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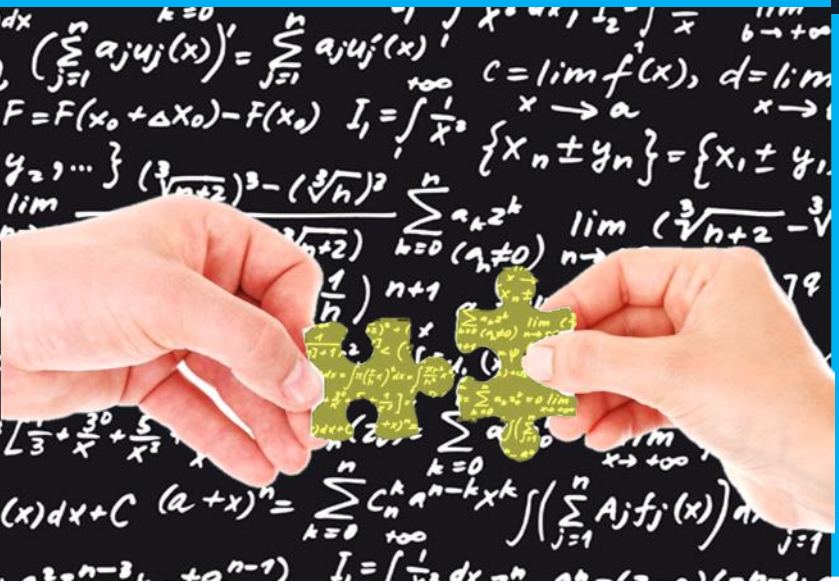
An assessment of fishing vessel capacity on subsidies, non-tariff measures, and attaining Sustainable Development Goals



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ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

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ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

WORKING PAPER

An assessment of fishing vessel capacity on subsidies, non-tariff measures, and attaining the Sustainable Development Goals

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Abstract

The members of the World Trade Organization (WTO) have been continuously involved in achieving a balanced outcome in the area of fisheries subsidies negotiations in 2018. The discussions have been ongoing and will continue in 2019. According to the 11th Ministerial Conference decision of the WTO, members are committed towards securing a deal in 2019. There are various aspects of fisheries subsidies that members of the WTO are presently assessing. The SDG (Sustainable Development Goals) Target 14.6[3] is one of the fundamentals for an outcome in the fisheries negotiations. The SDG Target 14.6 aims to prohibit or reduce fisheries subsidies linked to overfishing, overcapacity and illegal, unreported and unregulated fishing (IUU). In 2018, in the Rules Negotiating Group (RNG) on the fisheries clusters, members have discussed on overfishing and IUU issues. However, discussions on the overcapacity issue merits further investigations part of the SDG Target 14.6. This paper therefore aims to assess the relationship between fishing vessel capacity and fisheries subsidies as well as non-tariff measures, and provide further policy advice to trade negotiators in relation to the SDGs. In the assessment, we use panel data modelling of select developed OECD member countries that hold current vessel capacity and assess this against subsidies, non-tariff measures, exports and fish landing. The selected OECD member countries comprise of the proponents of the “Friends of fish” group. The finding of the paper provides policy recommendations for negotiators on fisheries subsidies and overcapacity. It also provides suggestions for special and differential treatment for developing and least developed countries (LDCs) in the fisheries negotiations.

Keywords: Fisheries, SDGs, Sri Lanka, OECD
JEL Codes: F13, F18, Q22, H23

[3] SDG 14.6 states that by 2020 countries must prohibit certain forms of fisheries subsidies, which contribute to overcapacity and overfishing. Moreover, eliminate subsidies that contribute to IUU fishing, and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the WTO fisheries subsidies negotiation.

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List of abbreviations

COFI	Fisheries Committee
FVGT	Fishing vessel per gross tonnage
FS	Fish support
HI	High income
IUU	Illegal, unreported and unregulated
LDC	Least developed countries
LMI	Lower middle income
LMS	Licensing management system
NLDP	National landing on domestic port
NTM	Non-tariff measure
OECD	Organization for Economic Co-operation and Development
PHT	Post harvesting technology
RNG	Rules Negotiating Group
RFMO	Regional Fisheries Management Organization
PSE	Producer support estimates
PSMA	Port State Measures Agreement
SDG	Sustainable Development Goals
TAD	Trade and Agriculture Directorate
TPP	Trans Pacific Partnership
UMI	Upper middle income
UNCLOS	United Nations Convention on the Law of the Sea
WTO	World Trade Organization

1. Introduction

Fish is an important commodity traded globally. It is also an essential source of protein for many people. It has estimated that worldwide one billion people (at least partly) depend on producing, processing and trading fish for their livelihood (FAO, 2018). Over the decades, fish provision has transformed the context of globalization and food consumption (Oosterveer, 2008). Seafood is one of the highest traded food commodities, exceeding the trade value of sugar, maize, coffee, rice and cocoa combined (Watson, Nichols, Lam, & Sumaila, 2017). Furthermore, according to the 2016 FAO Report on the State of the World of Fisheries and Aquaculture, both "fisheries and aquaculture remain an important source of food, nutrition, income and livelihoods for hundreds of millions around the world". The report also shows that in 2016, developing countries accounted for more than half of fish exports. In other words, the developing countries hold a greater share of the fisheries market as compared to the developed economies. As a result, for developing and least developed countries, fish is not just used for human consumption but also adds significant upstream and downstream value (Kumar, 2017).

