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Fish and Fisheries Products: from subsidies to non-tariff measures

Abstract

The current landscape of fisheries subsidies and tariffs is extremely harmful to fish stocks and the fish and fisheries products sector, with potentially irrevocable medium- and long-term effects. The health of the sector depends on its ability to reconcile employment and income generation priorities with the sustainability of fish stocks. Subsidies and tariffs must urgently be reformed. Non-tariff measures (NTMs), if introduced in a harmonized manner internationally, may help reconcile employment and environmental concerns. Financial resources currently spent on harmful subsidies should instead be channeled to helping fishers comply with NTM's, towards sustainable fisheries management.

Key words: Fish and Fisheries Products, Non-Tariff Measures, Tariffs, Subsidies

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Introduction

Countries undertake trade in fish and fish products to provide for nutrition, generate income and create employment. In 2015, 17 per cent of animal protein consumed in the world depended on fish (FAO, 2018). Some 35 to 38 per cent of world fish and seafood production enters international trade, generating a value estimated at US$ 152 billion in 2017 (UNCTAD, 2018a). Fish is a major source of income for developing countries. In 2016, the value of fish exports from developing countries reached US$ 76 billion, with net fish export revenues (exports minus imports) of US$ 37 billion (FAO, 2018). Hence already half of fish export income goes to developing countries. Furthermore, in 2016, fisheries and aquaculture provided direct employment for around 60 million people worldwide (FAO, 2018).

Fish trade, however important it may be as a source of revenue, is not taking place in a sustainable manner. The rapid and unsustainable growth in exploiting living aquatic resources during recent decades has led to overfishing and the degradation of fish stocks, habitats, ecosystems and biodiversity. Currently, about one-third of global fish stocks are at biologically unsustainable levels, causing an economic loss estimated at US$ 83 billion per year. FAO's recent reports on the State of Fisheries and Aquaculture (FAO, 2016 and 2018) point to the fact that the sustained expansion of trade in fish and fishery products observed in recent decades has been fuelled by growing fishery production and driven by high demand. Over-capture and acceleration in stocks depletion have already reached worrying thresholds.

Sustainability has been at risk for several years and trade and its intensification,[1] possibly driven by inadequate policy approaches and instruments, may not levy related concerns as discussed in a recent report produced by UNCTAD (UNCTAD, 2016). The current situation calls for immediate action coordinated at the international level, and for a shift to a new production paradigm. A first step is the conclusion of an agreement amongst WTO members on fish subsidies. However, interests and exposure to vulnerability are not perceived and appreciated in a similar manner by the fish sector actors, especially the largest ones who thanks to public subsidies may sustain non-profitable extraction activities. This absence of a shared vision and eventually interests is likely to lead to a "status quo plus" type of solution with harmful subsidies maintained in some form. This would be worrying news for fish resources and the oceans.

It is a well-known fact that subsidies promoting fishing efforts could significantly contribute to the depletion of fish stocks in situations of overfishing. This paper argues that tariffs, by inducing higher domestic prices that stimulate fishing effort, can also contribute further to the depletion of stocks already overfished. Within the same analytical framework, the paper further argues that technical regulations such as Sanitary and Phytosanitary measures (SPS) and Technical Barriers to Trade (TBT) can be used to constrain overfishing by monitoring catching devices and techniques and/or redefining fishing and catch conditions. As a result, depletion would be curbed or even reversed while fishing effort and eventually employment would be at worst maintained at their current level. This papers also presents some reality checks by assessing the presence and prevalence of trade measures, such as tariffs and technical regulations, and subsidies. Although information on subsidies that is not subject to political controversy is available only for a relatively small number of countries, several illustrative facts are generated.

Commented facts about subsidies often refer to absolute levels. However, when expressed with respect to production, employment or fleet size, the picture varies substantially. The prevalence of tariffs and technical regulations also varies across countries. Technical regulations are often presented as trade barriers being introduced as a substitute to falling tariffs. Data suggest that this pattern may not be extremely relevant for the set of investigated countries. Technical regulations could be used intensively by countries which are either large consumers or adopting an outward orientation strategy.

Both analytical and empirical findings suggest that countries should only apply subsidies on condition that they are accompanied by a set of technical regulations aimed at monitoring fishing productivity. However, such an outcome could only be reached with a strong effort of harmonization of those regulations at the international and regional levels.

[1] See for instance OECD (2007) for a discussion on the role played by globalization in framing the fishing industry and the consequent environmental threats.

Aiming at monitoring fishing productivity could cancel any trade-off between socio-economic sustainability and environmental sustainability, especially in a context of overfished stocks.

Section 1 presents a standard analytical framework to assess the impact of trade-related instruments on fish, which is a renewable resource. Section 2 presents major characteristics of subsidies and their incidence based on OECD Fish Subsidies Estimates covering 2008-2017. Stylized facts on trade policy instruments are presented in Section 3, covering UNCTAD tariff data and non-tariff measures (NTMs). Section 4 discusses possible implications for policy making and suggests desirable directions for the ongoing WTO negotiations on fisheries subsidies.

1. An integrated economic analysis of subsidies and trade policy instruments

a. Rationale of trade and trade related policy instruments

Trade flows are in most circumstances driven by differences in prices. Countries able to sell at a lower prices than those prevailing in some foreign markets would have the opportunity to sell their products there. The source of such price differences can be manifold from differences in endowment of factors of production or natural resources, differences in technology, to differences in institutions or in policy setup. Transport costs would also play a crucial role in determining relative prices. In principle trade could generate welfare gains although theory clearly indicates that these gains may not be evenly distributed and, in some cases, welfare loss is incurred by agents affected by changes in relative prices. Exports are often seen as a source of additional revenues due to, for instance, the expansion of reachable markets and eventually welfare. This is not necessarily the case of imports although gains form variety in consumption necessarily operates through imports. There are as many reasons to try to promote trade as there are sources of gains from trade and it may be tricky to set up an exhaustive list of such motives as each country and sector characterised by differing factors. Nevertheless, in the presence of a non-renewable resource, trade can have a strong detrimental impact by accelerating or even provoking complete depletion if totally unregulated.[2]

The use of trade related policy instruments is in many situations motivated by some trade objectives either on the import side or the export side or both. However, it can be motivated by any economic, social or political considerations beyond trade objectives. When the target is a non-renewable resource, environmental considerations should also be accounted for and may even become an objective per se.

Subsidies are mostly used to promote and maintain some level of production and or employment in the subsidized sector. By affecting production patterns subsidies may also impact exports (and imports) indirectly. Subsidies can also be used to promote exports directly, although such practice is in principle forbidden by WTO rules. In the context of the fish and fisheries products sector different types of subsidies are identified according to the impact they tend to have on fisheries resources: (i) beneficial subsidies dedicated to management, research and other types of sustainability oriented activities; (ii) capital cost and operating cost subsidies (also called capacity-enhancing subsidies), including those for boat construction and fuel; and (iii) ambiguous subsidies, including those to vessel buy-back programmes and rural fisher community development. While the first type of subsidies is expected to promote environmental sustainability, the second type is expected to favour stocks depletion, for example through trade effects that increase domestic production that may replace imports or boost exports or both. The third type can be either sustainability friendly or environmentally harmful depending on the current circumstances.[3]

[2] See for instance Copeland and Taylor (2006), Copeland (2011) for a detailed theoretical discussion and Eisenbarth (2018) for some empirical evidence.
[3] See Milazzo (1998), Sumaila et al. (2015) and Sakai and al. (2019) for a detailed description and discussion.

As to tariffs they are usually held responsible for generating inefficient resources allocation by inducing an economically unjustified price competitiveness gap favouring domestic products as compared to imported ones. However, a country with market power in trade might gain from protection. A tariff creates consumption and production distortions, but it also creates a terms-of-trade gain if the importing country demand can affect international prices. In more specific situations, tariffs may also be used to create some temporary protection to allow a domestic sector to develop its international competitiveness. This would correspond to the standard infant industry argument. In all cases trade effects will concentrate on the imports side, which are substituted for by domestic production.

Non-Tariff Measures other than subsidies can take several forms with potentially contrasting trade effects. Price and quantitative restrictions are likely to be implemented with the intent to act as barriers to trade. Measures such as Sanitary and Phytosanitary measures or Technical Barriers to Trade are in most cases implemented for non-protectionist purposes as discussed more in detail in section 3. Their precise impact on domestic production and trade flows requires some qualifications as argued in the next sub-section. In the case of fish and fisheries products, domestic production can benefit from some technical regulations especially in a situation of overfishing. Imports can also be negatively affected but may also rise if compliance with the implemented regulations is perceived as a quality improvement feature by consumers. In what follows positive demand effects are not necessarily referred to. However, even if we accounted for these types of effects the arguments put forward would still be valid and even reinforced.

b. Analytical framework

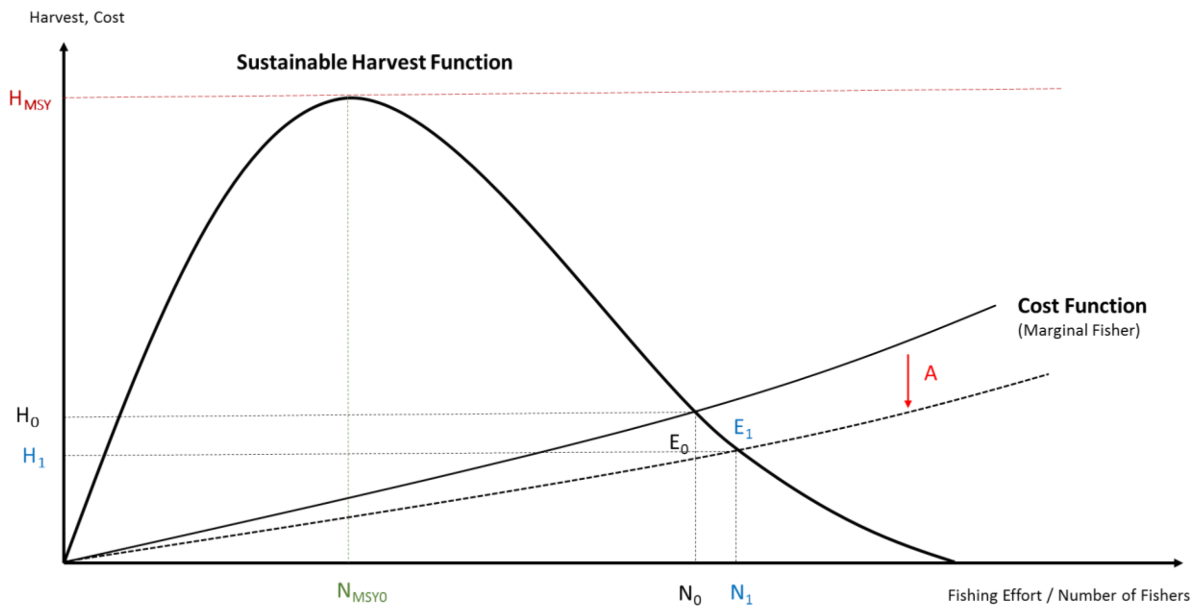
This section discusses the effect that trade-related policy instruments may have on fish and fisheries product markets. Analytical inputs are based on an augmented version of the Schaefer (1957) fisheries model, in line with the version developed in Bayramoglu and al. (2018). An important assumption is that fishers differ in productivity. In the theoretical framework referred to here, differences in productivity are associated with differences in fishing technology or techniques, which for instance can also be linked to differences in vessel size. An important feature of the logistic growth model is the existence of a level of stock called the carrying capacity that would correspond to the steady state stock in the absence of human intervention. Any practical interpretation would remain consistent with most analytical results presented below.

In order to predict precisely the impact of changes in policy instruments, such as subsidies and other non-tariff measures and tariffs, several functionalities of the framework need to be specified and possible without any loss of generality. On the supply side, the harvest function of a typical fisher depends positively on the stock of fish available, the number of workers employed and productivity. Fishers' individual supply is negatively affected by regulations in place that can affect overall productivity. In practice, these regulations could imply for instance rules such as restricting the length of the season (an extreme situation would be a complete ban where overall productivity would drop to zero), types of fishing gear and equipment that would be allowed, fishing areas, size of the fish that can be caught for the various species, or type of fishing techniques that can be used.

Fishing also entails various costs of production, which can be either fixed or variable. Variable costs would include the cost of labour, the cost of fuel or the cost of maintenance of the vessel used. These costs are variable as they are directly defined by the intensity of the fishing activity. Fixed costs on the contrary would not be directly associated with the intensity of the fishing activity. For instance, in order to start any activity or to modernize the technology used on vessels, fishers would have to invest funds that are not directly related to their fishing activity. The obligation to certify catches would also lead to additional fixed costs, although a large part would directly be impacted by fishing intensity. Fixed costs could be induced by the imposition of some regulation such as the obligation to install a GPS on vessels.

At the sectoral level, the supply of fish and fisheries products is defined by a sustainable harvest function based on a logistic growth model for the fish stock, some distribution function of productivity amongst fishers and the non-restrictive hypothesis that entry into the sector is free or up to some minimal initial investment in fishing capital such as vessel and fishing equipment. A representation of such a sustainable harvest function is provided in Figure 1.1.

Figure 1.1: A fisheries model: Tariffs and cost-reducing subsidy impact



The function is hump-shaped and skewed to the left. The maximum sustainable harvest, also referred to the "maximum sustainable yield" (H_{MSY}) in fisheries literature, is a function of both the carrying capacity and the intrinsic growth rate of the stock. In other words, the MSY is independent from fishing activities. Only the current stock is affected by fishing activities. The model predicts that harvest, originally at low levels, increases with fishing effort, to peak at H_{MSY}, and then eventually declines to zero as the number of active fishers increases. Beyond the H_{MSY} threshold, a trade-off between environmental sustainability and fishing effort and employment can appear. Policy measures affecting the costs curve will exacerbate this trade off. While policy measures able to affect the of the harvest function may dampen it.

