MRL standards of the corresponding country like MHLW reports etc.

3.2. Quantifying the Non-Tariff Measures

3.2.1. Methodology of the Present Study

Given the constraints of the study like the availability of data and the feasibility to carry out 0bjectives, the present study relies on the inventory approach of frequency indexing as it has an advantage over the coverage ratio. To quantify the trade effect, a gravity approach based on a panel data framework related to India's 32 trade partners over the period 1995-2012, with MRLs as the regulatory variable along with the resistance variables is adopted[4]. The rationale behind considering heavy metals as the regulatory variable is that fish and fishery products in the overseas markets are detained owing to the presence of heavy metals and, furthermore, that it is well quantifiable. Thus, following the methodology developed by Wilson and Oksuki (2003), it may readily be used as an independent variable. It favours the random effects model, hence the analysis solely centers on its essential assumptions.

4. NTMs: An Analysis of Rules and Regulations

It is now understood from the preceding discussion that NTMs are hidden and the reliable data source regarding NTMs prevailing in a country/commodity is provided with GATT notifications, government publications like Import Refusal Reports, customs tariffs, laws and regulations through which the country resists imports etc. Therefore, the study attempts to unravel the rules and regulations

[4] Rate of exchange, the choice of the currency in which trade transactions are taking place, trade openness of the exporter are important variables but excluded from the regression as the intention focused on assessing the impact of standards by taking quantifiable regulatory variables controlling for the scale effect in gravity equation framework.

framed/existing in the parent country as instruments of NTMs. The table below looks at the major trade requirements associated with EU countries, USA and Japan and some developing economies.

Table 1: India's Fishery Sector's Trade with Major Partners: Pre-requisites to be Followed

Requirements	EU	USA	Japan
Codex	To comply with	To comply with	To comply with
HACCP	Required	Required	Required
Veterinary Documents (i) Health Certificate (ii) Official Marks identifying the country	Required at BOP	Required	Required
Eco-labelling	Mandatory	Voluntary	Voluntary
Catch certificate	Required	Required	Voluntary
Bilateral Agreement	Trade Agreement includes fish and fish products as one component	FDA has established an agreement to provide technical assistance	A Comprehensive Economic Partnership Agreement (CEPA) with scrapping of tariffs inclusive of fisheries products
On the Border Inspection/or Border Inspection system	Required	Required	Required
Company Certification Number	Required	Required	Required
Certification requirement from exporting countries	Mandatory	Required, but not mandatory as EU	Required, but not mandatory as EU
RASFF[5]	Mandatory	Not a member	Not a member

Source: Author's Compilation

Here an attempt is made to bring forth the rules and regulations intended to ward off imports in the guise of food safety requirements. Nevertheless, certain requirements challenge or overwhelm these standards. Considering that India's fishery sector's trade is mainly with USA, Japan and EU countries where inspection on the borders is highly frequent, the succeeding sections explore the legal base.

4.1. EU Standards on Seafood Imports: An Exploration of Rules and Regulations

The EU is credited with having the principal single market for world fishery products amounting to EUR 36.0 billion for 2011, followed by Japan and USA (Europa, 2013). It is essentially the anxiety over consumer health and safety that led to the implementation of hygiene related regulations across the EU (Ibid). In the presence of all these stringent regulations, India is on the 'list one' country in the EU to export fish and fishery sector's products. The following table sheds light on different legislations or the legal base through which EU restricts import of food items

[5] The Rapid Alert System is the nodal agency through which members notify the cause of border rejections, which is mandatory.