Despite the merits of the fisheries sector, there has also been a growing concern about the depletion of fisheries resources at the international level. The World Bank Report on "The Sunken Billion: The Economic Justification for Fisheries Reform", which discusses the very weak economic performance of the global fisheries sector, has estimated the loss of economic benefits at about $50 billion a year (World Bank, 2017). The catches from illegal, unreported and unreported (IUU) fishing alone accounted for as much as $23.5 billion annually, representing an estimated 11 to 26 million tons of fish, which is equivalent to about one-fifth of the global reported catch (World Bank, 2017).

In tandem with this, in the context of the World Trade Organization (WTO), the concrete goal of reducing or eliminating fisheries subsidies was included in the trade and environment section of the Doha Declaration while the negotiations are taking place within the negotiating group on Rules. The WTO members have agreed to strengthen their fisheries subsidies disciplines (Oosterveer, 2008). In 2017, at the 11th WTO

Ministerial Conference, members agreed to work towards a work programme with a possible delivery of an agreement on fisheries subsidies by 2019 (WTO, 2017). There has been ongoing debate on the various textual proposals and ideas on the elimination or reduction to fisheries subsidies. There has been a number of proposals by different members of the WTO on the approach to the reduction or elimination of fisheries subsidies.

The WTO has developed a consolidated text which members are currently discussing, as of time of this study. The consolidated text is a compilation of the seven proposals by various proponents. In addition, a new proposal by China was circulated to members in November 2017 (Kumar, 2017). However, the textual proposals include various intricacies which members need to assess in order to ensure that the outcomes of the fisheries subsidies are balanced as well as maintain policy space for the developing countries. The focus of different members' proposals varies. For example, the European Union aims to reduce subsidies in relation to vessel capacity. Moreover, the European Union proposal links the provision of the granting or maintaining of fisheries subsidies by developing and least developed countries with stringent management measures (Kumar, 2017). These linkages to the management measures further specifies certain criteria, including the requirement that members have a management plan and fulfil generally accepted conditions, including the FAO code of conduct and guidelines (Kumar, 2017). The New Zealand, Iceland and Pakistan proposal, on the other hand, aims to prohibit subsidies in relation to overcapacity, overfishing and IUU. It also contains a highly ambitious transparency obligation proposed by New Zealand, Pakistan and Iceland which is mirrored in the Trans Pacific Partnership (TPP) Agreement[4] (Kumar, 2017).

In addition, on the relationship of fisheries subsidies to SDG Target 14.6, "commitments are required at the global level in [the] fisheries sector pertaining to the development assistance in the sector. The development assistance should target the developing countries fisheries private sector to develop its fishing capacity, so they are able to

[4] Note the TPP was later renamed by members as Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) when it entered into force on 30 December 2018.

compete with major global players and retain the competition for the world market price of fisheries" (Kumar, Ravinesh, Josef, & Chakradhar, 2019).

In 2018, the Chair of the Negotiating Group on Rules announced that members of the WTO would be working on a defined work programme. According to the Chair, at the May cluster, members were to focus on subsidies that enhance and/or maintain fishing capacity and subsidies that contribute to overcapacity and overfishing. In the June cluster, members were to focus on subsidies to fishing on overfished stocks, and at the July cluster, the theme were to be subsidies to IUU fishing. Special and differential treatment for developing members and least developed countries (LDC) as it relates to the theme of each cluster were to be taken up in an integrated way in the activities and discussions (WTO, 2018).

In the latter part of 2018 (September-December), the discussions on fisheries have intensified. Members agreed that the initial work programme on fisheries should include brainstorming for solutions in "incubator groups", text-based discussions, bilateral meetings, technical sessions for sharing information, and continued work to streamline the negotiating documents (WTO, 2018).

The aim of this study is to provide empirical evidence to support these discussions. The novelty of our work is three-fold. First, to the best of our knowledge this is the first paper which empirically estimates the effect of fishery subsidies on fishing vessel capacity and exports. Second, it also analyses the effects of NTMs (Non-Tariff Measures) on vessel capacity. Therefore, understanding the dynamic relationship between NTMs and vessel capacity with respect to fish trade will significantly contribute not only to maritime-trade literature but also assist in policy recommendations for negotiators in the WTO. Third, this paper uses a panel data analysis instead of cross sectional or time series analysis. The panel data estimates the relevant relationship between the variables over time, and it finds the unobserved individual effects. Hence, we have applied the methodology by using both fixed effect technique.