Heterogeneity of fisher productivity explains the asymmetric shape of the curve as new entrants will always be less productive than active fishers.

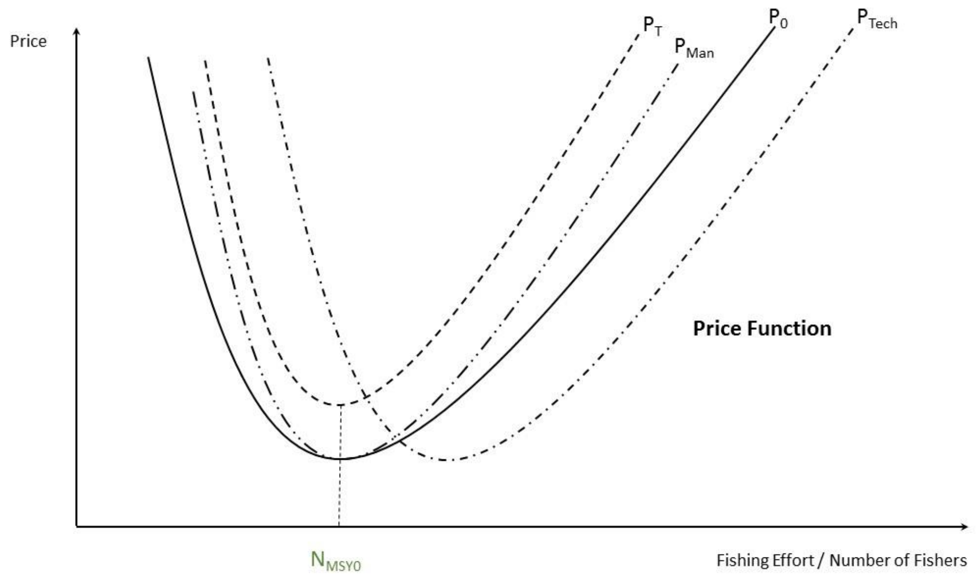
The other function represented in figure 1.1 corresponds to the cost function of the marginal fisher or last entrant. Any decrease in one or more cost component will shift the cost function downwards, as demonstrated with shift A above, resulting in a change of equilibrium harvest and fishing effort from E_0 to E_1. On the other hand, any increase in one or more cost component rotates the cost function counter clockwise.

The theoretical setup also predicts that increases in the price of fish increases profitability and consequently the overall fishing effort by attracting more fishers into the sector. Because fishers are heterogenous in their productivity, increases in prices will allow the participation of less productive (e.g. small scale) or less efficient fishers. An increase in the price of fish rotates the cost function clockwise. If the original fishing effort was below N_{MSY0}, then an increase in price would lead to an increase in fishers' participation and a higher harvest. If original fishing effort was either close to N_{MSY0} or above it then an increase in price would still increase the fishing effort. However, the total amount of fish caught would eventually fall due to the depletion of available fish stocks. Too intensive fishing would not allow the stocks to regenerate themselves and eventually lead to depletion and decreasing harvest. In other words, the very existence of a carrying capacity could lead to stock depletion if the current stock is above its MSY level.

In the absence of tariffs or some other trade distortive policy element, domestic and world prices would coincide. Supply and demand forces at play produce an equilibrium price that increases if supply falls and decreases if supply rises. Under standard conditions and properties, a price increase implies a fall in demand and vice versa. In this context a price that clears the market at any strictly positive level of harvest always exists.

Figure 1.2 represents the relationship between price and fishing effort. Below the N_{MSY0} level that corresponds to the MSY-compatible harvest, any increase in fishing effort will increase harvest and lower the equilibrium price. Beyond that threshold, as fish supply falls with higher fishing effort, due to stock depletion, equilibrium price trajectory moves upward.

Figure 1.2: Prices and fishing effort



Standard trade theory shows that in non-abnormal circumstances, the imposition of a tariff always distorts the domestic price of the affected product. The domestic price will increase because of the tariff. Depending on international market conditions and relative size of the domestic market, the increase may either be equivalent to the tariff or to a proportion of it. In the case of a small country importing from relatively large countries, the observed rise in the domestic price matches perfectly the tariff in ad valorem terms. A direct consequence of such a measure is a fall of imports, which if feasible are replaced by domestic production.

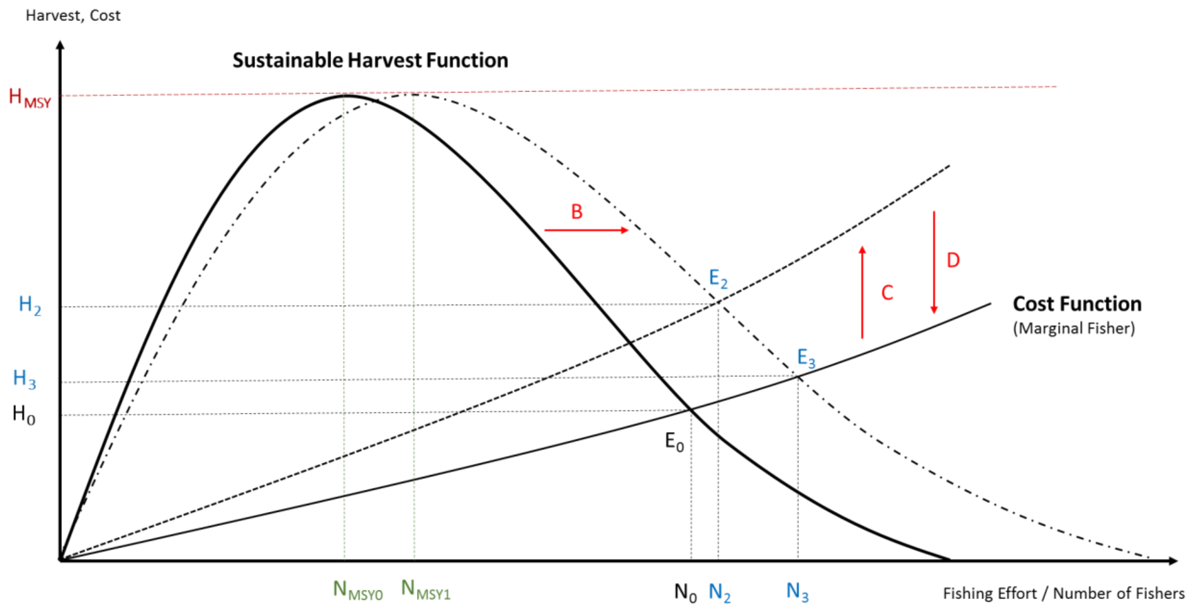
The effect of a tariff is represented by the shift from P_0 to the dashed price function P_T in Figure 1.2. The imposition of a tariff has the same effect from the domestic fisher point of view as an increase in fish price. The cost function of the marginal fisher then shifts down (as in Figure 1.1). We should observe a rise in fishing effort or equivalently an increase in participation and thus employment due to higher prices. However, if we are above the sustainable sector size N_{MSY0},the imposition of a tariff will also contribute to the acceleration of depletion. What can be interpreted as positive from an employment point of view, but also perhaps from a fiscal point of view due to additional tariff revenues, does not necessarily lead to sustainable environmental dynamics.

The effect of subsidizing renewable resources sectors, such as fish, are comparable to that of a tariff. Subsidies would in most circumstances lower production costs borne by firms. With lower production costs (as with fuel subsidies), the fishing effort will increase and depending on whether we stand below or above $N_{MSY0,}$ harvest will either increase or decrease. In the above N_{MSY0} zone, prices would keep on rising as fishing effort increases, while total harvest continues to fall. These dynamics could lead to a race to the bottom, eventually depleting fish stocks. In Figure 1.2, the price effect of such a subsidy is observed by moving along the original price function P_0.

The price function denoted by P_{Man} in Figure 1.2 reflects the effect of subsidies directed towards an improved management of resources. It represents a situation where a better management of resources increases harvest for the same fishing effort, leading to a steeper price curve. A major difference between the first type of subsidy and the second stands in the fact that while the former is likely to be paid to fishers directly, the latter may be managed for the sector as a whole by some specialized institution either governmental or not. Another important difference is that while the first type will clearly push fishers' costs downwards, the second type of subsidy costs may either increase or decrease fishers' costs depending on the very features of the measures implemented to improve resources management.

Non-Tariff Measures other than subsidies, (technical measures such Sanitary and Phytosanitary measures and Technical Barriers to Trade) may constrain sectoral productivity or increase the cost of production. When productivity is negatively impacted, the harvest function would shift to the right as shown in Figure 1.3 by the dashed harvest function (shift B).

Figure 1.3: A fisheries model: Technical Measures and Subsidies impact



This implies that the same harvest would now require a larger fishing effort as compared to the original set-up. Regulations imposing some constraints on the type of fishing gear to be used would have such effects. In other words, if environmental sustainability is taken into consideration, this could represent a rather efficient way to both preserve employment and the fish stock. Moreover, the theoretical set up suggests that the induced sectoral expansion could benefit relatively smaller fishing firms. A move from E_0 to E_3 could thus be associated with an increase in the participation of relatively smaller fishing firms or firms characterized by relatively smaller and less productive vessels. However, the implementation of such regulations may imply some specific additional costs. In figure 1.3, a cost increase would correspond to a counter clockwise shift of the cost function (shift C). This would dampen the sectoral expansionary effect of the harvest function shift but would reinforce the pro environmental impact. The cost increase could lead to the drop-off of smaller scale fisheries as suggested by the subsequent fall in the number of fishers in figure 1.3.[4] The sector could end up in a situation corresponding to point E_2 which can be considered as an improvement if compared to the original E_0 equilibrium. Indeed, the new equilibrium would be characterized by a

[4] Evidence such as in Fontagné and al. (2015) and Fugazza and al. (2017) on the impact of technical regulations suggests that in general small firms are likely to be relatively more affected by the implementation of more stringent measures as compared to larger firms. Such results has also been obtained in the specific case of fisheries in Senegal as shown in Niang (2004).

higher fishing effort and possibly a higher level of employment and a higher harvest. This harvest increase is due to the reduction of the depletion rate of the stock thanks to the new set of regulations aiming at managing fishing capacity. In other words, to avoid a negative trade-off between employment and environmental sustainability regulations monitoring fishing capacity are needed. Cost related measures could only affect one dimension by affecting the other dimension with an opposite sign. The market clearing price is expected to be lower than the original one.

In Figure 1.2, the dashed Function P_{Tech} represents the new price function that corresponds to the right-shifted harvest function as a result of the introduction of technical measures. As can be observed in Figure 1.3, technical measures would be extremely effective if the original fishing effort stands below levels supporting H_{MSY}, enabling a move from N_{MSY0} to N_{MSY1} along the dashed harvest function.

At harvest levels beyond H_{MSY}, if employment remains a major objective from a public policy point of view despite the risk of severe depletion, subsidies could be used to compensate for the rise in cost due to the new regulation. In that case, the cost function in Figure 1.3 would again rotate clockwise (shift D), and the sector may end up at point E_3 or anywhere between E_2 and E_3 depending on the subsidization effort.

Tables 1.1 and 1.2 report main domestic and international effects of trade related policy instruments. International effects are more likely to occur when the country implementing some policy is a large country in terms of production and/or consumption.

While tariffs and subsidies may both impact positively the domestic fishing effort by rising prices paid to domestic fishers in the former case or by lowering fishing costs in the latter, regulations such as SPS measures or Technical Barriers to Trade could be used to limit fishing productivity for instance by limiting fishing gear power or by restricting the set of allowed fishing techniques and devices.

Tariffs and subsidies however do not have the same global consequences. Imposing a tariff in a country could increase its domestic fishing effort and eventually its employment in the fish sector. Domestic prices are expected to rise while prices perceived by exporters may either stay the same or decrease if the imposing country is a large one. In all cases exporters would have to lower their price to remain competitive in country A markets implying that their fishing effort may fall. Tariffs may thus induce a geographical transfer of fishing effort from the exporting country to the importing country.

Effects on fiscal revenues reported in the last column of table 1.1 should be interpreted as first order effects. These effects could be either amplified or dampened over time. For instance, the imposition of a tariff would first raise tax revenues but as import demand reacts to the subsequent rise in imported product prices, then tariff revenues could fall and may even turn to zero if imports stop. The same for subsidies, they are a cost for the government, but this cost could be mitigated by increasing fiscal revenues from domestic taxes due to higher production levels.

Table 1.1: Expected domestic effects

	Underfished stock			**Overfished stock**			**Government revenues (primary effect)**
	Harvest	Fishing effort/employment	Domestic price	Domestic harvest	Fishing effort/employment	Domestic price	
Subsidy	+	+	-	-	+	+	-
Tariff	+	+	+	-	+	+	+
Technical Regulations	+	+	-,+	+	+	-,+	0

Note: Signs refer to the relationship between a change in a column variable and the subsequent change in the row variable of interest. For instance, a positive sign indicates that if a change occurs to a column variable (e.g. subsidy) the subsequent variation observed for a row variable (e.g. domestic price in a situation of overfished stocks) goes in the same direction.

Table 1.2: Expected international effects

	Underfished stock			Overfished stock		
	Exports	Imports	International price	Exports	Imports	International price
Subsidy	+	0,-	-,0	0,-	0,+	+,0
Tariff	-,0	-	0,-	-	-,+	+,0
Technical Regulations	+,0	-,0	-,0	+,0	-,0	-,0

Note: Signs refer to the relationship between a change in a column variable and the subsequent change in the row variable of interest. For instance, a negative sign indicates that if a change occurs to a column variable (e.g. tariff) the subsequent variation observed for a row variable (e.g. imports in a situation of underfished stocks) goes in the opposite direction.