Table No 2: Rules/Regulations/Directives for EU safeguards on Food Imports

ECRegulation178/2002	Establishes the structure and role of European Food Safety Authority – the general principles, requirements and procedures on matters of food safety and law emphasising the equivalency and traceability concepts.
Art11Directive91/493 (on fish and fish products)	Under this revision, in circumstances where a country may not have its own facilities, EU authorities may accept as "equivalent" health certification issued by acceptable bodies in another country.
EC/852/2004	The hygiene of foodstuffs - general requirements on primary production, technical requirements, HACCP, registrations/approval of food businesses, national guides to good practice.
EC/853/2004	Specific hygiene rules - for food of animal origin (approval of establishments, health and identification marking, imports, food chain information).
EC/854/2004	Specific rules for the organisation of official controls on products of animal origin intended for human consumption.
EC/882/2004	Laying down health rules governing the production, processing, distribution and importation of products of animal origin, veterinary certification, compliance with EU rules.
Decision 93/51/EEC and Directive 91/492	Microbiological criteria and testing standards.
Directive97/78/EC dt18 December 1997	Lays down the principles governing the organisation of veterinary checks on products entering the EU from Third World countries - checking and approving at Border Inspection Points.
Dec 94/360/EC	Fish products in hermetically sealed containers (stable at ambient temperature).
Directive 93/51/EEC and Directive 91/492	The Rapid Alert System for Food and Feed - the procedure that informs the other member states a product presenting a serious risk for the health and safety of consumers.
EC No 1005/2008	Establishing a community system to prevent, deter and eliminate IUU fishing (EU IUU Regulation) in 2008 and its accompanying regulations and other tools.
EU No 1169/2011	Provision for food information to consumers – information regarding the list of ingredients, the quantity or durability of the product, nutrition declaration etc.

Source: Author's Compilation

It is understood from the above Table that India's efforts towards satisfying or complying with the requirements of EU are sufficient and necessary to keep up trade with other trade partners. The product and process standards associated with seafood safety and its management is verified by frequent inspections and laboratory tests by the Export Inspection Agency.

4.2. Japan's Food Safety and Health Safeguards: An Exploration of Rules and Regulations

The Japanese Ministry of Health, Labour and Welfare (MHLW) provides guidelines for carrying out measures to ensure food safety. The guidelines have been forwarded to the public domain as well as to importers that foods are to be processed in accordance with specification standards of Japanese

laws and regulations/ordinances. The table below presents the rules with regard to Japanese food safety standards

Table 3: Rules/Regulations/Directives Related to Japan's Safeguards on Food Imports

Food Safety Regulations – Legislation - Food Safety and Quality of FAP in Japan	Food Safety Act, 2003 Act No.48, May 23, 2003
Policies ensuring food safety by establishing basic principles, clarifying the responsibilities of the state, local governments and food business operators and the role of consumers	Food Safety Act, 2003 Act No.48, May 23, 2003, Amendment No.50, June 2, 2006
Safety and sanitation of food	Food Sanitation Law, Law No.233, December 24, 1947 last amended Law No 87, July 26, 2005ensures the safety and sanitation of foods through MHLW
Hygiene control in Food manufacturing and processing	MHLW, 2008
Recommended for introduction of HACCP control System	MHLW, 2008
Testing the sample items inside Japan whenever found required	MHLW, 2008
Retaining all the associated documents of imported food to be confirmed at all times	MHLW, 2008.
Import Ban of food products from a certain country/food manufactured by a firm that repeatedly violates the food safety regulations	MHLW, 2012
Conducting of Regular Inspections	Article 28 of the Act & Schedule I of the "Development of Imported Foods Monitoring & Guidance Plan for 2012" MHLW 2012

Source: Author's Compilation

The Japanese MHLW integrates the risk analysis principles with spot checks at the border points. Any defiance will be followed by testing of 50 per cent of cargo and may extend to even 100 per cent. The Japanese sanitary rules/regulations are implemented through bilateral consultations with exporting countries and assist them in complying with their food chain requirements (ibid).

4.3. USA's Food Safety and Health Safeguards: An Exploration of Rules and Regulations

As with fish and fishery products, the number of rejections by USA is the largest for products from India as compared to EU and Japan. Fish and fishery products being food items, food safety and other violations come are under the United States Food and Drug Administration (USFDA). The table below depicts the rules regarding food safety standards.

Table 4: Rules/Regulations/Directives of USA's Safeguards on Food Imports

Ensuring the safety of domestic and imported meat, poultry and processed egg products etc.	Food safety and Inspection Service (FSIS) United States Department of Agriculture.
Interstate commerce or marketing of domestic and imported food.	(USFDA)Department of Health and Human Services.
Allowable maximum residue limits and pesticide tolerance limits for commodities	United States Environmental Protection Agency.
Import Inspections	(USFDA) FD&C, Act and other laws designed to protect consumer health, safety and welfare (FDA, March 17, 1999).
Screening System for Imports	(USFDA) February 2010 (PREDICT: Predictive Risk Based Evaluation for Dynamic Import Compliance Targeting).
Inspection of Fish and Fishery Products	USFDA's responsibility shared with National Marine fisheries Service and Seafood Inspection Programme.
Safety of all FAP imported into the United States	Food Safety and Maintenance Act, 2010 reassured USFDA as the competent authority.