The outline of the paper is as follows: section 2 will discuss fisheries trends and related global issues, section 3 will provide panel data analysis of vessel overcapacity and its

relationship to fisheries subsidies and non-tariff measures, section 4 will discuss the findings and section 5 will finally conclude with recommendations.

2. Trends in Fisheries Trade and Related Global Issues

The trend in fisheries landings (the catches of marine fish landed in foreign or domestic ports) and exports has changed since 1950s. In the 1950s, high income (HI) and upper middle income (UMI) countries dominated the landings, with only a small proportion coming from the other categories. Most HI country landings came from the waters of HI countries (mainly their own exclusive economic zones) and a smaller amount originated from the high seas and the waters of UMI countries. This remained the case in the 1970s. In the 2010s the HI countries' share of total landings declined as the HI and UMI regions had a relatively even share of the total catch. Lower middle (LMI) countries increased their landings, once again mainly from the waters of LMI countries. The LMI countries also increased landings from the high seas. By the 2010s, the flow of traded seafood was slightly more equitable with the expansion of exports by the LMIs (Watson et al., 2017).

As such, fish and fish products have become a major source of food, contributing about 19% of animal protein for human consumption. They are also a valuable source of foreign exchange, with more than 60% of global fish production coming from developing countries (Bottom, Re, Of, & Subsidies, 2006). As fish exports from developing economies rise, they increasingly represent a principal source of income and livelihood. Seafood exports benefit developing countries in many ways, including by contributing to poverty alleviation and food security (Watson et al., 2017).

With the increase in trade in fisheries products there has been much concern over the sustainability of the fisheries resources. However, an examination of the history of fisheries reveals that overfishing by humans is one of the fundamental causes of the decline of marine species. Factors that drive this overfishing include the increasing demand for fish, international global fish trade, poor management and ineffective monitoring of open access fisheries, IUU fishing, technological innovations, short term

economic and social pressures, and overcapacity (Bottom et al., 2006). In addition, global negotiations on trade issues in fisheries have led to the identification of subsidies and non-tariff barriers as areas of concern (Bottom et al., 2006). With regards to the latter statement, in the context of the WTO, members also have major concerns about non-tariff barriers in relation to fisheries and environmental certification.

In the international sphere, countries have made numerous commitments in relation to the oceans and the fisheries sector. These include the United Nations Convention on the Law of the Sea (UNCLOS) and the fish stock agreements, which are legally binding in nature. There are other non-binding agreements such as the Port State Measures Agreement, the International Plan of Action against IUU amongst others. In 2017, at the First Global Oceans Conference in New York, the call for action further requested members to act decisively to prohibit certain forms of fisheries subsidies, which contribute to overcapacity and overfishing, and eliminate subsidies that contribute to IUU fishing. It further requested member countries to refrain from introducing new such subsidies, and to accelerate work to complete negotiations at the WTO on this issue. It also recognized that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of those negotiations (United Nations, 2017).

Further discussions on the fisheries subsidies negotiations within WTO have been ongoing and members have yet to reach an agreement. The focus of the WTO in relation to fisheries concerns disciplines on subsidies in three areas: (i) IUU, (ii) Overfishing, and (iii) Overcapacity. According to a study on the estimation of subsidies, the total global fishery subsidies were set at about $26 billion for the eleven subsidy types, excluding fuel subsidies (Bottom et al., 2006). Thirty-eight developed countries provide 60% of these subsidies and 103 developing countries provide the remaining 40% of this amount. The proportion of estimated subsidies that contributed towards an increase in fishing capacity globally amounted to about $15 billion, while subsidies that contributed to fisheries management and conservation programs were approximately $7 billion. The remaining $4 billion are categorized as “ugly” subsidies, i.e., those that may lead either to fisheries conservation or to overcapacity depending on the context. Japan

and the European Union were the highest subsidizers of their fisheries, providing about $4.2 billion and $3.0 billion, respectively (Bottom et al., 2006).

On fisheries overcapacity, according to Milazzo (1998), capacity refers essentially to vessels, gears and labour. Fisheries subsidies contribute to overcapacity and overfishing by reducing the operational and capital cost of fishing. This results in an incentive for fishers to increase their catch and profit, with an aggregate impact to further stimulate effort and compound resource overexploitation problems (Milazzo, 1998); and revenue enhancing subsidies make fishing enterprises far more profitable even when the fishery resources are in decline (Pauly et al. 2002).

In this research, we will focus on the issue of fisheries overcapacity. Though much research has been undertaken to define subsidies (Bottom et al., 2006), the study on overcapacity and its relationship to fisheries subsidies, non-tariff measures and exports need to be examined empirically. Empirical assessment from this study will be useful in identifying and providing further insight into the current WTO negotiations on fisheries subsidies disciplines, which members aim to conclude in 2019.