Table 1.1 shows that technical regulations aiming at monitoring fishing productivity are the only policy instruments capable to cancel any trade-off between employment and environmental objectives independently of fish stocks status. Their impact on exports could be either positive or neutral and that on imports either negative or neutral. This is true whether stocks are currently either underfished or overfished. This implies that changes in trade balance would remain limited in all cases. Table 1.1 and 1.2 further reveal that a country with a strong production and export objective may be tempted to use subsidies to reach it. However, if stocks turn overfished then subsidies would be detrimental both in terms of production and eventually export performance.

No distinction between migratory and non-migratory species has been made so far. From a qualitative point of view previous results would hold. The fact that species are migratory could lead to spill over effects across fishing countries that would necessarily call for a higher degree of cooperation and integration of country policy approaches. This necessity is reflected by the provisions in the United Nations Convention on the Law of the Sea (UNCLOS) specifically dedicated to migratory species and the establishment of fishing quotas/harvest caps established and monitored by regional fisheries management organisations (RFMOs).

The case of harvest caps as already established for some species and mostly some highly migratory ones, such as tunas, could become extremely relevant when trying to curb the general trade-off between production and employment objectives and environmental sustainability. Caps on catches of all species and especially the overfished ones may be a first best policy approach. The implementation and the monitoring of such system could become extremely complex and politically delicate. Moreover, the way quotas are allocated amongst fishers is crucial in order to maintain employment at its highest level. Competition in the attribution of quotas may lead to the exclusion of least productive fishers due to upward auctioning of such quotas by more productive entities.

c. Practical implications

This section has presented so far, a theoretical analysis of how fishing as an economic activity reacts to trade-related policy instruments. It has discussed how actors undertake behavioural changes in response to changes in multiple variables such as tariffs, subsidies, technical measures, fleet, productivity, fixed costs, and status of fish stocks. The theoretical model showed that while unchecked tariffs and subsidies may lead to a race to the bottom in terms of fish stocks, non-tariff measures may put a brake on such impacts. In terms of the practical, real-world implications, and especially considering the ongoing intergovernmental negotiations on removing harmful fisheries subsidies, it is useful to provide a snapshot of the current state of play in the global fishing industry.

The objective of the next sections is possibly to identify patterns in the use of trade related policy instruments that could match with country patterns in terms of resource extraction. Such patterns have been defined in Kumar et al. (2019). The authors classify countries into three broad groups in terms of fisheries resource extraction:

1- *Holders of fisheries resources*: They hold major fishing areas, as in the case of small island developing states or of countries with a large coast/total perimeter ratio, such as Greece or Chile. Australia could also be included in this category. Previous theoretical insights suggest that such countries would focus their policy efforts on maintaining production and employment. We should then observe relatively generous subsidies as per quantity produced and/or employment. As to tariffs, they may be introduced to complement domestic production promotion. The same would be true for non-technical regulations. However, domestic consumption concerns may also be accounted for, translating into relatively low tariff protection and relatively high prevalence of technical regulations.

2- *Holders of fisheries extraction capacity*: These countries enjoy the largest number of fishing vessels, hence have the highest fishing capacity and technological know-how. In this context, theory could predict a relatively generous subsidy policy translating however into relatively small level of subsidy per produced quantity unit due to high technological know-how. Such know-how could be reflected in relatively high capital intensity in the domestic fleet. Such countries may be tempted to set up a forward oriented strategy to fully utilize their capacity, assuming obviously that the status of fish stocks they access to permits it. Domestic consumption may be a strong driver of domestic productive capacity development in order to minimize exposure to import idiosyncrasies. We could observe the application of relatively high tariffs and more pervasive use of technical and non-technical measures.

3- *Largest suppliers of marine capture in fisheries*: Apart from the United States of America, these are predominantly larger developing countries such as China, Indonesia, Peru, India, and the Russian Federation. Large suppliers of marine capture may rely, but not necessarily, on strong extraction capacity and/or access to large fisheries resources. Their distinctive feature however would remain their high marine capture volume. Such countries could be characterized by a relatively low level of subsidization per unit produced. The prevalence of subsidy as per worker of vessel does not need to follow any precise pattern. The same holds for technical regulations. As far as tariffs are concerned, there is no clear motivation for keeping them high as this type of country is already a big supplier, meaning that it is not exposed critically to foreign competition. A country may be a larger supplier of some specific species and would show a strong inclination to export such species to take advantage of its relative natural endowment advantage. Again, the consumption dimension could play an influencing role in defining the policy design to be implemented. However, they are likely to be characterized by a large trade surplus as exports are a major element in selling their relatively large supply of fish.

As just discussed, consumption is a dimension to be accounted for in all groups. Consumption of fish and fisheries products may represent a crucial dimension in food security schemes. Most recent estimates (FAO, 2018) reveal that 30 per cent of world's population rely on fish and fisheries products as their main source of proteins. Propensity to consume fish varies across countries depending among other elements on societal habits or geographical circumstances. Sub-groups based on specific consumption patterns and specific trade policy instruments combinations may be identified in a country grouping exercise. Such exercise is the purpose of the next three sections.

2. Subsidies: some stylized facts

Despite their strong potential distortionary impact on both national and international markets, subsidies remain in general imperfectly reported by countries. The Agreement on Subsidies and Countervailing Measures ("SCM Agreement") obliges WTO member countries to submit a series of notifications to a dedicated committee within the WTO secretariat (the Subsidies and Countervailing Measures Committee). However, as discussed by Formenti and al. (2019), in the case of fish subsidies, the legal framework and guidelines may not be the most appropriate to guarantee transparency and accurateness of such notifications.

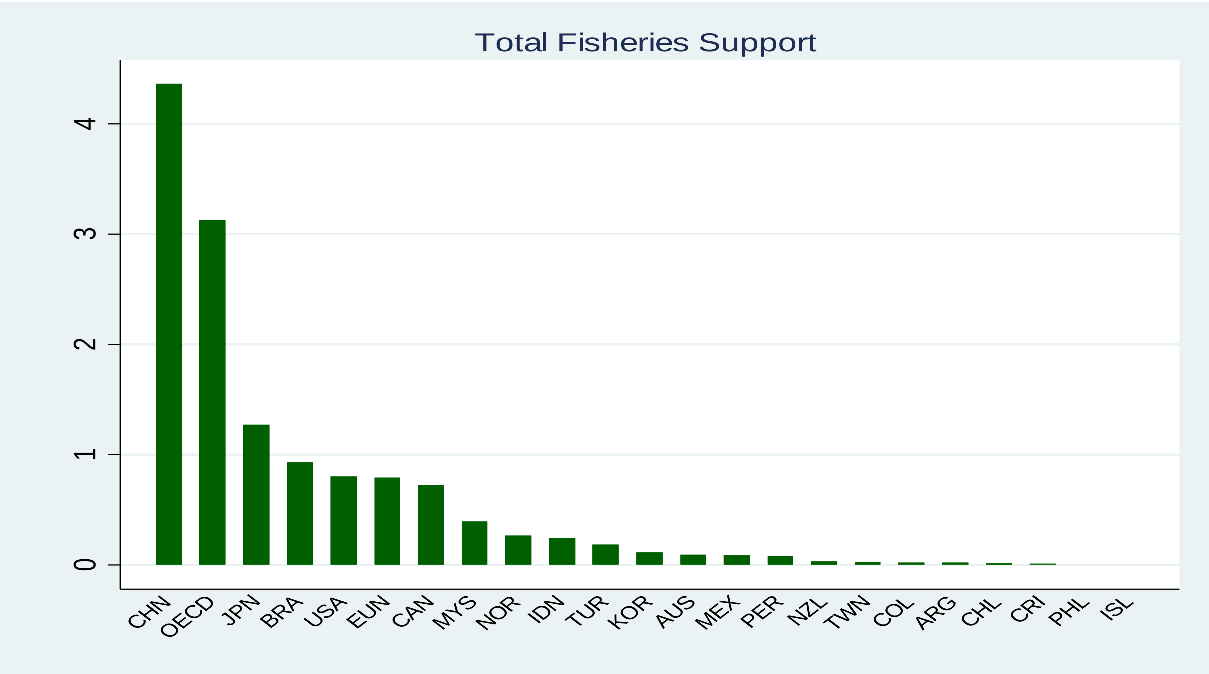
a. Data

The only official or at least non disputed source of data on subsidies is the Fish Subsidies Estimates dataset produced by the OECD.[5] This has proved to be the least controversial source of information so far at least amongst represented country governmental institutions. Information is available for all OECD members plus ten non-OECD economies. Data are not systematically available for the whole set of countries each year. To avoid country coverage issues, data below will either refer to a specific year characterized by high coverage or to an average of all estimates obtained between 2008 and 2017. Besides preserving country coverage such approach allows to contain year to year variability and may provide a smoother and eventually more stable profile of subsidy payments across countries.

b. Absolute versus relative subsidy indicators

Figure 2.1 shows the average annual amount of subsidy paid by represented countries in descending order in the period 2008-2017. The OECD total is represented together with the amounts paid by its members separately. The figure represents European Union countries as a single group and sums up all subsidies paid within the group. The largest subsidizing country in absolute terms is China (41 per cent or total estimated subsidies) followed by Japan (12 per cent), Brazil (9 per cent), the United States (8 per cent), Canada (7 per cent), Malaysia (4 per cent) and Norway (2.5 per cent). Taken together, OECD countries total estimated effort represents about 60 per cent of China's effort. European Union share in total estimated subsidies is between that of the United States and Canada. However, the average level of subsidies paid by a European Union country would fall between the level paid by Peru and New Zealand. The largest subsidizer in the European Union during the 2008-2017 period has been Spain followed by the Netherlands, Denmark, Sweden and Italy. Subsidies levels paid by these European Union countries stand between Australia and Turkey. At the extreme right of the graph stands Iceland. Subsidies granted by Icelandic authorities are negative. This is mostly the consequence of a reversal of the tax waiver policy has been granted to the industry.

Figure 2.1: Annual subsidies (US$ Billion) average 2008-2017

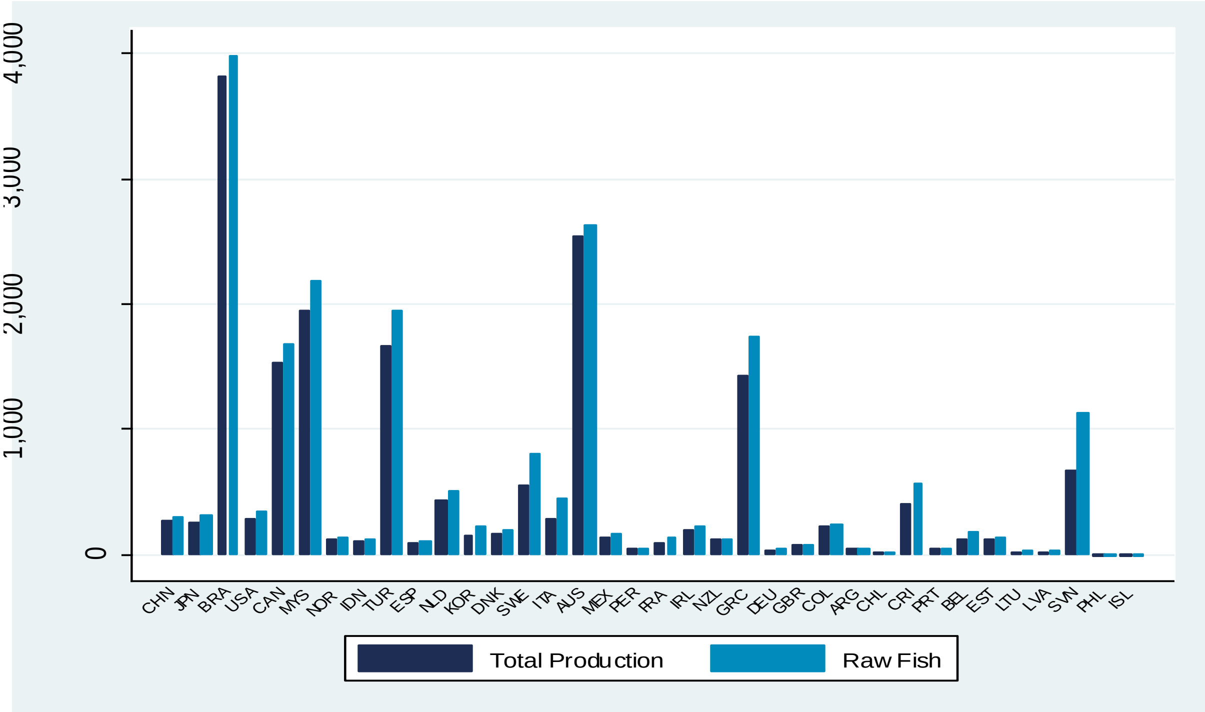


Source: Authors' calculations based on OECD official estimates.
Note: Full country names are provided in the appendix.

[5] Detailed information and original data can be found at https://stats.oecd.org/Index.aspx?DataSetCode=FISH_FSE#.

Figure 2.2 graphs subsidy levels computed per unit of production expressed in metric tons. Both production of raw products and total production (raw products plus preparations) are considered. Logically numbers for production of raw fish stands above that of total production as the amount of subsidy used is the total and is applied to both categories indistinctly. Countries are ranked by absolute level of subsidy amount as per Figure 2.1.

Figure 2.2: Subsidy per metric ton produced: Raw products and total production (Average 2008-2017)



Source: Authors' calculations based on OECD Fish Subsidies Estimates and FAO FishStatJ.
Notes: Countries are ranked according to the total amount of subsidies paid. Full country names are provided in the appendix.