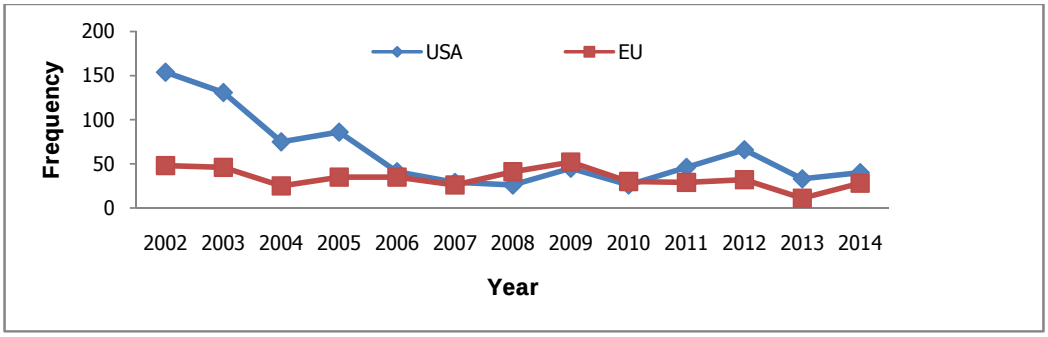
Source: Author's Compilation

The Food Protection Plan (FPP) of the USFDA is responsible for improving food safety standards of food items consumed in USA. Thus, the FDA has established agreements with several exporting countries such as China, India, and countries from Latin America, Europe and the Middle East as part of strengthening collaboration, providing technical assistance etc., (Lem *et al*, 2012).

4.4. An Analysis of the Rationale behind Border Rejections

The export markets, notably EU, USA, Japan, Canada and Australia give a vivid picture of the compliance performance of developing countries with variation across countries. Considering that India's exports to EU, USA and Japan constitute around 60 per cent with regard to fish and fishery products, the study restricts itself to that sample. The figure below depicts, in percentage terms, the rejection of fish and fishery products from India by the EU and USA, overtime.

Figure 1: Number of Consignments Rejected by USA and EU: 2002-2014



As Figure (1) shows, over the years the intensity of border rejections has drastically come down in both the EU and USA indicating efforts taken at the institutional level.

Figure 2: Reasons for EU's Rejection of Fish Products

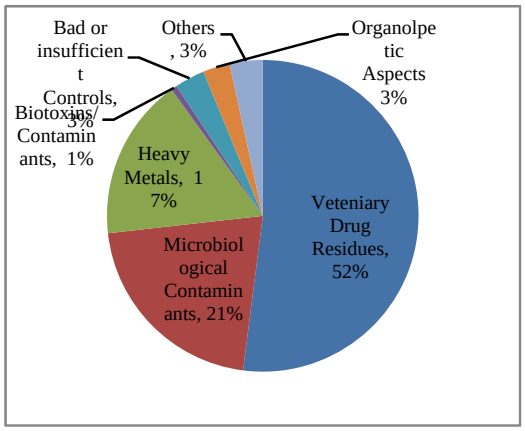
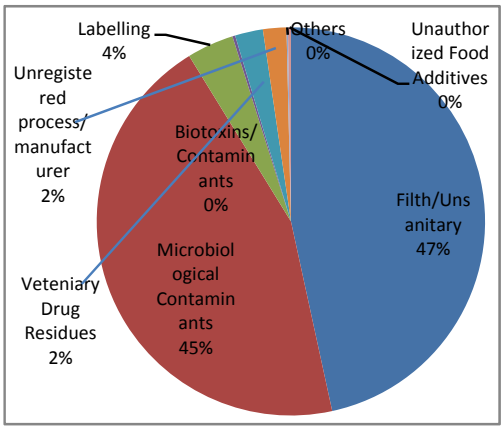


Figure 3: Reasons for USA's Rejection of Fish Products



Figures 2 and 3 provide a comparative picture of the reasons behind the border rejections of fish and fishery products over the years by the EU and USA, respectively, and the relative magnitude of the different categories of reasons leading to the outcome. Microbiological contaminants are an issue in both the countries - filth/unsanitary condition (47%) is more an issue with respect to USA whereas veterinary drug residues (52%) is an issue to EU countries. The OASIS and RASFF data reveal that it is more with regard to high value species like crustaceans and cephalopods.