3. Variables and Data Source

The present study has collected data from different secondary sources, covering the period of 2000 to 2016 for selected countries, namely Australia, Norway, Iceland, New Zealand, Spain, Sweden, Argentina, Japan, Republic of Korea and the United States (see Appendix Table A1). Data for Fishing Vessel per Gross Tonnage (FVGT) has been taken from the annual vessel and gear survey, PISCES, and the Licensing Management System (LMS). Here, Gross Tonnage is defined as the total measured cubic content of the permanently enclosed spaces of a vessel, with some allowances or deductions (1 gross register ton = 100 cubic feet = 2.83 cubic meters). Further, producer support estimates (PSE) of fisheries estimates the more comprehensive data gathering carried out on an annual basis by the Fisheries Committee (COFI) of the Trade and Agriculture Directorate (TAD) from OECD members and participating non-OECD economies. This dataset is designed to monitor and quantify developments in fisheries policy, to

establish a common basis for policy dialogue among countries, and to provide economic data to assess effectiveness and efficiency. Further, National Landing in domestic ports (NLDP) data was taken from ABARES, Commonwealth and State government agencies. NLDP data measures quantity of fish, crustaceans, molluscs and other aquatic invertebrates (and animals), residues and seaweeds landed in ports of the reporting country by vessels registered to that country. Additionally, we have also collected data on fish export from the UN Comtrade, observed in 1000s of USD dollars. Data for NTMs have been taken from the comprehensive UNCTAD NTMs database.

NTMs we have calculated for the main chapters at Harmonized coding 2-digit level. These statistics are simple averages of counts across countries and thus have to be interpreted as representative of the use of NTMs for the average country. Data related to Post Harvesting Technology (PHT) has been collected from the OECD fisheries database.

The following relationships are assumed for each variable. The FVGT measures the vessel capacity by countries. It assumes that the greater the gross tonnage per vessel capacity the greater fishing vessels capacity to fish. The PSE fish support measures the amount of development support provided by the countries to the fisheries sector. Here, it has been assumed that the greater the fish support to the industry, whether direct or indirect, the marginal cost to the individual fisher is reduced and thus more investment in fishing vessel capacity occurs. The NLDP shows the amount of landing by a country in its domestic port. If the landings are primarily on domestic ports, it is likely that the fisheries vessels may be domestically based, or incentives are provided for domestic landing and onshore processing. The analysis of NTMs as a percentage of exports assumes that the greater the compliance rate of an individual fishing firm in the selected country, the more likely it is to fish, thus enhancing vessel capacity or has high vessel capacity to fish. A further assumption is that as vessel capacity increases, there is likelihood that they also boast better PHT, or at least have more access to it in their country of origin. The detailed explanation of data sources and units of measurement are provided in Appendix Table A2.

4. Methodology

The study examines the relationship between fisheries overcapacity and fisheries subsidies, NTMs and fisheries exports for the selected countries. To achieve these objectives, our study uses panel data estimation for the selected countries, which has many advantages over the cross sectional and times series models. Baltagi (2008) outlines a number of the benefits of using panel data, which are as follows: panel data models take large samples, as they take N cross section and T time series observations. Hence, models with large samples will have more degrees of freedom, more information, more variability, and less multi-collinearity, which makes them econometrically more efficient. Hence, we have estimated three-panel data models using the fixed effects technique, which assumes that the differences across countries stem from unobserved country-specific characteristics and year effects.

Table 1 shows a summary of the statistics of the panel data set. This indicates that the average fish support of FVGT, FS Estimated, Exports, NLDP, NTMs and PHT are 12.49, 1.71, 21.3, 20.75, 1.47 and 2.35, respectively. Total observations (N * T) in this database are 170 from 2000 to 2016.

Table 1 Summary Statistics of Data

Variable	Mean	Std. Dev.	Minimum	Maximum	Observations
FVGT	12.49	1.21	10.31	14.36	170
FS Estimated	18.71	1.79	14.21	22.13	170
Exports	21.36	0.68	20.38	23.11	170
NLDP	20.75	1.57	17.80	23.21	170
NTMs	1.47	0.58	1.29	2.79	170
PHT	2.35	1.67	-0.69	5.76	170

Source: Authors' calculations.
Note: Std. Dev = standard deviation; FVGT= Fishing Vessel per Gross Tonnage; FS = Fish Support; Exports= Fish Exports; NLDP=National Landing in Domestic Ports**;** NTMs = to the percentage of total trade; PHT=Processing and harvesting technology.
*Note**: Summary Statistics are estimated using log data.