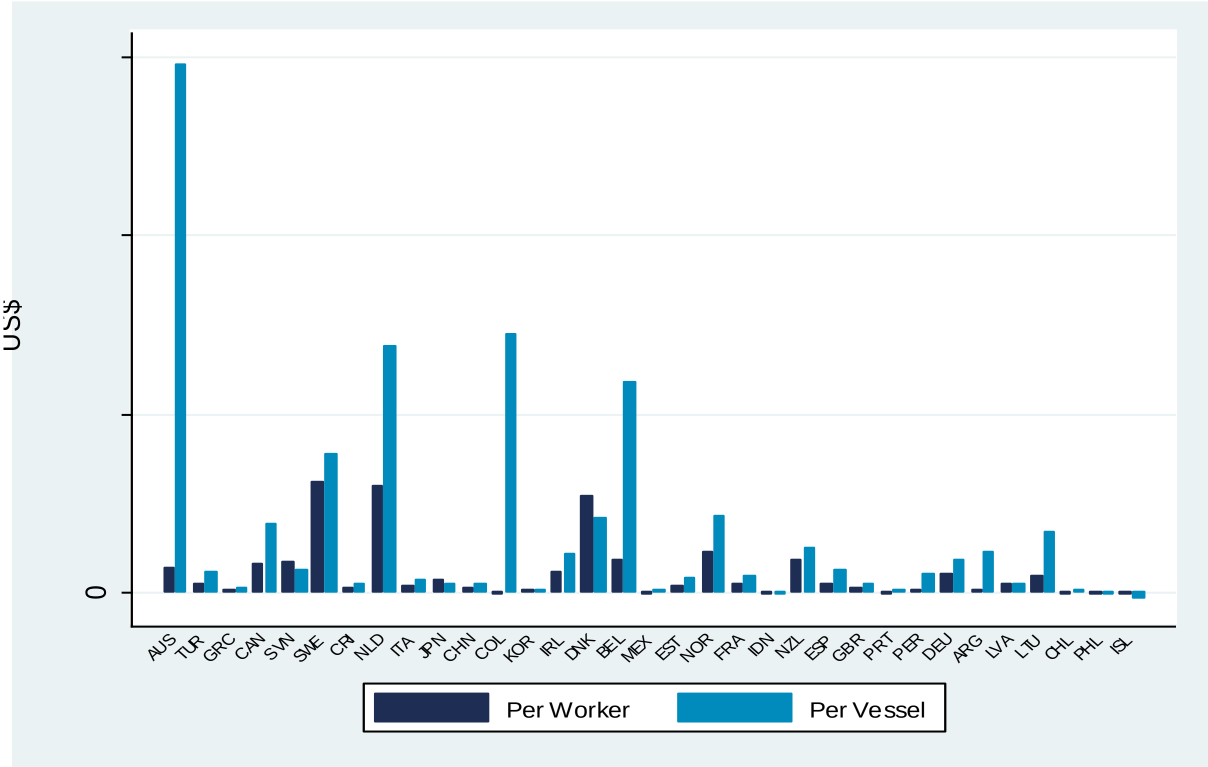
Ranking in absolute terms does not systematically match ranking in relative terms. While Brazil, Malaysia and Canada are also found to be high subsidizers in relative terms, the opposite is true for China, the United States and Japan. In relative terms, China almost becomes an average country in comparison to outliers like Brazil along the production dimension. We also have relatively modest subsidizers in absolute terms that turn out to be amongst the highest subsidizers per tonnes of production such as Australia, Turkey, Greece and Slovenia. It would be erroneous to conclude that high levels of subsidy paid per tonne produced are a clear indicator of inefficiency of the productive sector itself. Efficiency measurement should be closely linked to the type of fish techniques allowed or used by the fish industry. Moreover, production per se is also intimately linked to the major species caught and their respective stock status. A high level of subsidy per tonne could simply mean that the stocks are completely depleted and there is not much fish left to be caught.

Note on the other hand that even if we exclude aquaculture, from production numbers, China still plays an important role in shaping the relationship between fisheries support estimates (FSE) values and production values. As discussed previously, the sign of the relationship between the amount of subsidy paid and the absolute level of marine capture cannot be defined unequivocally. If the subsidy is paid to support a non-efficient sector, then the relationship would be negative. If on the contrary the subsidy is paid to boost productivity, then the sign of the relationship could turn positive. With different countries with diverging sectoral efficiency profiles then the overall sign of the relationship does not have to be significantly different form zero. In our reference sample, the sign of the relationship is undetermined if China is not included. Once China is included in the sample for calculations then the relationship becomes significantly positive either on a year-to-year basis or during the whole period under consideration. In order to control for non-country specific elements that may influence the relationship we also run a simple regression over the whole period between FSE value and marine captures eliminating any possible year-specific effects. Even in this framework the inclusion of China makes the relationship significantly positive while it is insignificantly different from zero otherwise.

Considering the previous discussion, these relative numbers, if interpreted with caution, can represent a relevant indicator of the importance of subsidies for the sector in its integrity.

Figure 2.3 shows the level of subsidy paid as per number of workers reported in the sector and as per number of registered vessels independently of their size and other characteristics.

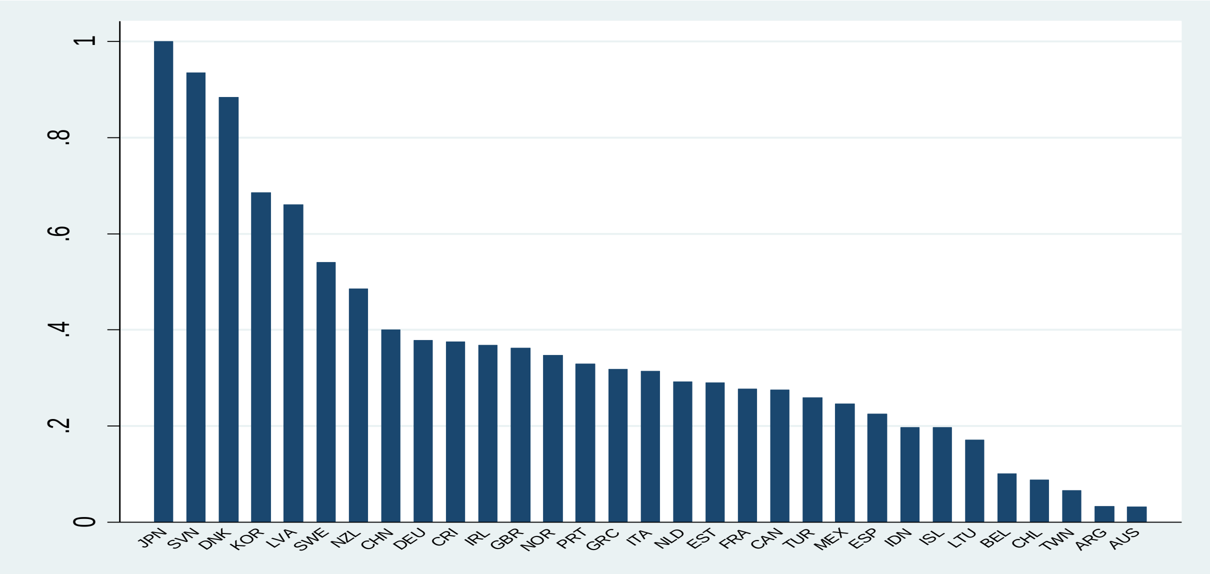
Figure 2.3: Subsidy paid per worker and per vessel (Average 2008-2017)



Source: Authors' calculations based on OECD FSE and OECD.Stat.
Notes: Countries are ranked according to the total amount of subsidies paid per metric ton produced. Full country names are provided in the appendix.

Again, the objective is not to assess efficiency per se but rather the different kinds of incidence of subsidies in the sector. Countries are now ranked according to values represented in Figure 2.2, that is the amount of subsidy paid per metric ton of total production. Amounts of subsidy per worker stand between US$ 50000 and 60000 for countries such Sweden, the Netherlands and Denmark. It is about US$ 22000 for Norway but only about US$ 2500 for China and about US$ 1100 for Brazil. Figures per vessel indicate that Australia has by far the largest figure, close to US$ 300000 per declared vessel. The second highest figure represents less than half of this amount (Colombia). It is closely followed the Netherlands and then Sweden, Denmark and Norway. Not surprisingly, employment-related and fleet-related figures strongly and significantly correlate with each other. Note that the United States are not represented in Figure 2.3 as information about sectoral employment and harmonized provided by the OECD is missing. The level of subsidy per vessel, however, can be computed and would produce a number close to that obtained for New Zealand. Nevertheless, countries vary significantly when looking at ratios of vessels on workers as shown in Figure 2.4. These ratios could be interpreted as an indicator of capital intensity in the sector. However, this interpretation could be misleading as there is no control of the average size of vessels or of the fishing technology embarked in the vessels deployed.

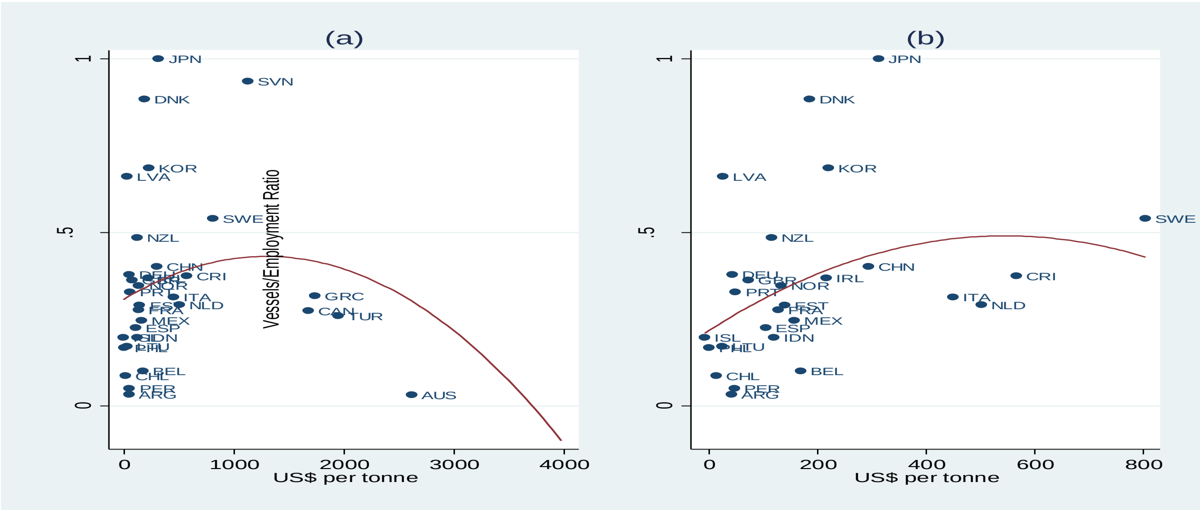
Figure 2.4: Ratio of Number of Vessels on Number of Workers (Average 2008-2017)



Source: Authors calculations based on OECD.Stat.
Note: Full country names are provided in the appendix.

Numbers reported have been normalized to the highest ratio observed, that is for Japan. The latter is by far the country equipped with the relatively largest number of vessels. Australia stands at the other extreme of the distribution characterized by a very low number of vessels per worker. This difference may be due to several elements that cannot be controlled for in this set of computations. For instance, it would be important to include the distribution of the size of the vessels in each country. Consequently, rather than pointing to differences in efficiency we would rather underline the possibly strong heterogeneity behind the industry model chosen in the various represented countries.

Figure 2.5: Ratio of Number of Vessels on Number of Workers against FSE per Metric Ton (Averages 2008-2017)



Source: Authors calculations based on OECD FSE, OECD.Stat and FAO FishStatJ.
Note: Panel b) excludes observations corresponding to a per metric ton subsidy larger than 800 US$. Full country names are provided in the appendix.

Figure 2.5 graphs the vessels per worker ratios against the fisheries support estimate (FSE)[6] per metric ton of total fish production. A quadratic fit function is also represented. The left quadrant includes all countries while the right one includes only countries whose US$ per metric ton amount is below 1000. Different groups of countries sharing the same characteristics in terms of vessels relative intensity and production subsidization can be identified.

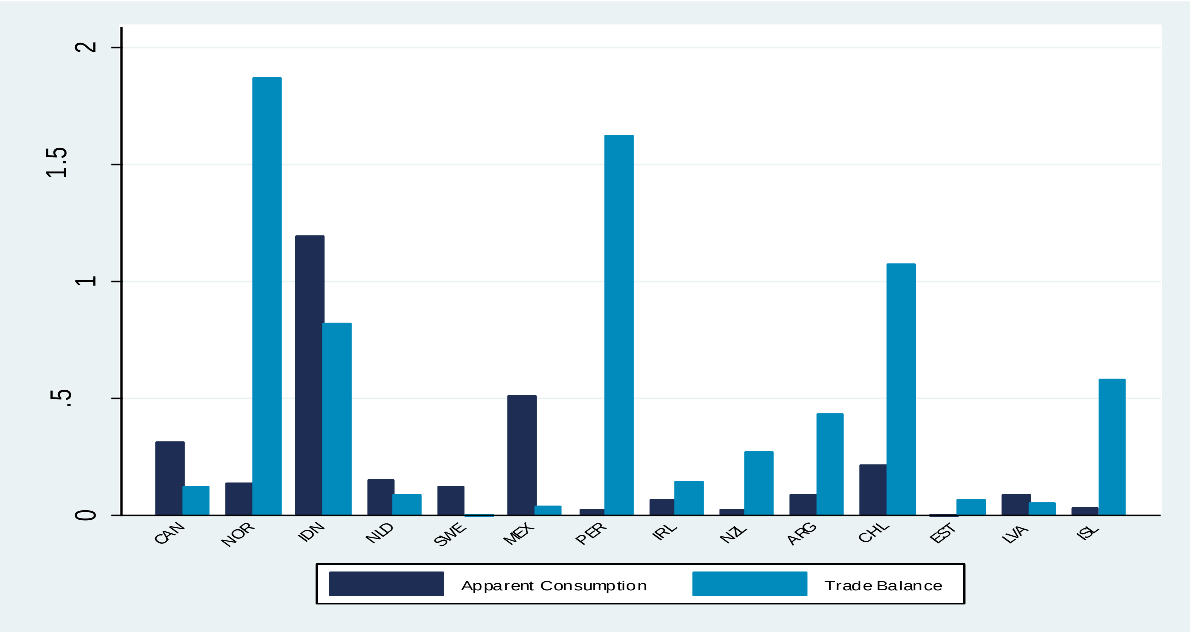
Australia is clearly an outlier with a very generous subsidy policy and an extremely low relative vessel intensity. Canada, Turkey and Greece are the closest to Australia in terms of subsidization per metric ton but are characterized by a higher vessel intensity. Another group of countries with vessel intensity close to that of Australia but with a lower prevalence of subsidies is composed by Belgium, Chile, Argentina and Taiwan, Province of China.