5. Quantifying Non-Tariff Measures - Frequency Index and Econometric model

5.1. Methodology and Econometric Model

It is evident from the above discussion that these NTMs are more trade distortive in nature though the intention itself is not particularly protectionist. The quality standards prevailing in the fishery sector's exports are, therefore, a real concern for a developing country like India. The importance of NTMs is analysed in terms of their impact on trade rather than their use, *per se*. These NTMs generate certain economic effects (Beghin, 2006) resulting in a shift in the supply and demand curves (Roberts, Josling and Orden, 1999). The rational approach, both from theoretical and empirical points of view, is to consider the overall impact by examining the relative strength of trade restrictiveness of each NTM (UNCTAD, 2013). Therefore, the study relies on the frequency index to understand the overall impact of NTMs on specific products because it helps to expose the structure of comparative advantage and thus creating trade or a diversion effect.

5.2. Hypothesis of the Study

An improved level of compliance with seafood safety standards is detrimental to India's trade in the fishery sector.

5.3. Frequency Index: The Incidence of Non-Tariff Measures

An inventory approach makes it feasible to estimate the intensity of trade covered by NTMs with respect to specific sectors, individual countries or groups of countries. The study has relied on this methodology to understand the intensity of NTMs prevailing in the EU with regard to fisheries products. The frequency index exhibits the percentage of import transactions covered by a select groups of NTMs for an exporting country. It is calculated by

$$F_{jt} = [\ \sum(Dit\ Mit)/\sum(Mit)] * 100 \quad \text{..... (1)}$$

Where Di reflects the presence of NTM in the tariff line item; Mi indicates whether there are imports from a particular country j of a particular good i; a dummy variable takes on the value 1 and 0 for its presence and absence respectively; and t corresponding to the year for which it is measured.

Table 5: Frequency Index of Non-tariff Measures

HS Code	Product Description	Frequency Index (in per cent)
030191 to 030199	Live Fish (Ornamental fish, other live fish – Trout, Eels, Crap etc)	82.35
030211 to 030290	Fish, Fresh or Chilled excluding fish fillets and other fish meat of heading No.03.04 (excluding livers and roes) – (Species salmoniade, tunas, coalfish, mackerel, dogfish and other sharks, eels etc.)	45.45
030311 to 030390	Fish Frozen Whole - Fish crustaceans, molluscs and aquatic invertebrates//fish frozen excluding fish fillets - (species- salmon, halibut, paice, sole, flat fish, tunas, herrings, cod, swordfish, tooth fish, sardines, haddock, coal fish, mackerel, dog fish, eels, sea bass)	33.6
030510 to 030579	Fish, dried, salted or in brine; smoked fish, whether or not cooked before or during the smoking process; flours, meals and pellets of fish, fit for human consumption.	90.7
030611to 030629	Crustaceans, whether in shell or not, live, fresh chilled, frozen, dried, salted or in brine; crustaceans, in shell, cooked by steaming or boiling in water, whether or not chilled. Frozen, dried, salted or in brine (rock lobster and other sea crawfish, lobsters, shrimps and prawns, crabs etc.)	63.45
030710 to 030799	Molluscs, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; aquatic invertebrates other than crustaceans and molluscs, live, fresh, chilled, frozen, dried, salted or in brine; flours, meals and pellets (oysters, scallops, mussels, cuttle fish, octopus, snails etc.)	65.89

Source: Author's

The above table shows to what extent products traded within the Harmonized System (HS) 6-digit classification are affected by NTMs. Here NTMs refer to categories classified as A B and C-SPS, TBT and Pre-Shipment Inspection requirements and, therefore, are more quality control measures termed as "core" NTMs and are more trade restrictive. As the index takes care of only the presence or absence of any NTMs, it summarises only the percentage of products to which one or more NTMs are applied. It is evident from the above table that 82.35 per cent of the products that come under HS Code 030191 to 99; 45.45 per cent under HS Code 030221- 90; 33.6 per cent under HS Code 030311-90; 90.7 per cent under HS Code 030510-79; 63.45 per cent under HS Code 030611-29 and 65.89 per cent under HS Code 030710-99. Frozen shrimp (030613), squids (030741), cuttle fish (030749) etc., traded on a large scale from India are high value species. The severity of NTMs existing for products traded under fish and fishery sector products is evident from the frequency index and, therefore, India needs to develop a real compliance capacity in order to maintain export trade momentum. Trade restrictiveness, as explained by the frequency index, is corollary to the gravity approach in quantifying the effect of NTMs.