Correlations among the variables are displayed in table 2. As expected, the results show that FVGT is positively correlated with fish support in terms of subsides, NLDP

and PHT. Therefore, this implies that there is a significant positive association between FVGT, NLDP and PHT. As such, one can deduce that subsidies in the selected economies have had a positive effect on vessel capacity. In other words, some economies that are negotiating fisheries subsidies and demanding for stronger disciplines are in a position to do so as they have already developed their vessel capacity through subsidization. As such, the increased vessel capacity through subsidization has had a negative impact on marine resources.

Table 2 Correlations for the panel data set

	FVGT	FS-Estimated	Exports	NLDP	NTMs	PHT
FVGT	1					
FS Estimated	0.463	1				
Exports	0.409	0.381	1			
NLDP	0.677	0.359	-0.033	1		
NTMs	0.156	0.166	0.151	0.103	1	
PHT	0.658	0.187	0.188	0.598	0.508	1

Source: Authors' calculations.
Note: Std. Dev = standard deviation; FVGT= Fishing Vessel per Gross Tonnage; FS = Fish Support; Exports= Fish Exports; NLDP=National Landing in Domestic Ports**;** NTMs = to the percentage of total trade; PHT=Processing and harvesting technology.
*Note**: Variables were in natural logarithms.

Equation 1 aims to assess the aggregate relationship of fisheries overcapacity, taking into account vessel sizes 0-75m and above to fisheries subsidies, NTMs and fisheries exports.

$$\boldsymbol{FVGT_{it} = \beta_0 + \beta_1 FSE_{it} + \beta_2 EX_{it} + \beta_3 NLDP_{it} + \beta_4 NTMs_{it} + \beta_5 PHT_{it} + e_{it}} \qquad (1)$$

Subscripts $\boldsymbol{i}$ and $\boldsymbol{t}$ denote country and time period respectively; the dependent variable $\boldsymbol{FVGT_{it}}$ is the fishing vessel gross tonnage; $\boldsymbol{FSE_{it}}$ refers to fish support measure by the each $\boldsymbol{i}$ country at $\boldsymbol{t}$ period of time; $\boldsymbol{EX_{it}}$ is the marine export measured in $1000s; $\boldsymbol{NLDP_{it}}$ provides information on amount of landing by a country in its domestic port; $\boldsymbol{NTMs_{it}}$ shows magnitude of barriers to the fishery exports at HS two-digit level. Finally, the $\boldsymbol{PHT_{it}}$ shows the Post Harvesting Technology. Our country sample consists of 10 countries, and our sample period spans from 2000 to 2016. Thus, the present study used balanced panel data with the annual observations as they provide sufficient quality for the analysis.

$\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are coefficients of $\boldsymbol{FSE}$, $\boldsymbol{EX}$, $\boldsymbol{NLDP}$, $\boldsymbol{NTMs}$ and $\boldsymbol{PHT}$ respectively. $\boldsymbol{e}$ is the classical error term in the model. The selection of our sample countries was based on which had more fishing capacity and fish support from subsidies, in addition to cross-temporal considerations of data availability.

5. Empirical Results

We have applied the Hausman test, which helped us to decide between a fixed and random effect specification. The probability (Prob. > chi2) is 0.001, indicating that the fixed effect is appropriate.

Table 3 (1) summarizes the results of equation 1 when assessing the overall effect of fisheries subsidies (FS estimated) on vessel capacity by using a fixed effect model. The result shows that fish subsidies are positively correlated to vessel capacity. This indicates that direct and indirect subsidies for the selected developed countries in the study contribute to vessel capacity.

Table 3 Estimates of Panel Results, 2000–2016, dependent variable: FVGT

Variables	**(1)**	**(2)**	**(3)**
	All sizes	**FVGT 0m-23.9m**	**FVGT 23.9m+**
FS estimated	4.190** (-1.895)	-0.011* (-0.006)	-0.011* (-0.006)
Exports	-9.820** (-3.770)	0.005*** (-0.001)	0.005*** (-0.001)
NLDP	-2.320** (-9.110)	0.011*** (-0.003)	0.011*** (-0.003)
NTMs	-4,877* (-2,588)	1.978** (-9,43,353)	1.937** (-9,30,086)
PHT	-1,114*** (-189.4)	-148,345** (-69,038)	-174,935** (-68,067)
Constant	680,058*** (-25,398)	-1.440 (-9.266)	-1.197 (-9.134)
Observations	170	170	170
R-squared	0.486	0.417	0.567

Source: Authors' compilations from Stata 14.0
Note: Std. Dev = standard deviation; FVGT= Fishing Vessel per Gross Tonnage; FS = Fish Support; Exports= Fish Exports; NLDP=National Landing in Domestic Ports**;** NTMs = to the percentage of total trade; PHT=Processing and harvesting technology.
*Note**: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

In relation to exports and vessel capacity, exports are negatively correlated to the vessel capacity for the selected developed countries. This is simply because the fish captured in the ocean by these countries may cater for the domestic market as opposed

to exports. According to the 2016 FAO State of World Fisheries “in 2013, per capita fish consumption in industrialized countries was 26.8 kg. A sizeable and growing share of fish consumed in developed countries consists of imports, owing to steady demand and static or declining domestic fishery production.”