The largest group of countries is characterized by a vessel intensity comparable to that of the Canada’s group but with levels of subsidy per metric tons produced close to the group of Belgium that is below 400 US$ per metric ton. Two additional groups can be identified. One would include the Netherlands, Costa Rica and Sweden with relatively generous subsidy policies. The other would include Latvia, the Republic of Korea, Denmark and Japan. The latter group is characterized by relatively high vessel intensity and relatively low levels of production subsidization.

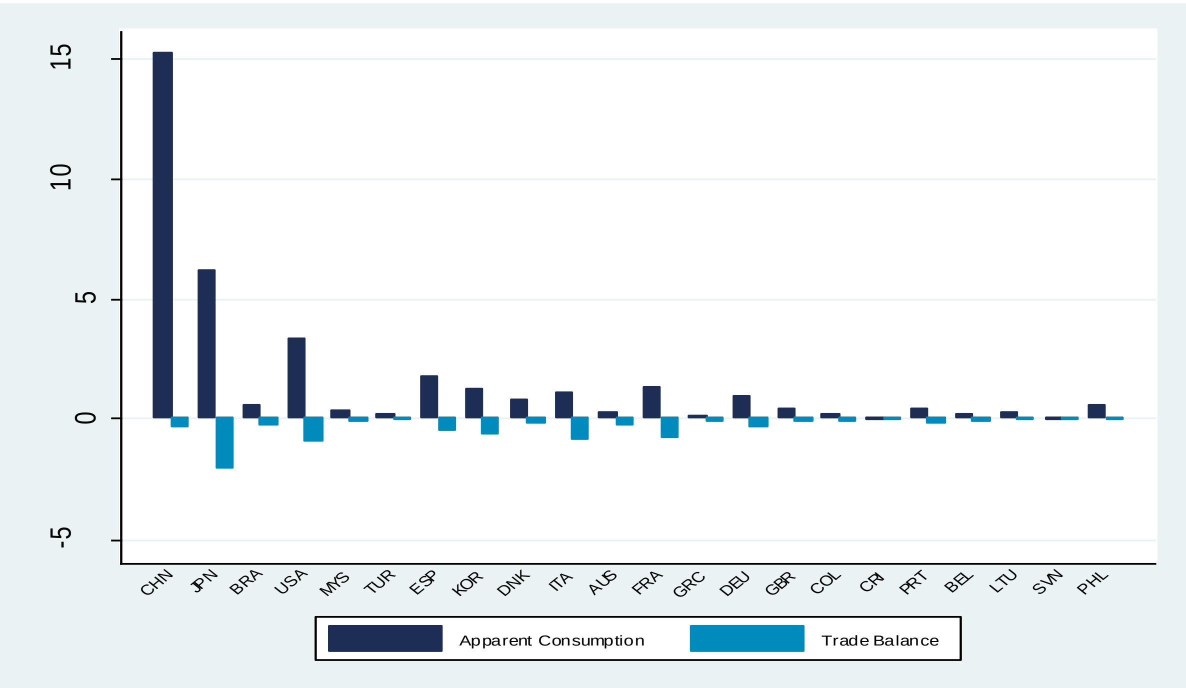
[6] Annual monetary value of gross transfers to fishers from taxpayers, arising from policies that support fisheries, regardless of their objectives and their economic impacts.

Figure 2.6: Apparent Consumption, Trade Balance and Subsidies (Averages 2008-2017): raw products

(a)



(b)



Source: Authors calculations based on OECD FSE, OECD.Stat and FAO FishStatJ.
Notes: Panel (a) displays countries running a trade surplus and Panel (b) displays countries running a trade deficit. Countries are ranked according to the total amount of subsidies paid.

The analysis so far has focused on productive features. However, as discussed previously additional dimensions such as consumption should also be taken into consideration. When considering consumption, it becomes crucial to also consider trade. Indeed, consumption roughly corresponds to production minus the trade balance that is the difference between exports and imports.[7] If a country is a large consumer of some good or product then it may have to import to satisfy domestic demand in cases where domestic production is too weak. Figures 2.6 and 2.7 show the results of such computations applied to raw products and preparations respectively. Note that we do not include aquaculture production although trade figures would implicitly account for this type of products. This implies that our estimates are lower bounds of domestic consumption in the case of raw products. Products from aquaculture can play a predominant role for countries such as China, where aquaculture production is about 4 times larger than its marine landings in weight. As a comparison, OECD total aquaculture production represents in weight about 40 per cent of its total marine landings.

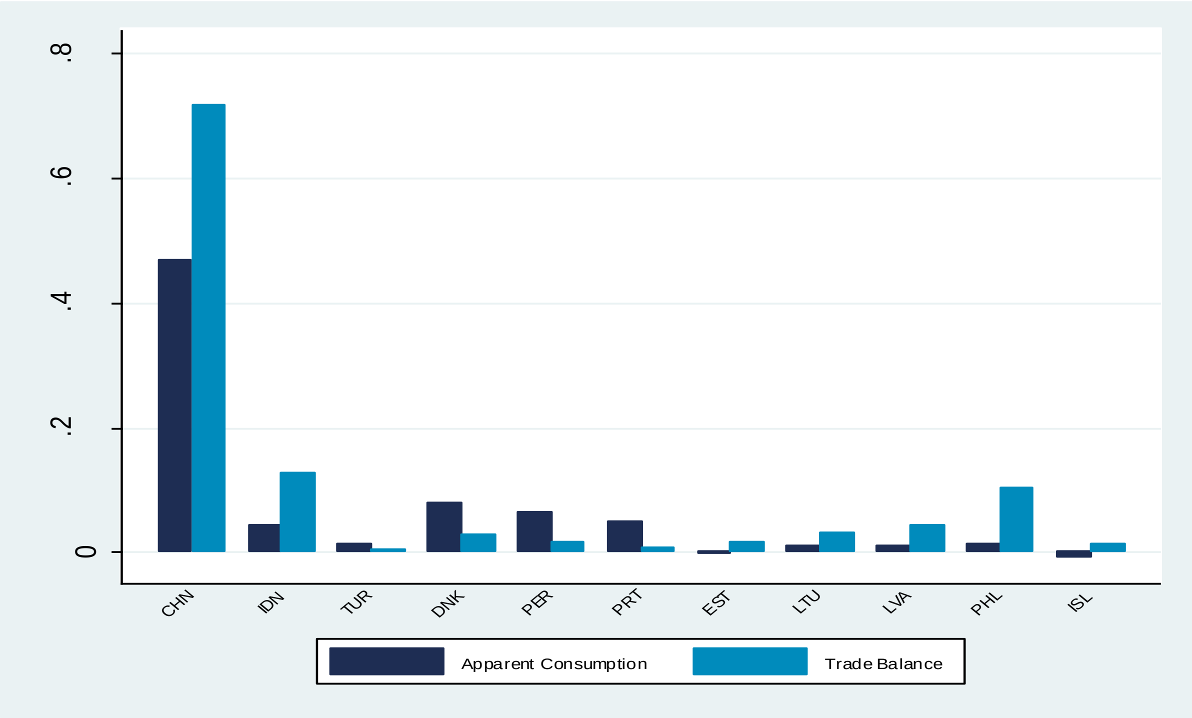
Panel (a) refers to countries with a positive weight balance (trade surplus) while panel b refers to countries with a negative weight balance (trade deficit). Countries are ranked according to the total amount of subsidy paid, from highest on the left to lowest on the right. Results suggest that large subsidizing countries are not necessarily characterized by a trade surplus. Amongst the top five subsidising individual countries (as per Figure 2.2) only Canada has a slightly positive trade balance. Panel (a) further shows that those countries running the largest trade surplus in quantity terms are not necessarily the most generous in terms of subsidy policy. As already mentioned, Iceland is the extreme illustration with negative subsidy levels. In the case of Norway, Chile and Peru, trade surplus in quantity is several times larger than consumption and it may become plausible that subsidies were used to support export orientation. Panel (b) indicates that the largest trade deficits in terms of quantity are found for Japan followed by the United States and Italy. Other large European economies such as Germany, France, Spain and Portugal also run relatively important trade deficits clearly driven by consumption. In these cases, subsidies may have been used to guarantee a minimal level of domestic production to limit exposure to imports collapses and guarantee food security. Note that although China runs a deficit in weight terms, the corresponding number switches to positive when computed for values. The basket of products exported by China has an average unit value larger than the average unit value of imported products. Other countries in a comparable situation are Turkey, Denmark, Australia, Greece, Colombia, Costa Rica and the Philippines. The only two countries in the exact opposite situation, that is running a trade surplus in quantity but a trade deficit in value are Sweden and Latvia.

Figure 2.7 presents information about preparations comparable to that shown in Figure 2.6. Again panel (a) shows surplus countries in weight terms while panel (b) shows deficit countries. Only eleven countries now run a surplus against fifteen previously. Indonesia, Peru, Estonia, Latvia, Iceland are the only countries running a surplus for both raw products and preparations. The largest surplus however is run by China. In all cases but Turkey, Denmark, Portugal and Peru, trade surplus outweighs consumption. In some circumstances, subsidies may have helped creating and promoting some vertical integration process leading most probably to higher value addition creation. As in the case of raw products, despite a deficit in quantity terms, some countries are found to run a surplus once considering monetary values. This situation is verified for Malaysia, the Netherlands, New Zealand and Chile. However, we do not find any country showing a surplus in quantity and a deficit in value.

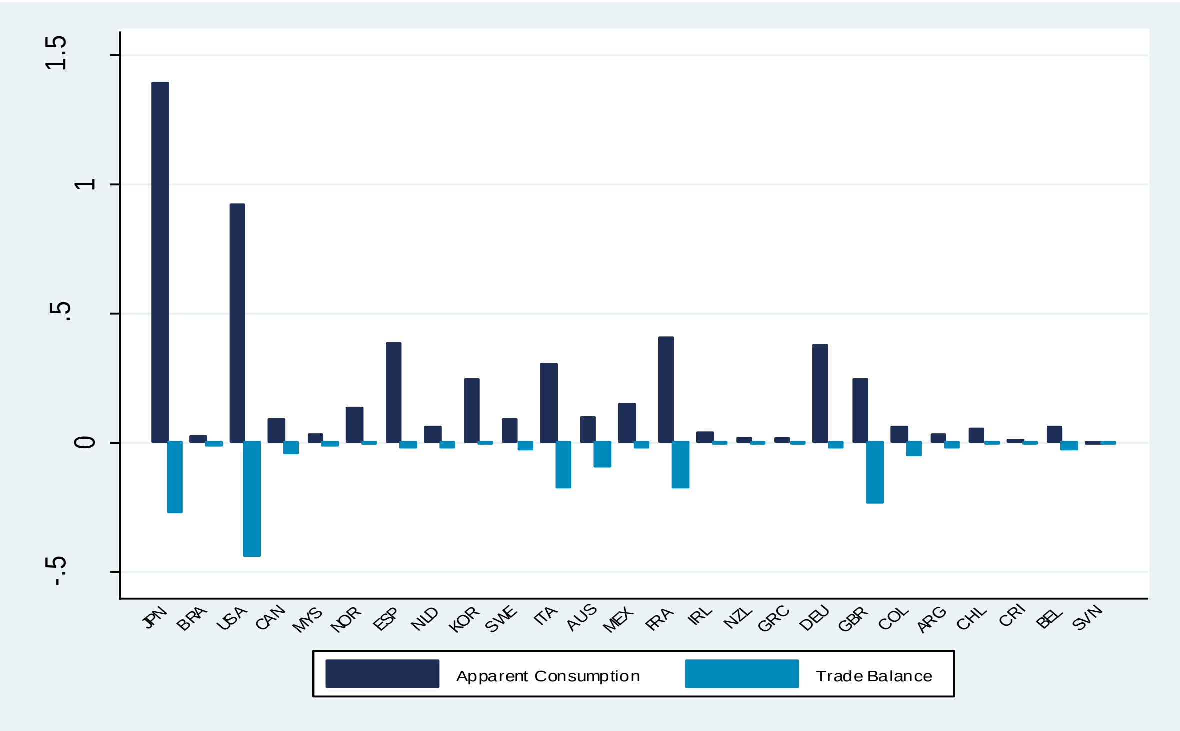
[7] The formula used in the paper is: Apparent Consumption in country A = Production in country A + Imports from the rest of World to country A – Exports of country A to the rest of the World. Figures used for the various aggregates are period averages.

Figure 2.7: Apparent Consumption, Trade Balance and Subsidies (Averages 2008-2017): preparations

(a)



(b)



Source: Authors calculations based on OECD FSE, OECD.Stat and FAO FishStatJ.
Note: Panel (a) displays countries running a trade surplus and Panel (b) displays countries running a trade deficit. Countries are ranked according to the total amount of subsidies paid.