5.4. Modelling Approach

5.4.1. Estimating the trade Potential of Fishery Sector Exports from India in the Context of Non-Tariff Measures: A Gravity Model

The present study tries to examine the impact of NTMs on the fisheries sector's exports from India, following Tinbergen (1962), the resistance variables have been included. The Gravity model of trade has its base in Tinbergen (1962), who developed aggregate trade flows between countries (A and B) as "proportional to the gross national products and inversely proportional to the distance between them" (Chaney, 2013).

$$T_{AB} \alpha \frac{(GDP_A)\,(GDP_B)}{\text{Distance AB}} \quad \text{..... (i)}$$

Moreover, the Gravity equation has been widely accepted in explaining the trading of goods that are differentiated by country of origin (Anderson, 1979). Bergstrand (1989) argues that the Gravity approach is coherent both with market imperfection and product differentiation theories and is focused on factor endowments and technological upheavals in a dynamic system. The Gravity model of trade has been used in quantifying the value impact of NMTs (UNCTAD, 2013). Panel data models have been identified as the best strategy for assessing the effect of the implementation of NTMs. NTMs are more specifically bilateral in nature that bilateral trade relations may well be explained using the Gravity model. The model has the potential to encompass all policy related barriers like tariffs, quotas and other NTBs, thus integrating all the issues. Chen *et al* (2008), by taking the MRL of pesticides (chlorphyrifos on vegetables and oxytetracycline on aquatic products) as regulatory variables along with mass factors of the Gravity model, measured the effect of food safety standards on China's agricultural exports. The important connotation of the theoretical gravity equation is that trade between regions depends more on bilateral barriers. Moenius (2000) estimated the impact of product standards on trade flows using the gravity model. The effect of a particular standard, which may be exporter-specific, importer-specific or shared between nations, can be captured through a gravity equation specification. To adequately

control for the scale effects and resistance factors, other trade determinants have not been incorporated. Wilson and Otsuki (2003) examined the impact of residue standards on beef and Sun *et al* (2005) used the gravity model to explain the negative impact of stricter chlorpyrifos standards on China's vegetable exports to Japan.

The model used in this study may be specified as follows:

$$Xij = f(Xi, Xj, Rij) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where Xij is the column vector of the export value of commodity C from exporting country I (India) to importing country j (J = 1…32). Xi are the exporting country variables and Xj are importing country variables and Rij are resistance variables.

The resistance variables include two factors: distance between India and importing countries j, MRL standards in commodity C imposed by the country j. The selection of countries is based on India's consistent trade relationship with those countries prior to 1995 and persisting. The country group consists of EU countries, USA, Japan, Canada, Australia, Middle East and South East Asian countries. Based on the above discussion, the model to be estimated in this study is specified as follows:

$$\ln Xij = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta 3 \ln MRL_{1ijt} + \beta_{4j} MRL_{2jit} + \beta_{4j} MRL_{3ijt} + \beta_5 \ln D_{ijt} + U_{ij}$$

(Pooled OLS) …… (3)

$$\ln Xij = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta 3 \ln MRL_{1ijt} + \beta_{4j} MRL_{2ijt} + \beta_{4j} MRL_{3ijt} + \beta_5 \ln D_{ijt} + \alpha i + Vit$$

(Random Effects Model) …… (4)

Depending upon the interpretation of the unit error, we have tried with the two contenting models, i.e., the fixed effects and random effects models within the panel data framework. Some of the regulatory variables are constant overtime, but vary across cases. The choice of model selection rests with the random effects model. Hence, a poolability test for OLS versus random effects model has been carried out which favours the random effects model. Thus, it is statistically justified to go with the most efficient estimator.

