Oman's Fish Exports to the EU: Do SPS Measures Matter?

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Abstract

Oman's fish exports to the EU have been experiencing a declining trend since mid-2000s. This paper investigates whether the SPS measures adopted by the EU affect Oman's fish exports to European markets. The results obtained from the dynamic unbalanced panel data model for the period 2000-2013 indicate that fish exports to the selected EU markets have been influenced by the domestic ban on export, structural change, and exchange rate fluctuations rather than by SPS measures. These findings provide important signal to policy makers of the respective countries in designing adaptive policy approach to address such external influences.

Key words: Fish export, SPS measures, Export ban, European markets, Oman

1. Introduction

With the gradual rise of global seafood trade since 1976 as recorded in the report by the Food and Agricultural Organization (FAO) of the United Nations (FAO, 2012), concern about the seafood quality and safety standards has been at the forefront of both national and global trade policy debates. At a global level, for instance, 'food quality and safety' was proposed as a strategic action in the 1992 World Declaration and Plan of Action for Nutrition to ensure continued access to safe and nutritious food (Tansey, 1994). In 2012, the innately linked issue of food safety and food security was ranked third by the United Nations Environment Program (UNEP) among the twenty one challenging issues confronting the 21st century global economy (UNEP, 2012). On the other hand, at a national level, this global concern resonated through the development of various legislations by major importing countries such as the European Union (EU), the United States of America (USA), Japan etc. (Arvanitoyannis and Tserkezou, 2006; Toyofuku, 1997).

More prominently, the World Trade Organization (WTO) Agreements on technical barriers to trade (hereafter, the TBT Agreement) and on sanitary and phytosanitary measures (hereafter, the SPS Agreement) are the outcomes of such safety and quality concerns. These two complementary agreements are part of non-tariff measures (NTMs). While the TBT and SPS Agreements share some similarities in regard to harmonization of standards, the principle of equivalence, non-discrimination, avoidance of unnecessary obstacles, and transparency etc., the difference between the two persists in the coverage and the basis for application (Chillaud, 1996). Following the WTO Doha Development Round and with the advent of these agreements, the trade regime of fish and fishery products has witnessed a gradual decrease in protective tariff measures (Neeliah et al., 2012) and the proliferation of NTMs such as SPS measures (Henson et al., 2000).

The global concern of seafood quality and safety, the SPS and TBT Agreements, and the subsequent development of rules and measures adopted by the leading fish importing countries have important strategic implication for a country like the Sultanate of Oman (hereafter, Oman) for, at least, the following political, economic, and strategic reasons. First as a member of the WTO since 2000, Oman has the commitment to abide by

the rules stipulated in the Agreements and by the fish importing countries with regard to quality and safety. Second, to strengthen the role of fisheries as foreign exchange earner, and being a net exporter of fish and fishery products it is important to respond to food safety standards introduced by the leading seafood importing nations and lucrative markets such as the EU and the USA. Last but not least, fisheries in Oman are anticipated to play a vital role in the national economic diversification portfolio (Bose et al., 2010) and, in this context, the authority should boost the country's international competitiveness using the benchmark of fish quality and safety (Busch and Bain, 2004).

In the context of these above-mentioned reasons, it is important to investigate the potential impeding effects of such quality standards on Omani fish exports. Although perception-based qualitative statement of such impact is conveyed in recently conducted studies by Qatan et al. (2013) and Al-Busaidi et al. (2016), the empirical analysis of such issue is limited in Oman, and, therefore, such empirical undertaking should provide useful information to the process of policy refinements and their effective implementations in both private and public sector environments. For this reason, and considering the historical trade relations of Oman with the EU countries and the increased usage of SPS measures in seafood trade, this paper first portrays the legislative and regulatory initiatives that have been undertaken by the authority in Oman to overcome challenges following the SPS Agreement and the resulting EU ban on fish exports in 1998. The paper then proceed to examine whether empirical support (or otherwise) can be given to the hypothesis that SPS measures adopted by the EU countries are acting as significant barriers to fish exports to the EU.