3. Trade policy instruments: some stylized facts

a. Data

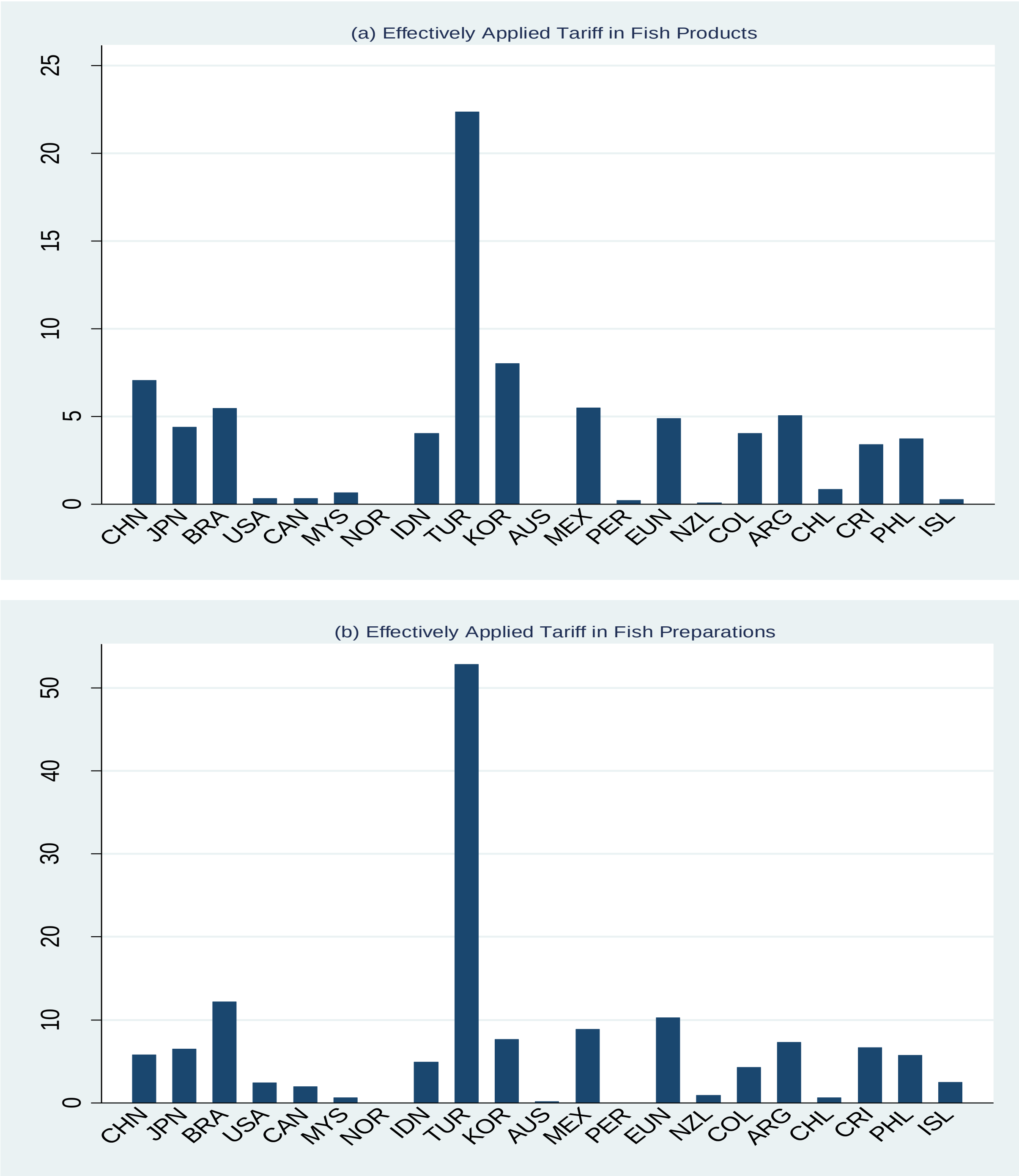
Both tariffs and NTMs data are retrieved from the UNCTAD-TRAINS database.[8] The latter offers the most comprehensive set of information on both Tariffs and several categories of Non-Tariff Measures. As to the latter, only a limited number of countries have informed over several years. In order to keep our analysis as consistent as possible only the most recent available year is considered. Tariffs are matched using the closest timewise available reported information. Tariffs reported at the product category level are computed using simple averages of all composing products. Unfortunately, some economies included in previous sections analysis do not have any entry in the NTMs database. These economies are: Norway, the Republic of Korea, Turkey and Taiwan, Province of China.

b. Tariffs

Tariffs are still prevalent trade policy instruments despite more than two decades of liberalization. However, their incidence varies across products within and across countries. Inter-country variation could be significant in the case of fish and fisheries products as discussed at length in Fugazza (2017). Figure 3.1 below reports sectoral averages of effectively applied tariffs (i.e. preferential tariffs are included) computed for our restricted sample of countries for both raw (panel a) and processed (panel b) products. Countries are ranked according to their total amount of subsidies paid to the sector. Note that the value retained for the European Union (EUN in the graph) represents the average level of subsidies paid by its member states not their sum. The average level of tariffs varies across countries but is in most cases below 8 per cent for raw products and below 12 per cent for processed/preparations products. This difference could be qualified as tariff escalation but should not be generalized as we also observe de-escalation for some developing countries i.e. Chile, China and Peru.

[8] Data can be downloaded at https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-trains.aspx

Figure 3.1: Effectively applied tariffs in Fish and Fisheries Products



Source: Authors' calculations based on UNCTAD TRAINS database.
Note: Latest available year. The EUN figure is obtained by computing the average of subsidies paid by European Union member states individually.

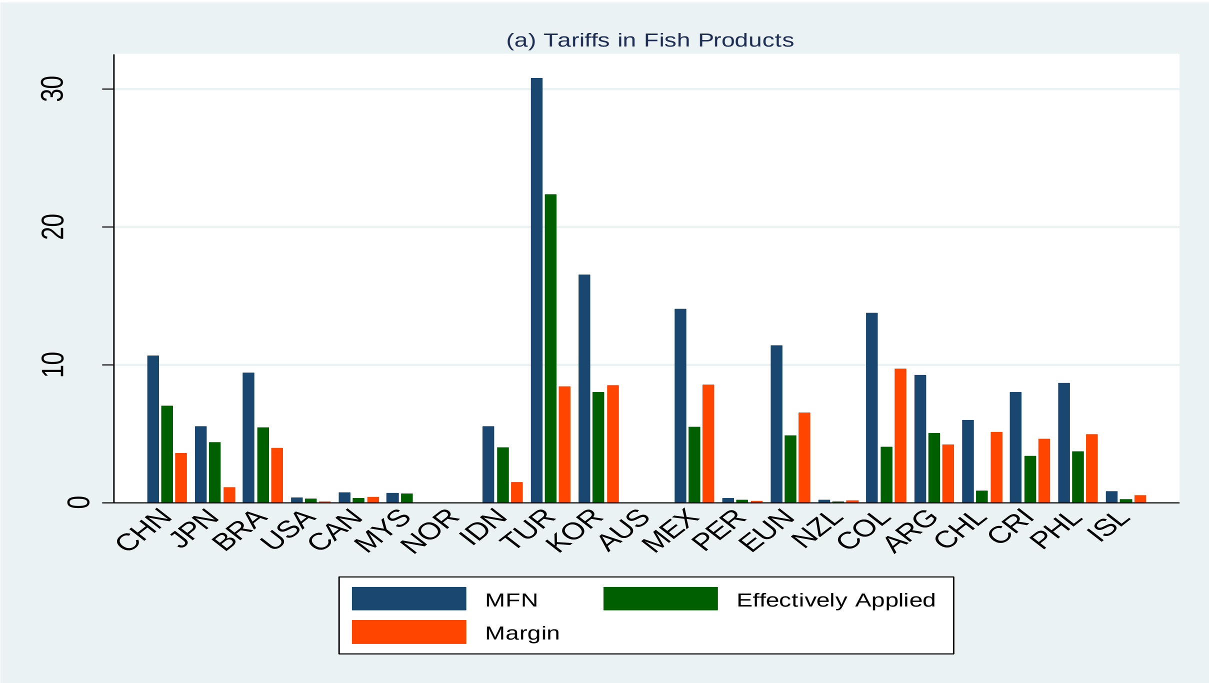
The underlying ranking does not show any strong correlation between the financial effort made in terms of production subsidization and tariffs whether we consider raw or processed products. Country results reveal that Turkey proves to be the most protectionist country as well as a strong subsidizer of domestic production. Tariffs on raw products are above 20 per cent on average. The corresponding figure for preparations is about 50 per cent. Leaving Turkey aside two groups can be identified, the liberal and the light protectionists. Indeed, average tariffs range between 0 (Norway, Australia) and 8 (the Republic of Korea) per cent for raw products and between 0 (Norway, Peru) and 12 (Brazil) per cent for preparations.

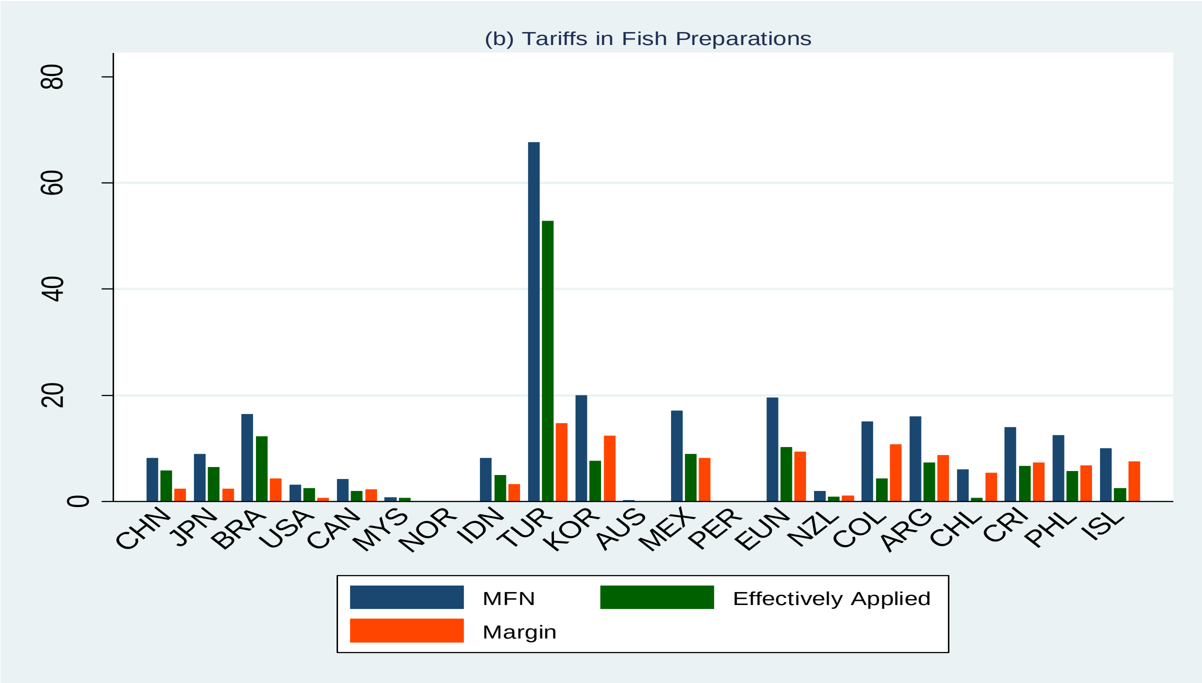
Figure 3.2 offers a direct comparison between applied Most Favoured Nation (MFN) and effectively applied tariff rates. The difference between the two, which corresponds to the third bar for each country entry, can be interpreted as an average indicator of the effective preferential margin granted to imports in fish and fisheries products. Obviously, such a margin would be zero if MFN rates are also zero. Moreover, absolute levels are smaller for countries that apply smaller MFN rates. All countries are involved in some preferential trade and preference margins are relatively higher for raw products as compared to processed ones. In relative terms, preference margins on raw products are particularly high for Chile, New Zealand, Colombia and Mexico and Iceland. As to processed products, preference margins are higher in relative terms for Chile, Iceland, Colombia and the Republic of Korea. In all these cases, the preference margin represents at least 60 per cent of the MFN applied rate.

As in the case of effectively applied tariffs, no prominent pattern emerges when considering the possible relationship between preference margins and the degree of total production subsidization. However, and treating Turkey as an outlier, we can again try to divide the sample into liberal and light-protectionist countries. The group of liberal countries would grow if we were to consider the preference margin as an indicator of market openness rather than the effectively applied rate only. Countries which would clearly remain in the light-protectionist group are China, Japan, Brazil and Indonesia.

Non-Tariff Measures are another major element of trade policy. They are discussed in the next sub-section with a focus on technical regulations due to their potential pro-environmental effects as argued in section 2.

Figure 3.2: Preference Margins in Fish and Fisheries Products





Source: Authors' calculations based on UNCTAD TRAINS database.
Note: Latest available year. The EUN figure is obtained by computing the average of subsidies paid by European Union member states individually.

c. Non-Tariff Measures (NTMs)

NTMs encompass all measures affecting the conditions of international trade, including policies and regulations that restrict trade as well as those that facilitate it. For practical purposes, the commonly used definition of NTMs is as stated in UNCTAD (2013): "Non-tariff measures (NTMs) are policy measures, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both."

It is frequent that NTMs are erroneously referred to as non-tariff barriers (NTBs). The difference between the two terms is that NTMs include a wider set of measures than NTBs, the latter term being only used to describe discriminatory NTMs imposed by governments to favour domestic over foreign suppliers. In the past most NTMs essentially took the form of quota or voluntary export restraints, the so-called core NTMs. As these measures are restrictive by design and have a clear tariff equivalent, at least from a theoretical point of view,[9] the term barrier was used. Nowadays policy interventions take many more forms, and it is therefore more accurate to refer to them as measures instead of barriers, to underline that the measure may not necessarily be trade or welfare reducing.

Table 3.1 contains the various categories identified in the UNCTAD/MAST 2012 classification. Import-related measures are separated form export-related ones. Import-related measures are split into technical and non-technical measures.