The Breusch-Pagan test rejects the null hypothesis (Var (αi) = 0). Therefore, the random effects model has been estimated, using the Generalised Least Squares (GLS), which is corrected for heteroscedasticity and auto correlation.

5.4.2. Estimation Results and Discussion

Dependent variable is India's bilateral trade of fish and fishery sector's exports to partners. The estimated coefficients of the gravity model have the expected signs and are statistically significant, excepting the distance variable with a positive sign. The regulatory variable lead is also statistically significant and supported the hypothesis that regulatory measures masquerading in the form of food safety standards are real impediments to trade. The overall R^2 of the model being 0.45 and subsequently 0.49 and 0.32 between and within R^2 respectively, explains the goodness of fit of the model with the significance of the Wald chi square test explaining the overall fitness of the model.

Table 6: Estimation of Gravity Equation with Regulatory Variables

Independent Variable	Coefficients	Level of Significance	
Constant	-16.2 (-5.07)	0.000	Overall R^2 =0.4579
GDP of India	1.063 (7.29)	0.021	Between R^2 =0.4959
GDP of Trading Partners	0.328 (2.31)	0.000	Within R^2 =0.3159
Distance	0.768 (2.41)	0.016	No of Observations = 576
Lead	1.089 (2.62)	0.009	No of Groups =32
Cadmium	-0.043 (-0.13)	0.899	Wald χ^2 (6) = 276.02*
Mercury	-1.527 (-0.81)	0.419	Breusch and Pagan Lagrangian multiplier test for random effects chibar2 (01) = 2650.47*

Source: Author's (Figures in brackets are z values *implies significant at 1% level)

The GDP variable captures the impact of both country size and productive potential of the exporting country, and the size and purchasing power of the importing country. The coefficients of the GDP of India and its trade partners have positive signs and are statistically significant. The co-efficient 1.06 implies that, on an average, as the income of the exporting country increases by one per cent, its exports to trade partners increase by 1.06 per cent. For trade partners, the income elasticity is 0.328, implying that as their income increased by 1 per cent their imports increased by only 0.328 per cent. Here a twist can be noticed - the income elasticity of the exporting country is greater than that of the importing country implying that in this multilateral framework, bilateral export flows have higher elasticity with respect to exporters' income than that of importers. In this context, it may be explained that as the productive power of India increases, more income will be diverted to capacity building of export-intensive sectors that reflects enhanced exports. The fisheries sector, being a sunrise sector, has reaped the advantages of capacity building with favorable policies, as reflected in increased exports.

The distance variable, being a resistance factor, is a proxy for the transportation cost variable and since it reflects costs, which encompass both constant and variable costs, the variable cost is expected to increase with distance. If so, the price of the goods in the importing country increases with a positive effect on transportation costs (Frankel *et al*, 1997). Thus, it may be interpreted that the co-efficient of distance measures the marginal cost per percentage increase in distance. It is expected to be negative, but turned out to be positive and significant. It may be explained that due to increased infrastructure development and in the electronic era, distance does not affect trade much due to the availability of better information about the export market along with long standing trade relations and the tacit understanding of the characteristics of the product. Theoretical literature argues that country-specific importer/exporter standards involving the standardisation trap through forced adaptation, testing and certification in particular markets raises compliance costs and should reduce trade. The regulatory variable lead with a co-efficient of 1.089 is positive and significant, implying that regulation is trade restrictive and that regulatory stringency leads to trade being restricted by 1 per cent. The positive sign of the regulatory variable indicates that the total fishery imports are greater for a country with less stringent regulations on heavy metals like lead. The EU Directive 2001/22/EC, EC1881/2006 and EC No396/2005 wef 2008 raised the upper limit of maximum residue limits of heavy metals like

cadmium, lead etc., resulting in a positive relation. As the range of residue limit increases, exports also tend to increase.

5.4.2.1. Gravity Estimates at the Disaggregated Level: Cephalopods (Squid, Cuttle Fish & Octopus) & Crustaceans (Shrimps & Prawns)

OASIS and RASFF data reveal that the rejection is with respect to cephalopods and crustaceans and, therefore, the reason behind rejection is more with the presence of cadmium, mercury, lead etc., and to a lesser extent with arsenic and the residue level above MRL for oxytetracycline. Therefore, the trade elasticity of these products has also been estimated.