The remainder of the paper is organized as follows. Section 2 briefly describes the rationale of SPS measures and its implications in the national context. Section 3 presents an overview of Oman fisheries sector. Section 4 discusses the institutional and regulatory situations with particular reference to seafood quality and safety. In Section 5, data sources, data limitation, the empirical model, and the estimation techniques are discussed. Section 6 presents the results with discussion, and Section 7 contains some concluding remarks.

2. SPS measures: rationale and the national context

The rationale behind SPS measures involves the following: First, is to protect animal or plant life or health from the spread of pests and disease causing organisms. Second, to

protect human or animal life or health from risks arising from additives, contaminants, toxins, etc. and the third is to protect a country from damage caused by the entry, establishment or spread of pests (Chillaud, 1996). In this context, the SPS Agreement sets out rights and responsibilities of national authorities and provides them with a framework to develop their domestic policies on food quality and safety. The basic rules stipulated in the Agreement covers food safety, animal health and zoonoses, and plant health under the standards guidelines and recommendations established by the Codex Alimentarius Commission (CAC) relating to food additives, veterinary drug and pesticide residues, contaminants, toxins, methods of analysis and sampling, and codes and guidelines of hygienic practice, the Office International des Epizooties (the OIE), and the Secretariat of the International Plant Protection Committee (IPCC) respectively (for further details see https://www.wto.org/english/tratop_e/sps_e/spsund_e.htm. Accessed July 4, 2016). The Hazard Analysis and Critical Control Point (HACCP) system has been adopted as an international standard for food safety by the CAC and has received acknowledgement in the SPS Agreement (Vapnek and Spreij, 2005).

There is no apparent disagreement with regard to the socio-economic importance of safety and quality control measures. However, the focal point of the practical debate has been the way such measures work as they involve scientific assessment of risk, the tolerable limit and assessment of which differs between developed and developing countries, the availability of technical, financial, administrative capacities, and environmental conditions in developing countries (Henson and Jaffee, 2008). The record of the WTO disputes about SPS measures on seafood trade illustrates these tensions.

It has been argued in the literature that the SPS measures that have proliferated since 1995 have affected fish exports from developing countries to developed ones because compliance with technical standards demands resources and technical capacity (Henson et al, 2000). For example, as presented by Cato and Lima Dos Santos (1998) the cost of upgrading sanitary conditions in the Bangladesh Frozen shrimp industry to satisfy the EU requirements was estimated to be $17.6 million over the period 1997-98 and the estimated annual cost of maintaining HACCP program per industry was $225,000. Henson et al. (2000) estimated that the costs of upgrading a landing site and laboratory facilities for chemical and

microbiological analysis were around $1.2 million and $1.1 million respectively. For Oman, the survey results by Qatan et al. (2015) suggested that the highest outlays associated with the implementation of the HACCP system were associated with the required structural changes, followed by the compliance costs such as hiring quality controllers, product testing, and maintenance of hygiene standards. The estimated cost of about $US 254,545 for restructuring seafood establishment was reported by Qatan (2010) and Al-Busaidi et al. (2016), the reliability of such estimate, of course, depends on the ability of respondents to accurately identify cost elements.

However, some scholars have emphasized that such measures have the potential to generate positive benefits by creating competitive edge for the exporting countries in the long-run (Cato and Subasinge, 2004; Henson and Jaffee, 2008). According to Qatan et al. (2015) the fish processing industry representatives and the management authority in Oman viewed that the introduction of the *Quality Control Regulations* did bring important positive changes in relation to improved product quality and customer satisfaction, access to markets with stringent standards, and improved quality control through improved morale and commitment. Zaibet (2000) noted a strong interest in HACCP implementation by seafood establishments in Oman to safeguard their competitive position in the EU markets.