The data collected for countries in our reference sample cover measures from chapters A to G and chapter P. Because of objective difficulties in the collection of data on some measures, data covering other types of measures, namely those related to chapters I to O, were either not actively collected or only collected for a restricted group of countries. Subsidies are also part of the broad group of Non-Tariff measures. Even though their main impact is on domestic production, whenever this impact is large enough to make domestic products competitive on international markets in terms of quality and/or price, they qualify as NTMs. As shown graphically and discussed in section 2, subsidies may push either downward or upward domestic prices depending on fish stocks status and this will have an impact on

[9] See Fugazza (2013) for a graphical illustration and technical discussion.

trade flows. For depleted species, prices would tend to increase and this may lead to an inflow of imports. If the objective of the subsidy policy were to preserve domestic production, the resulting impact would go against it. Moreover, when the subsidizing country is a large exporter, changes in domestic prices may also directly affect international prices.

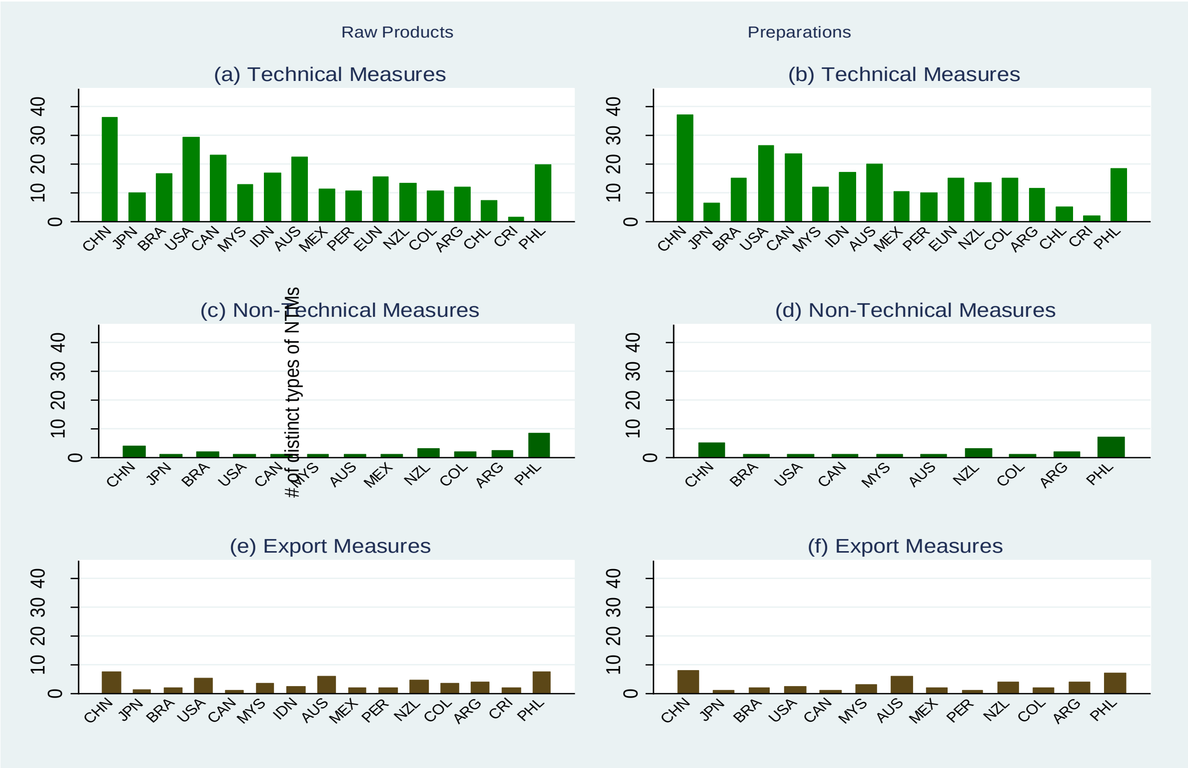
Table 3.1: UNCTAD's NTMs classification (2012 Version)

Imports	Technical measures	**A** SANITARY AND PHYTOSANITARY MEASURES
		B TECHNICAL BARRIERS TO TRADE
		C PRE-SHIPMENT INSPECTION AND OTHER FORMALITIES
	Non technical measures	**D** CONTINGENT TRADE-PROTECTIVE MEASURES
		E NON-AUTOMATIC LICENSING, QUOTAS, PROHIBITIONS AND QUANTITY-CONTROL MEASURES OTHER THAN FOR SPS OR TBT REASONS
		F PRICE-CONTROL MEASURES, INCLUDING ADDITIONAL TAXES AND CHARGES
		G FINANCE MEASURES
		H MEASURES AFFECTING COMPETITION
		I TRADE-RELATED INVESTMENT MEASURES
		J DISTRIBUTION RESTRICTIONS
		K RESTRICTIONS ON POST-SALES SERVICES
		L SUBSIDIES (EXCLUDING EXPORT SUBSIDIES UNDER P7)
		M GOVERNMENT PROCUREMENT RESTRICTIONS
		N INTELLECTUAL PROPERTY
		O RULES OF ORIGIN
	Exports	**P** EXPORT-RELATED MEASURES

Figure 3.3 shows the prevalence of NTMs by category for a restricted number of countries with respect to the subsidy sample used so far due to lack of data. Graphs under column (a) refer to raw products and those under column (b) to preparations or processed products. We must observe by comparing graphs of column (a) with corresponding graphs of column (b) that contrarily to tariffs, there is apparently no escalation in the prevalence of NTMs when moving from raw products to processed products. In addition, technical measures are clearly the most prevalent according to the indicator used in this exercise. This is true for both raw and processed products. The most prevalent categories are SPS measures followed by TBTs as discussed extensively in Fugazza (2017). Non-technical measures are not systematically used. While the Philippines imposes eight distinct types of non-technical measures on either raw or processed products (half of them are price-control measures), European Union countries do not impose any. Some countries further impose technical restrictions on imports. Prevalence of export measures is the highest in China, Australia and the Philippines. In most cases, these measures refer to some quantity restrictions and inspection and certification requirements.

Except for Costa Rica, most countries impose a relatively high number of different types of NTMs with a comparable mix of SPS measures and TBTs. There are redundant combinations of measure types within these two categories. Special authorization requirement for SPS reasons based on some testing requirement together with certification requirement, inspection requirement and labelling requirements are always imposed in conjunction with some technical labelling requirements such as the size of the tag reporting some of the SPS measures related information and its location. These measures may reflect the willingness to guarantee traceability and most importantly food security. However, technical measures related to the process of production (i.e. TBT regulations on production processes) are only imposed by the United States and Canada amongst countries in our sample. The aim of the imposed measures is to regulate fishing methods and equipment in order to limit bycatch, such as dolphins when fishing tunas, and not fishing productivity per se. Even though reducing bycatch is clearly pointing to that direction sustainability does not seem to be a major objective of the regulatory framework in most countries but rather food security. This argument may be reinforced by the fact that countries applying relatively low tariffs such as Canada, Australia or New Zealand show a relatively high prevalence of technical regulations.

Figure 3.3: Prevalence of Non-Tariff Measures in raw products and preparations



Source: Authors' calculations based on UNCTAD TRAINS database.
Note: Latest available year.. The number of distinct measures refers to the number of sub-chapters (3-digit level) as defined in the UNCTAD-MAST NTM classification represented in the set of regulations in vigour. Each sub-chapter can only be counted once independently of the number of measures referring to this very same sub chapter.

4. Discussion

Analysis in previous sections has revealed a high degree of complexity and diversity across countries' sector policy frameworks and approaches. Nevertheless, some matching between theoretical insights and predictions and current data is possible along several dimensions. It is important to identify features which are shared by several countries with different extractive profiles as defined in section 1. This could clarify the underlying forces driving the fish sector both at the national and international level. It may then be important to underline the role played and to be played by trade in the context of an accelerating depletion rate of existing fish stocks. Previous analysis may provide additional insights to the ongoing WTO negotiations on fish subsidies and suggest some direction for future policy developments in the sector.

a. Patterns in trade related policy instruments

While some countries certainly privilege employment in the sector, others see food security as a major objective due to high levels of domestic consumption. Other countries yet may opt for a more aggressive approach towards international markets. For example, there are countries that heavily subsidize the fish sector not only to cover domestic consumption, but to go beyond that and become a key global exporter as well. There are also cases where domestic catch is largely expected to cover domestic demand, and therefore high tariffs are applied to protect the domestic fishing industry. The heterogenous landscape clearly does not suggest any coordination or harmonization towards protecting the level of fish stocks around the world.

Countries represented in our sample which are part of the group of fisheries resources holders defined in section 1 tend to be relatively generous subsidizers and are characterized by strong domestic consumption and are not necessarily outward oriented. Norway could be an exception if we assume the country should be part of that group due to its relatively generous natural endowment in various fish species. The use of tariffs in this group can diverge drastically. Two countries that could be included in this group are Australia and Turkey. They are both quite generous subsidizers but while Turkey opted also for some tariff protection, Australia has adopted a much more liberal approach keeping food security under control with a relatively strong regulatory framework. For this group of countries subsidies could be crucial in keeping exploitation of their natural endowment on a growing path. Sustainability may become an issue if fish stocks are not properly managed. Norway would again be an interesting case: first for its fisheries management based on access and quota regulations, coupled with capacity adjustment schemes and second for its know-how and investment in mariculture production. Like marine production, mariculture production requires an appropriate management approach and adapted regulatory framework to guarantee environmental sustainability by limiting negative spill over effects such as nutrient pollution (eutrophication).

Countries holding fisheries capacity are mainly European countries. Japan, the Republic of Korea and New Zealand are also part of that group considering their intensive use of vessels. In our exercise these countries are characterized with relatively higher vessel to fishermen ratios. Even though this remains a rather imperfect measure of capital intensity it can suggest relatively high fisheries capacity. Production and its evolution are clearly a major concern for this group of countries. Most of them are also strong consumers of fish and fisheries products implying that domestic production is necessary to limit exposure to import volatility in both quantity and value terms. Except for New Zealand they all impose non-zero tariffs, indicating the willingness to further protect the domestic sector from disruptive import flows. Subsidies here are again critical in supporting domestic production although they may stimulate imports in cases of overfishing. Indeed, assuming that fish species living in the Exclusive Economic Zone (EEZ) of a country are overfished, subsidies that maintain or even expend fishing capacity may lead to an increase in domestic prices, making imports of substitutable species more attractive in in the eyes of domestic consumers, even though tariffs are charged. Increasing these tariffs further would only deteriorate the situation as discussed previously. A puzzling situation is observed as most countries are net importers of food, meaning that they may have to pay higher prices for the products they buy from their trading partners if depletion extends to all fishing areas and species around the world. Considering most figures published recently (e.g. FAO (2018), this does not seem to be an implausible scenario.

The last group of countries identified in Kumar and al. (2019) and discussed in section 1 covers all large producers. Those represented here are the United States, China, Indonesia and Peru. Chile could also be included in that group in view of its large trade surplus comparable to that of Peru. The first three are large subsidisers in absolute terms. However, Peru is close to the levels representing the country average obtained within the European Union. The three largest subsidizers must deal with strong internal consumption. The United States and China are net importers in quantity terms. In value terms however, only the United States records a deficit. In other words, most countries are plainly outward-oriented and subsidies could allow them to sustain high catch levels even if they have to sent their vessels around the world without always being fully profitable. This pattern is quantitatively identified and discussed in Sala et al. (2018).

b. Trade patterns and sustainability

There is merit in analysing the impact of trade policy on the main fish trade routes around the world. This is important as a matter of addressing sustainability issues in places where they matter most in volume and value terms. Naturally, when looking at the fish trade picture in such a comprehensive manner, aquaculture-driven trade flows also must be taken into account. Regardless of whether countries reach an agreement at the WTO on fisheries subsidies, trade policy, in particular sustainability standards that are compulsory or voluntary, can have a huge impact.

In 2017, China was the largest exporter of fish and fish products, both in volume and value terms, followed by Norway, Viet Nam and India (Rabobank, 2019). According to the World Seafood Map 2019, main trade routes in volume terms included salmon, whitefish and pelagic exports from Norway to Europe, fishmeal and fish oil exports from Peru to China (feed for aquaculture), molluscs from China to the Republic of Korea and Japan, as well as exports of multiple species from Southeast Asia (Viet Nam, Thailand) to the United States. Significant exports in several species took place from the United States and the Russian Federation to China as well, which then re-exported processed fish. Although it is a large producer, China also imported large quantities of premium fish (such as crustaceans from Ecuador) to answer the demand by its growing segment of better-off consumers (Rabobank, 2019). Future growth in fish trade is expected to be fuelled by farmed species, as aquaculture, already the main driver of increased global production, is expected to surpass wild catch as of 2020.

Given the current patterns of world fish trade, it may be opportune to identify key drivers of fish stock depletion at the macro level on key trade routes and address these through the identification of the full tariff and subsidies landscape. Such an analysis would be followed up with the consideration of harmonized sustainability standards.

In some cases, countries are already moving to brand their fish trade voluntarily, in accordance with sustainability principles. Ecuador can be taken as an illustrative example as the country established its own sustainable tuna value chain standard.[10] Ecuador is the second exporter of canned tuna and loins worldwide, accounting for 15% of global exports of this species (US$ 1.094 billion annually). In 2015, Ecuador accounted for 5.83% of tuna catch at global level. The tuna processing sector represents 7% of total national exports. It employs 24,000 people directly in processing tuna loins, and 120,000 people in support industries, with a significant share of women. Main export markets are European Union, United States, Colombia, Argentina and Chile.[11]

An increasing trend of NTMs in fish trade can be observed, particularly with regard to ensuring food security and sustainability. Given the size and importance of fisheries in the Ecuadorian economy, trade policy measures including NTMs are especially relevant for the competitiveness of the Ecuador tuna value chain, which depends on efficiency, differentiation, reputation and technology use. Ecuador actively worked in recent years on defining and implementing a set of norms and programmes to improve the sustainability of its fisheries sector. These efforts were undertaken in collaboration with international organizations such as FAO and UNCTAD, which identified tuna as a strategic sustainable and green product through the National Green Export Review of Ecuador.