Table 7: Gravity Estimates at the Disaggregated Level: Cephalopods (Squid, Cuttle fish & Octopus) & Crustaceans (Shrimp and Prawns)

Variables (dependent variable: Cephalopods (HS92 Code: 030741, 030749, 030751, 030759)	Coefficient	Level of Significance	Variables (dependent variable: Shrimps and Prawns (HS92 Code: 030613, 030623)	Coefficient	Level of Significance
GDP (India)	0.404 (2.30)	0.021	GDP (India)	0.608 (3.48)	0.000
GDP (trade partners)	0.635 (3.85)	0.000	GDP (trade partners)	0.671 (5.48)	0.000
Distance	-0.09 (-0.44)	0.659	Distance	0.168 (0.54)	0.591
Cadmium	0.518 (1.26)	0.209	Cadmium	0.538 (1.67)	0.095
Lead	1.021 (1.63)	0.10	Lead	0.108 (0.10)	0.924
Mercury	-1.742 (-0.94)	0.346	Mercury	.0000031 (2.86)	.004
Constant	-5.856 (2.54)*	0.011	Constant	-9.44 (-2.79)	0.005
Overall R^2 = .414 Between R^2 = .48 No of Observations = 414 Wald chi2(6) =101.8* Breusch and Pagan Lagrangian multiplier test for random effects chibar2(01) = 1349.72 *			Overall R^2 = .53 Between R^2 = .637 No of Observations = 468 Wald chi2(6) =172.80* Breusch and Pagan Lagrangian multiplier test for random effects chibar2(01) = 1162.92*		

Source: Author's (figures in the brackets are standard errors *,**,*** implies significance at 1%,5% and 10% level respectively

Heavy metals, as the regulatory variable, were used for assessing trade restrictiveness at the disaggregated level. The MRL of heavy metals found in fish and fishery products includes cadmium, lead and mercury. The coefficient of the regulatory variable is positive and significant with respect to lead (1.021) as in the case of cephalopods and cadmium (.538) and mercury (.0000031) for shrimps and prawns, thereby implying that tighter the standard, the more trade restrictive is its impact. The positive sign of the MRL coefficients may be explained that trade partners during the various revisions have

increased the upper limit of residue limit, resulting in increased exports of these items. The result conforms to those of earlier researchers like Chen *et al* (2008), Wei *et al* (2011) and Guo-Xue *et al* (2012). The positive and significant coefficients of GDP of trade partners, i.e., 0.635 and 0.671 in the case of cephalopods and crustaceans imply that as the GDP of trade partners increases by 1 per cent, the import of cephalopods and crustaceans increases by 0.635 and 0.671 per cent respectively. Similarly, the positive and significant coefficients of GDP of India imply that a 1per cent increase in GDP leads to an increase in exports of cephalopods and crustaceans by 0.404 and 0.608 per cent respectively. The variable distance found insignificant indicates a less significant role in the electronic trading era.

6. Conclusion

Most of the fishery sector's items come under the umbrella of food and safety standards. The review of literature shows that the gravity equation is one methodology whereby trade elasticity in the presence of NTMs may be quantified while the incidence of NTMs may be understood from the frequency index. Moreover, the nature of NTMs is so hidden that the rules and regulations were looked at to unravel the source. Therefore, to understand food safety regulations, particularly in respect of seafood exports, this exercise was carried out. Further, the hypothesis that an improved level of compliance with seafood safety standards is detrimental to India's fishery sector trade was tested by considering heavy metals (cadmium, lead and mercury) as regulatory variables. Our gravity model results suggest that India's trade in fish and fishery products is yet to achieve trade-creating benefits. Along with the basic gravity variables, the regulatory variable, which is a proxy for NTMs, distorts trade and has been found significant. An analysis of the taxonomy of rules, regulations and directives of EU, USA and Japan also supports the evidence that NTMs masquerading in the form of food safety standards are the real impediments to trade development. The presence of NTMs is so high, as per the latest available data, with respect to trade in fish and fishery sector products with EU countries that it has gone up to 90 per cent in respect of some product categories.

The existence of NTMs such as food safety and environmental standards raises the basic issue of uncertainty in quality and more importantly, the gains depend on how the issue is addressed in resolving the problem. As we have seen, India's fishery sector trade, with all its quality assurance and food safety measures remains truncated. The existing fields need to be examined to identify the ills and shortcomings that plague them. In this respect, efforts must be made to address it at the institutional level. In an internationally changed trade scenario, India is fast emerging as a force to be reckoned with at the global level. More importantly, considering that the sector enjoys a comparative advantage, the exporters in this sector need to be educated in terms of accessibility, affordability and quality.