To be eligible for exporting fish and fish products to the EU it is essential for an exporting country to 1) establish a Competent Authority which is responsible for official controls throughout the production chain, 2) have a food safety legislation that is equivalent to the EU's own hygiene legislation, 3) guarantee through the Competent Authority that the relevant hygiene and public health requirements are met, 4) provide a list of establishments that are authorized to export fish and fish products, 4) produce evidence of safe handling of the product covering the entire supply chain to examine its acceptability by EU inspection officials (Doherty, 2010). The 'net to plate' notion embraced by the supply chain concept demands effective partnership and competency of all actors involved (Doherty, 2010; Qatan et al., 2015). Further analytical details on the operational strengths and weaknesses of the fish supply chain in Oman can be found in Al-Busaidi et al. (2016).

As argued earlier, the conformity of Omani seafood products with the international quality and safety standards is the key to lucrative export markets access such as the EU and maintaining international competitiveness. On July 1, 1998, the EU banned fish and fish

products from Oman due to the detection of non-compliance with the EU standards and the implementation of the Commission Decision 97/296/EC. Subsequently, a mission was carried out by 2 inspectors of the Food and Veterinary Office (FVO) of the Directorate General XXIV in November 1998 to verify the compliance with requirements at least equivalent to the Council Directive 91/493/EEC. The report asked for official guarantees for the following from the Omani competent authority: 1)the implementation of the standards of Council Directive 80/778/EEC for drinking water and ice use in the establishments, 2) the distribution of the Community legislation to the establishments and vessels with approval for fish export to the EU, 3) the implementation of monitoring plans in 1999 for mercury, histamine, parasites, 4) the procedure of issuing the export health certificate, 5) the future recruitment of inspectors and laboratory staff, 6) the training of inspectors for the HACCP assessment, 7) the organization of reference laboratories, 8) provision of new list of establishments and vessels complying with Community requirements, and 9) deficiencies have been corrected for the establishment visited by the team (EC, 1998).The ban was lifted in 1999 after receiving the satisfactory written assurances by the Commission and consequently Oman was listed in Annex II to Commission Decision 2006/766/EC.

Following the EU ban in 1998 the authority safeguarded seafood quality and safety to meet internationally acceptable standards by adopting HACCP (MNE, 2007). In November 2006, the FVO re-visited Oman to evaluate the Competent Authority and its capacity of guaranteeing the conditions laid down in Decision 99/527/EC. In their evaluation the team considered the minimum requirements of Regulations (EC) No. 852/2004, No. 853/2004, No. 854/2004, and No. 882/2004. After detailed investigation the team reported the following deficiencies: 1) the overall production chain of fish products exported to the EU was not controlled by the system, 2) incorrect handling and documentation/reporting of the approved establishment (Article 8(1) of 882/2004/EC), 3) failure to identify some deficiencies by the HACCP inspectors and inconsistent follow-up of inspection outcomes, 3) although accreditation was in progress the quality system in the laboratories was not established, 4) poor number or lack of some official analysis expected by community provisions, and inconsistent sampling procedures with national provisions for histamine and bacteriology, and 5) lack of knowledge of some of public health requirements. Despite the reported shortcomings the team felt that fishery products exported to the EU could not

pose threat to consumer health. However, the team asked for a detailed action plan to address the issues in a satisfactory manner (EC, 2006). Accordingly the detailed response was provided by the Competent Authority of Oman the updated regulations (12/2009) embraced the EU requirements stipulated in EU regulations 1881/2006 in relation to fish and fishery products such as maximum limits of Total Volatile Basic Nitrogen (TVB-N), Histamine, Heavy Metals (such as Mercury (Hg), Lead (Pb), Cadmium (Cd) etc.), Inorganic Tin, Dioxin, Polycyclic Aromatic Hydrocarbons (PAH), Marine Bio-toxins, Additives, Veterinary drug residues, etc. (MAF, 2011).