The National Landing on Domestic Port (NLDP) has a negative correlation to vessel capacity. As the vessel capacity increases, most of the vessels presumably either catch more fish or would be landing on other foreign ports. One of the reasons could be that the landing fees in foreign ports would be cheaper and/or these vessels also go out into distant waters to fish thus it becomes more efficient to land in foreign ports.[5] Another reason could be that though these countries have a large vessel capacity, the catch per unit by each vessel may be low, given competition amongst the national fleets, thus causing the NLDP to correlate negatively with capacity.

On the synergy between NTMs and vessel capacity, the NTMs and vessel capacity are negatively correlated. The reasons for such relationship could be that the NTMs in relation to the exports of fish heavily discipline onshore fisheries processes and are not related to the vessel size and capacity or specification. In addition, given the size of the fisheries processing, in the developed countries, increased exports and high revenue would therefore negate the cost of NTMs. As a result, as exports rise, the costs of compliance on NTMs are reduced. NTMs in the ocean are more in relation to NTMs for fish resource extraction, and relate to conservation and management measures, which were not part of the model due to data constraints.

The PHT is negatively correlated to vessel capacity. Similar to NTMs for exports, the post-harvest technology is linked with onshore fisheries processes and are not related to vessel capacity but more toward onshore processing and exports of fish and fish products for example for filleting, loining and canning.

[5] Refer to https://www.portsregulator.org/images/documents/Global-Pricing-Comparator-Study-2016-17.pdf

5.1 Assessment of Fisheries Subsidies by different Vessel Size Range

To further analyze the effects of fisheries subsidies, a second analysis of disaggregated vessel sizes is conducted. A similar approach has been applied in relation to the panel data analysis and models. However, in this subsequent analysis, the FVGT of 0m-23.9m (equation 2) and FVGT range greater than 23.9m and above are assessed (equation 3). This is mainly to ascertain whether there are variations for fisheries subsidies and overcapacity for the selected countries in relation to vessel size.

$$\boldsymbol{FVGT_{\mathrm{it}}[0m - 23.9m]} = \boldsymbol{\beta_0 + \beta_1 FSE_{it} + \beta_2 EX_{it} + \beta_3 NLDP_{it} + \beta_4 NTMs_{it} + \beta_5 PHT_{it} + e_{it}} \quad (2)$$

$$\boldsymbol{FVGT_{\mathrm{it}}[3.9m\ and\ above]} = \boldsymbol{\beta_0 + \beta_1 FSE_{it} + \beta_2 EX_{it} + \beta_3 NLDP_{it} + \beta_4 NTMs_{it} + \beta_5 PHT_{it} + e_{it}} \quad (3)$$

Table 3 summarises these in relation to FVGT of 0m-23.9m (2) and 23.9m and above (3). Another assumption made in this regard is that for all vessels less than 23.9m are operational in the exclusive economic zones, and that this category also includes small scale, artisanal and subsistence fishing. The category of vessel sizes greater than 23.9m and above is for large commercial fisheries and could be operational in either the EEZs or the high seas.

5.2 Results of Fisheries Subsidies by Vessel Size

With reference to table 3 (2), on FVGT between 0m-23.9m, fisheries subsidies have a negative relationship to vessel capacity. In other words, high subsidies are provided to low vessel capacity, but as capacity is acquired, the subsidies are reduced. For vessel capacity below 23.9m, this is valid as for small-scale fisheries sector subsidies are required for the sector to develop. In other words, the SDG Target 14.6 in this regard is viewed in light of social sustainability. For the selected countries, the FVGT for vessels

above 23.9m (table 3(2)) also shows a negative correlation to vessel capacity. This indicates that for these countries as large-scale vessel capacity has been acquired, the subsidies are phased out. This is because for these developed countries the fishing industry with large fleet capacity has moved away from the infant stage to fully-fledged commercial industries that compete in the global market.

With regard to vessel capacity and exports, FVGT and exports are positively correlated to vessel capacity for both vessel size below 23.9m and vessel size above 23.9m. However, a one per cent increase in vessel capacity leads to a small increase of only 0.005 per cent in exports. As such, though the relationship is positive, in absolute terms it is low. It indicates, however, that as export demand for fish increases, it is likely that the players in the fishing industry increase the vessel capacity to catch fish.

The NLDP is positively correlated to the vessel capacity for vessels both below 23.9m and those above 23.9m. For small-scale fisherman, with vessel capacity below 23.9m, landing on domestic ports may be easier given its proximity. For vessels 23.9m and above, the NLDP is positively correlated to FVGT. Though at an aggregate level the NLDP is negative (table 3(1)), at the disaggregate level it is positive, because some of the vessels, though far away from fishery locations, would still be linked to an on-land processing facility. Otherwise, perhaps the vessel owners of the developed countries are able to meet the port standards in the selected developed countries.