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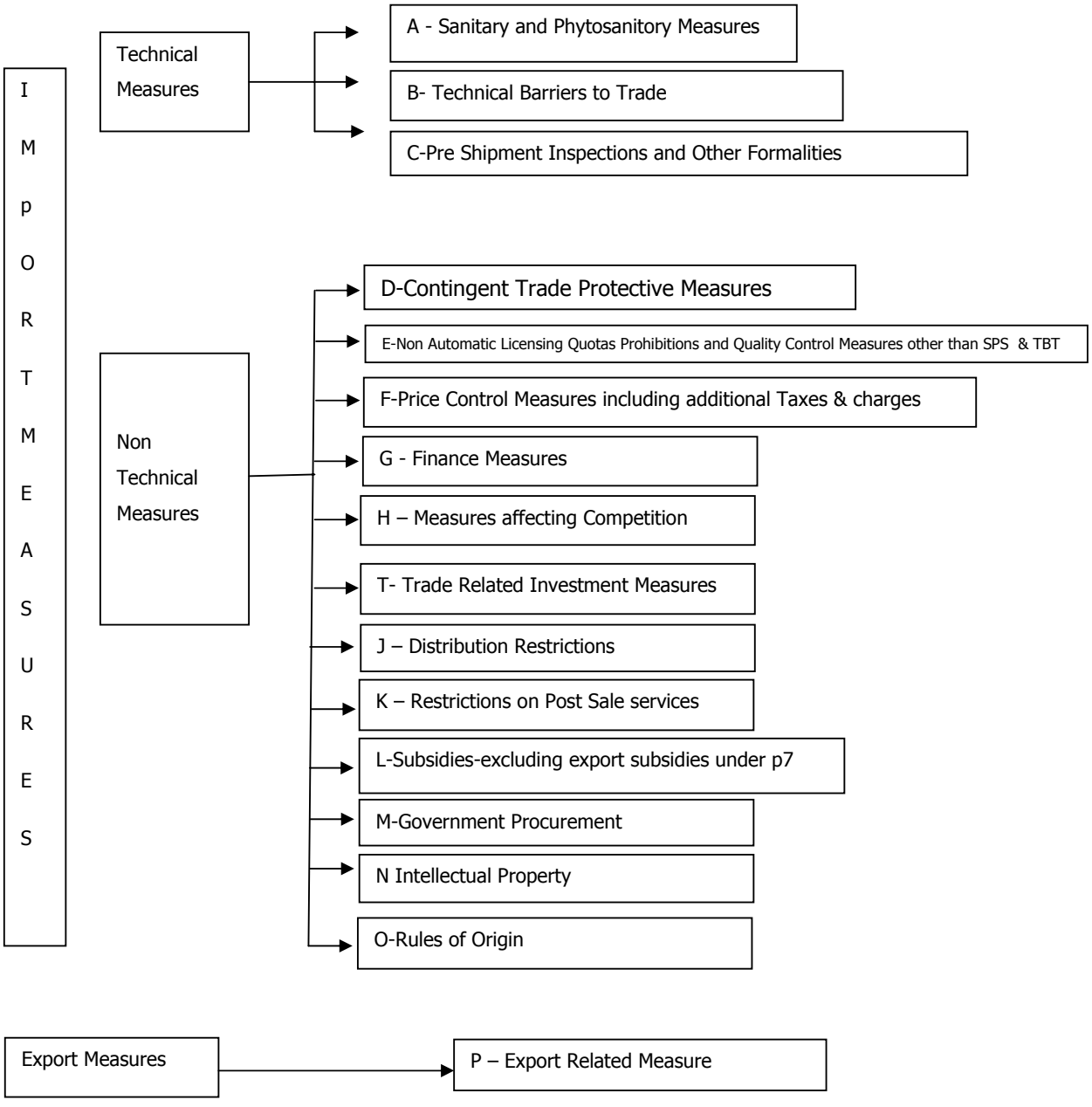
Appendix A: UNCTAD Classification of Non-Tariff Measures



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