Under the leadership of its private sector association CEIPA (Ecuadorian Chamber of Tuna Industry and Processors), Ecuador introduced a voluntary Code of Conduct for Responsible Management of the Ecuadorian tuna value chain, involving 16 fishing vessels and 27 processing plants. CEIPA led a voluntary certification standards project that resulted in the creation of the "Sustainable Tuna of Ecuador" brand. Together with the government, CEIPA is working on positioning its tuna brand based on a combination of public and private strategies, including technical aspects such as responsible and sustainable fishing of tuna. The Code of Conduct is also very important when it comes to dealing with IUU fishing and environmental pollution. CEIPA is working to help the Ecuadorian tuna sector compete on a level playing field internationally through an action plan on regulating reported fishing, as well as fisheries subsidies, and improving production capacity.

Ecuador is a good example of a country where the private sector leads the implementation of its own sustainability standards and encapsulates these within a distinct brand name. Other fish exporting countries with a sizable private sector where certain fish species represent a significant share of exports would be compelled to follow this example

[10] Based on presentation by Ms. Monica Maldonado, CEIPA, Ecuador at the Second Oceans Forum on Trade-related Aspects of Sustainable Development Goal 14, 16-17 July 2018 downloadable at https://unctad.org/en/pages/MeetingDetails.aspx?meetingid=1831

[11] See UNCTAD (2016) for a comprehensive description of the sector.

to broaden the range of their export markets while at the same time moving towards voluntary sustainable fishery management standards.

Coordinated efforts of harmonizing sustainability standards may help fishing firms fulfil several consumer demand-driven certification requirements (voluntary sustainability standards – VSS) and open-up multiple export markets while at the same time improving the management of their fish stocks. An additional important feature of certification requirements is that they can have multiplier effects as they trickle down in the fisheries value chain when it involves imports, processing and re-exporting. The number of voluntary eco-labelling schemes specifically for seafood products has increased significantly in recent years. Seafood production under global certification initiatives grew 40-fold from 2003 to 2015, covering more than 14 per cent of global production (Potts and al., 2016). The scope of marine and fishery labels is relatively broad, ranging from those that guarantee safety for wild species to those that address over-fishing, bycatch, destructive fishing practices, IUU fishing, discards, ghost fishing, ecosystem deterioration, and damage to the food chain. The Global Sustainable Seafood Initiative (GSSI) has attempted to standardise the criteria on which these certification schemes are based. The consumer market drives demand for marine ecolabeling certification, and voluntary ecolabeling schemes for certified seafood do not appear to contravene multilateral trade rules, though voluntary standards can create barriers to trade for less-developed countries and small producers. In Africa and the Pacific, only less than 6% of seafood production is certified (UNCTAD, 2018b).

A prominent marine eco-label is Marine Stewardship Council (MSC) label. The MSC was established by Unilever and the World Wildlife Fund (WWF) in 1997. It defines principles, criteria, and processes for third-party certification of fisheries. MSC standards are based on three core principles:

(i) Fishing practices must be sustainable for the targeted fish population and avoid overexploitation;
(ii) Fishing practices must maintain the structure, productivity, functions, and diversity of the ecosystem on which the fishery depends;
(iii) Fishery management must meet all local, national, and international regulations, and a data-collection system must be in place to monitor and respond to changing circumstances to maintain sustainability.

31 performance indicators under these principles assess fishing activities for certification. MSC complies with FAO Guidelines for the Eco-labelling of Fish and Fishery Products from Marine Capture Fisheries and is consistent with the ISEAL Alliance Code of Good Practices on Standard Setting and Impact Monitoring. The MSC also establishes a Chain of Custody Standard for Traceability. For seafood to be sold with the MSC ecolabel, every activity in the value chain must be assessed and certified by an independent body to ensure that it conforms to the MSC Chain of Custody Standard.

Most MSC-certified products originate from large scale marine fisheries, including salmon, prime white fish such as cod and pollock, and spiny lobster. Although developing countries account for more than 70% of total marine capture fishing, they contribute less than 3% of total MSC-certified tonnage. Germany, the Netherlands, the United States, the United Kingdom, Sweden, and Switzerland supply two-thirds of MSC-certified products. MSC is making an effort to expand its focus on fisheries in developing countries and emerging economies, especially in areas facing acute threats to biodiversity (Marine Stewardship Council, 2018). However, the cost of MSC certification is too high for many small scale and artisanal fisheries to bear. The costs of certification can vary greatly depending on the certification scheme, the size and complexity of the fishery, and the time involved in the certification process. The availability of reliable scientific data can also affect certification.

The costs of the certification process are paid to the independent third-party certification body. Main cost components are fishery pre-assessment, assessment, and reassessment, and, in the case of MSC certification, chain-of-custody assessment. An additional license fee for the use of the label or logo is paid directly to the labelling organization. Certification by an independent accredited contractor costs between US$15,000 and US$120,000. After certification, fisheries undergo annual auditing, which costs US$75,000 per audit, and the fishery must be re-certified every five years. The total assessment costs for MSC certification can range from US$10,000 for a small, simple fishery to more than US$250,000 for a large, complex fishery. For example, an Alaska pollock fishery took four years to become fully certified at a total cost of US$500,000 (Marine Stewardship Council, 2019).

The MSC standard focuses on minimizing environmental impact, but it does not demand a management process that guarantees ecosystem sustainability. Instead, the key sustainability indicator is the maximum sustainable yield of the targeted stock. Moreover, the MSC standard has no bearing on socioeconomic sustainability or benefit sharing. The MSC process is largely designed for industrial fishing and does not address tenure or other issues of importance to smaller community and artisanal fisheries. Finally, the MSC, like most ecolabels, does not take a holistic approach to ecosystem management, nor does it apply to every level of the value chain.

c. Policy implications and possible insights to WTO negotiations

The analytical framework discussed in this paper can be used to identify desirable policy schemes and combinations. A crucial feature of a renewable resource like fish is the current status of stocks. Overfishing leads to stock depletion and generates a positive relationship between fishing effort and prices. For non-overfished stocks, the latter relationship is the standard negative one. In this case, more fishing effort increases harvest and lowers prices for non-exceptional market clearing dynamics.

Insights from previous analysis suggest that tariffs are expected to have similar effects as subsidies on the domestic fishing effort. Both could lead to the depletion of fish stocks. Both tariffs and subsidies could create incentives also to intensify high-seas fishing, meaning that fish stock depletion would not only occur within a country's Exclusive Economic Zone. Tariffs, contrarily to subsidies, may generate some fiscal revenues if imports are not fully interrupted. These revenues could be used to compensate for the depletion effect of the trade measure if reinvested for instance in better resource management or in re-training fishers to lower the overall country fishing effort. If stocks are already overfished, this may not however represent a first best policy option.

Insights from section 1 analytical framework further suggest that certain types of technical measures (SPS measures and TBTs) may improve environmental sustainability by containing depletion. Any measure that regulates productivity-related features can improve harvest levels and at the same time preserve or even expand fishing effort, that is, sectoral employment. This result is crucial and may call for some harmonization of technical measures at the regional and international level. Differences in regulations that eventually define the sector productivity within a country may create strong negative spillover effects. For instance, more lenient and permissive approaches in terms of fishing techniques and vessels characteristics may create tensions in international seas if some countries decide to adopt a stricter set of measures.

Technical measures, if properly designed, may indeed lead to a superior situation with converging environmental and social concerns. However, if the implementation of such measures implies additional costs to fishers, then small scale and artisanal fishers may be severely affected, either dropping out of the sector or opting for non-compliance, leading to IUU fishing. Intensification of SPS and TBTs on both international and domestic markets may indeed have dramatic effects as about 90% of employment in capture fisheries value chains is engaged in the small-scale sector (Fugazza 2017). The access of small and artisanal fishers to local and export markets may be endangered. Hence when putting in place NTMs that help enhance the sustainability of fisheries value chains, it is also crucial to identify policies specifically dedicated to the small-scale sector such as: precise assessment of export/domestic regulations on domestic producers; facilitation of access to crucial information concerning export/domestic requirements for specific products; private sector-based initiatives that could promote the participation of small and medium enterprises in export/domestic markets; enhanced coordination and collaboration among all relevant international and regional organizations. In this context, the establishment of a subsidizing scheme dedicated to assisting small scale and artisanal fishers in their compliance effort along those lines could be considered without necessarily interfering with sustainability objectives.

Overfishing is the reflection of a negative trade-off between fishing effort (or equivalently employment) and environmental sustainability. Policymakers may not allocate the same weight to these two components and this may lead to choosing different policy schemes. If we apply the above recommendations to countries in our sample, the policy mix of New Zealand would be most consistent with a balanced appreciation of both environmental and sectoral activity employment concerns. It uses subsidies with parsimony, imposes almost no tariff on any type of fish product but at the same time regulates, although moderately, imposing technical measures on domestic production and consequently imports. A precise and in-depth analysis of each component would be necessary to corroborate this observation but at first glance these are the kind of conclusions that can be drawn.

Heterogeneity across countries as illustrated previously could help explain the non-trivial political economy dynamics within the process of WTO negotiations on fish subsidies. In the analytical framework discussed in section 1, if countries have no strong environmental concerns and are relatively short sighted, subsidies may not be discarded despite fish stocks depletion. In the depletion zone, subsidies would keep fish prices high and for net exporting countries this would imply advantageous terms of trade. As shown previously, some relatively important subsidizers are also large importers and high prices on international markets may not necessarily represent a positive outcome and they would dampen the terms of trade effect obtained from exports. A more detailed analysis at the species level with relevant and reliable price indicators would be necessary to estimate precisely some overall terms of trade effects. Nevertheless, currently subsidizing countries have never expressed clearly the intention to drop subsidies completely, even those qualified to be harmful by promoting fishing effort. This may suggest either true positive terms of trade effects for all these countries or a perception of the real terms of trade effects biased by some vested interests.

The desirability of a set of technical regulations such as SPS measures and TBTs which are harmonized at the regional or international level is not only motivated by the necessity to account for environmental sustainability but also by the necessity to find efficient ways to fight against illegal, unreported and unregulated (IUU) fishing. Illegal fishing refers to fishing activities that contravene a country's laws or regulations when they are undertaken in its Exclusive Economic Zone. If countries do not apply the same set of laws and regulations, the very definition of illegal fishing will vary from country to country, making any discussion about the topic extremely difficult and confused.

d. Way forward

It may be possible to propose a few plausible pathways towards achieving sustainable fish stocks based on the analysis made in this paper. The ideal case scenario is the introduction of both domestic and international quotas that would limit catch and prevent stocks from ever moving beyond biologically sustainable levels. Quotas following UNCLOS regulatory approach already exist for several migratory species. They are set up and their implementation is monitored by respective RFMOs. The idea would be to extend such a quota system in a coordinated way also to species essentially in EEZ in the various countries. There could be a global objective and quotas would be defined according to the respective weight in terms of current stock existing in each country. According to Sakai (2017) and as shown in Bayramoglu, Jacques and Copeland (2108), subsidies have little effect on stocks that do have individual quota-based management in place. Subsidies however would affect employment depending on the type of quota management system in place. With individual transferable quotas for instance, there is a risk of ending up in a low employment equilibrium, as the presence of subsidies by increasing the price of transferable quotas would crowd out less productive fishers.

In the absence of quotas, subsidies such as cost reducing transfers and direct payments are harmful. However, at least in the short run, an international quota regime regulating and monitoring both high seas and EEZ in a coordinated manner would be hard to implement due to the practical difficulties related to oversight. For example, a quota system may stumble when it comes to sovereignty rights.

A more realistic approach may be to transition harmful subsidies so that freed up funds are reallocated to sustainable fisheries management. Based on the above observations, Sakai (2017) argues that improving overall fisheries management practices, including through national quota-based management, should be of the highest priority. An alternative pathway may be to introduce cap-based approaches that prohibit subsidies contributing to overcapacity and overfishing in excess of a monetary limit. The difficulty with monetary approaches is that they do not distinguish between the effects of different kinds of subsidies.

Finally, in the short run, regardless of whether there is a fisheries subsidies agreement at the WTO in the near future, consumer demand driven standards will encourage exporters to move towards sustainable fisheries management. The proliferation of NTMs and voluntary sustainability standards, while increasing the cost of trade, are means to promote sustainable fisheries development. Seafood production certified under global sustainability initiatives grew 40-fold from 2003 to 2015 and already accounts for more than 14 per cent of global production (UNCTAD, 2016). Meeting such measures and standards may depend on technical know-how, production facilities and infrastructure which are lacking in many developing countries and small enterprises. Therefore, developing countries need to be assisted with standard compliance to broaden their export market destinations while at the same time ensuring the long-term health of their fish stocks.

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Appendix

Table A.1: Country ISO alph-3 codes and corresponding UN official country names

ISO-alpha3 code	Official country Name	ISO-alpha3 code	Official country Name
ARG	Argentina	ISL	Iceland
AUS	Australia	ITA	Italy
BEL	Belgium	JPN	Japan
BRA	Brazil	KOR	Republic of Korea
CAN	Canada	LTU	Lithuania
CHL	Chile	LVA	Latvia
CHN	China	MEX	Mexico
COL	Colombia	MYS	Malaysia
CRI	Costa Rica	NLD	Netherlands
DEU	Germany	NOR	Norway
DNK	Denmark	NZL	New Zealand
ESP	Spain	PER	Peru
EST	Estonia	PHL	Philippines
FRA	France	PRT	Portugal
GBR	United Kingdom	SVN	Slovenia
GRC	Greece	SWE	Sweden
IDN	Indonesia	TUR	Turkey
IRL	Ireland	USA	United States of America
EUN	European Union		