With regards to PHT and vessel capacity, the relationship is negative for vessel sizes both below 23.9m and above 23.9m. This could simply be a result of the processes requirements on shore in factories and might not be relevant to vessel capacity in the ocean.

In relation to NTMs and Vessel Capacity, there is a positive correlation for vessel sizes both below 23.9m and above 23.9m. In other words, the higher the vessel capacity the higher the ability of the countries to meet the NTMs. This could be because as vessel capacity increases, the vessel owners become more profitable and thus the cost to meet the NTMs, despite being high, is a smaller proportion of the marginal cost. For

vessels above 23.9m, despite the high NTMs, the ability to meet these in relation to the cost may be small as compared to the returns.

6. Conclusions

In the ongoing negotiations on disciplines on fisheries subsidies, the members of the WTO, within the Rules Negotiating Group (RNG), are aiming to find a mutually beneficial solution for all members, in particular for the LDCs. For the developing countries and the LDCs, fishing is a source of food security, livelihood and social sustainability. The analysis of the selected countries reveals various correlations between vessel capacity and fisheries subsidies, exports, NLDP and NTMs. The assessment of the relation of these variables to vessel capacity is important to better inform members and enable sound decision making on any outcomes in 2019. As such, to better assist the WTO members in the negotiations, we present the following policy recommendations on the basis of our findings:

On subsidies and vessel capacity of the developed countries, it is evident that subsidies do contribute to the FVGT of these countries. Moreover, the current negotiating text focuses on disciplines on subsidies that are direct in nature as per the Agreement on Subsidies and Countervailing Measures (ASCM). However, both direct and indirect subsidies have contributed to the vessel capacity of these selected countries over the years. Most of the developed countries have phased out direct subsidies in its fisheries sector; however, indirect subsidies are still prevalent. Members should look at the effect of indirect subsidies and their contributions to vessel capacity as well. If indirect subsidies are not disciplined for countries with high vessel capacity, it will place a burden on fisheries subsidies disciplines vis-à-vis direct subsidies on LDCs. This will result in reduced policy space in the global fisheries market for the developing countries. Only the selected countries with high vessel capacity will be dominant players in the market with the retention of indirect subsidies. “As a result, the overall effect of the SDGs will be derailed when assessed in terms of food security and poverty alleviation and elimination of fisheries subsidies in 2030” (Kumar et al., 2018). The WTO members should therefore focus on strong discipline for direct and indirect subsidies on

those countries that have high vessel capacity, as opposed to other areas which are not in the jurisdiction of the WTO such as “fish stocks in overfished conditions”. The latter is more a management issue which must be directed to the relevant Regional Fisheries Management Organizations (RFMOs).

On vessel capacity and exports of developed countries, the correlation is negative, as these developed countries with high vessel capacity evidently catch fish for domestic consumption. The additional demand for the developed countries would be met by imports from developing countries. In the context of the subsidies negotiations on fisheries, some of the proponents are strongly advocating for generally accepted standards, which could even lead to acceptance of private standards for sustainability. There are certain private standards that have become the norm for fisheries product certifications (Kumar et al., 2018). These standards may be used to disguise impediments to imports from developing countries. Given that most fish caught by domestic vessels are for the domestic market, the imposition of strict private standards would be a way to protect a country’s national interests. While domestic producers in the developed countries may be able to meet the standards of the domestic market, these same standards may come to preclude interested exporters from foreign markets, particularly those from LDCs. In the context of the fisheries subsidies disciplines, whilst recognizing the SDG Target 14.6, members must also ensure that any fisheries environmental standards do not become a disguised restriction to fisheries trade from developing countries and in particular the LDCs.

On Vessel Capacity and NLDP, for the selected developed countries, as the vessel capacity increases the national landing on domestic ports decreases. This could be because most of the catch may be landed into foreign ports of other countries as these vessels are from distant water fishing nations, or some may have a joint venture processing and foreign direct investment in other countries. Finally, perhaps the Port landing charges and fees may be lower in foreign ports. In the context of the current WTO negotiations, some members are demanding that in order for the developing countries to grant or maintain fisheries subsidies, apart from other standards, the developing countries must adhere to the Port State Measures Agreement (PSMA). The PSMA can also be coined as a standard NTM for ports. Members in the negotiations

should therefore discuss the implications of a uniform application of Port Standards and disciplines on fisheries subsidies and the burden of such implementation on developing countries, in particular the LDCs. In the event of an agreement for the uniform application of Port Standards as a condition on fisheries subsidies, it is likely that most developing countries and LDCs would not be able to comply. More so, those developing and LDCs that earn revenue from Port landing and processing of raw fish into value added products would be severely affected. For example, for the Pacific region, Fiji and Papua New Guinea are signatories to the interim economic partnership agreement. Under the fisheries global sourcing provision of the agreement, both Fiji and Papua New Guinea can source fish from anywhere and process it onshore, thereby enabling eligibility for duty free exports into the European Union. In the event that these small island States are unable to meet the required port standards, they would not be able to process the fish and export to the European Union. In other words, the global sourcing provision will become ineffective. Ultimately, the major exceptions to this provision could be the ports of the developed countries where majority of fish landing would occur, including processing and exports. This again will provide policy space for the development of the fisheries sector of the developed countries. On the other hand, the social sustainability of the developing and LDCs will be decapitated.

On Vessel Capacity and NTMs, for developed countries, the relationship is negative. This is mainly because as these countries have high vessel capacity, the cost of compliance for the NTMs is thus low. Secondly, the NTMs are related to onshore processing as opposed to that of fisheries resource extraction. Some of the developed country members aim to remove subsidies for onshore products simply because the cost of compliance for these countries is relatively low in relation to the large vessel capacity and cost per unit of catch. In the context of the WTO negotiations, some members are extending the reduction of fisheries subsidies to onshore processing. This would result in imposition of supply chain certification. “At present the European Union and the United States impose unilateral measures in relation to IUU. The European Union applies trade related measures to combat IUU in the form of yellow card (identification of non-cooperating countries) and a ban on imports from the particular country. These are applied broadly to all fish and all fleets of a particular country regardless of the IUU fishing that triggered the identification, which means it is more

likely to have a disproportionate impact on small-scale fisheries. The US IUU trade related measures are designed to target only fleet, species and product type directly tied to the IUU that has given rise to the identification. As such the European Union system is more opaque [than] the US system." (Approaches, 2016).

On NTMs and SDGs, the SDG Target 14.6 specifies that members of the WTO are to develop disciplines in relation to fisheries subsidies linked to IUU, overfishing and overcapacity. From our analysis on NTMs and vessel capacity, we have noted that there is a negative relationship. In other words, as the onshore processing and exports of fisheries in the developed countries increase, with high returns on exports, at firm level the cost of compliance for NTMs is low. This is possible for those countries with high vessel capacity as per the analysis. However, for developing countries with low vessel capacity, the removal of fisheries subsidies would deter the fishermen from these countries to fish. This would severely affect the large number of low income and poorly resourced fishermen. In other words, the cost of compliance for NTMs for these developing countries is likely to be high at individual firm level. As an outcome, this will lead to adverse effects on food security and poverty alleviation thus affecting the attainment of the SDGs by 2030 (Kumar et al., 2018).

On Vessel Capacity and PHT for developed countries the relationship between vessel capacity and post-harvest technology is negative. This is because the PHT is linked to onshore processing and exports. Some members in the WTO are demanding for disciplines on fisheries related activities including onshore activities. If such discussions expand further, members need to be cognizant that countries with high vessel capacities would be the ones that would be most able to minimize the cost from the harvesting processes, and thus the elimination of subsidies would favour their fisheries sector development. However, for developing and LDCs, this would further add the burden of additional marginal cost to the low income and already poor fisheries. The high cost of implementing PHT standards would affect investment in the fisheries sector for the developing and LDCs. However, as a special and differential treatment provision, technology transfer is a critical element in creating a balance of social sustainability for the developing and LDCs in the fisheries subsidies negotiations. Technology transfer in fish and aquaculture harvesting and processing should be prioritized. Such technologies

are required to address the concerns of the export standards in the fishing sector largely (Kumar et al., 2019).

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Appendix

Table A1 List of Countries in the Sample Study

Country	Region	Income
Australia	East Asia &Pacific	High Income
Norway	Europe & Central Asia	High Income
Iceland	Europe & Central Asia	High Income
New Zealand	East Asia & Pacific	High Income
Spain	Europe & Central Asia	High Income
Sweden	Europe & Central Asia	High Income
Argentina	Latin America & Caribbean	High Income
Japan	East Asia & Pacific	High Income
Korea	East Asia &Pacific	High Income
USA	North America	High Income

Source: Authors' compilations based on data from OECD and World Bank country classifications by income, 2017.

Table A2 Variable Descriptions of the panel model

Abbreviations	Variable name	Unit of Measurements	Source
FVGT	Fishing Vessel per Gross Tonnage	Gross tonnage per vessel size	Annual vessel and gear survey, PISCES, Licensing Management System
FSE	Fish Support Estimated	US $ (current Prices)	Trade and Agriculture Directorate (TAD)- OECD
EX	Fish Exports	1000 US $ (current Prices)	UN Comtrade Database.
NLDP	National Landing in Domestic Ports	US $ (current Prices)	ABARES, Commonwealth and State government agencies.
NTMs	Non-Tariff Barriers	NTMs for the average country	UNCTAD TRAINS NTMs database
PHP	Post Harvesting Technology		OECD

Source: Authors' compilations