3. An overview of fisheries sector

Oman is an important fishing nation in the Arab region with about 3264 km coastline. The Ministry of Agriculture and Fisheries (hereafter, MAF) is the sole authority responsible for the management of fisheries resources in Oman. The fisheries sector in Oman consists of three distinct segments namely, traditional (or artisanal), coastal and industrial. Fisheries are categorized by target species, grouped into five major categories namely large pelagics, small pelagics, demersal, sharks and rays, and shellfish and molluscs. The fishing industry is dominated by small scale fishers and historically the traditional sector has been dominant, both in terms of landings and total value. For example, in 2014 the traditional sector's share in both total landings and values were about 98.3% and 96.9%. In addition, the traditional sector provides direct employment (both full- and part-time) of 45,635 fishermen (MAF, 2014) and the daily livelihood of many people depends on the fishing industry (ESCWA, 2007). Qatan (2010) reported that there were more than 4000 fish traders (truckers) and 3000 workers involved in seafood processing, marketing, and industry related activities. Although the sector's relative share to Gross Domestic Product (GDP) at both current and constant (2010) prices remains stable around 0.5% - 0.6% during 2003-2012, it plays an important role in the country's socio-economic development including food security (Bose et al. 2010).

Reduction of post-harvest losses and improvement of fish quality and safety through the improvement of transportation, post-harvest handling, processing, storage and marketing activities are essential part of strategic actions adopted by the Ministry. For instance, to promote efficiency and fairness in relation to pricing and the distribution of fish and seafood products, a central wholesale fish market with electronic auctioning system and other modern

services has been in operation since April 2014 at Al-Filaij, a village of Barka in Al-Batinah Governorate (Qatan et al., 2015, Al-Busaidi et al. 2016). This initiative is expected to address some fundamental distributional and pricing concerns with regard to fish products in the country (Bose et al., 2010).

The seafood processing companies (both with and without HACCP system in place) deal mainly with locally sourced fresh and frozen fish products and supply to local, regional and international markets. The yearly number of seafood companies with quality control number (requiring the adoption of HACCP) range from 16 to 25 during 2000-2013 (See Table 1).

Table 1: Number of Fish Processing Companies with Quality Control Number: 2000-2013

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Company	16	20	25	25	25	25	23	21	21	19	20	20	21	19

Fish exports are important source of foreign exchange earnings, and thereby, strategic objectives of the sector encourage fish exports to regional (such as the Gulf Cooperation Council (GCC) countries) and international markets (such as the EU and the USA). Consequently, local consumers face competition with the foreign buyers. To maintain domestic market stability and satisfy local consumers' demand the Ministry of Agriculture and Fisheries has implemented export ban on selected preferred species in recent years (see Table 2). The main policy motivation behind such measures on key large pelagic and demersal species was to ensure the availability of these popular species in the domestic market and to reduce inflationary pressure on fish prices. This supports the fact that fisheries management is also driven by market fundamentals, preferences and behaviors of its main actors.

Table 2: Various Ministerial Decisions (MD) on fish export ban.			
MD No.	**Time Period**	**Species**	**Ban Rate**
2/2011	1/3/2011- 30/9/2011	Kingfish, Grouper, Longtail tuna, Large Jacks, Emperor	100%
5/2011	16/4/2011- 15/6/2011	Emperor	Allow to export an equal amount to what's domestically distributed
108/2011	30/8/2011 – 30/9/2011	Kingfish, Grouper, Longtail tuna, Large Jacks, Rabbitfish	100%
		Seabream, Emperor, Grouper (Spiny cheek grouper)	Allow to export an equal amount to what's domestically distributed
143/2011	1/12/2011 – 31/5/2012	Yellowfin tuna, Kingfish, Longtail tuna, Rabbitfish	100%
		Emperor, Grouper, Large Jacks, Seabream, Indian Mackerel	Allow to export an equal amount to what's domestically distributed
217/2012	30/9/2012 – 31/5/2013	Yellowfin tuna, Kingfish, Longtail tuna, Jobfish	100%
		Emperor, Large Jacks (include: Gaint Trevally, Blacktip Trevally, Greater Amberjack), Seabream (except; Santerseabream), Grouper (except; Spiny cheek grouper)	Allow to export an equal amount to what's domestically distributed
		Indian Mackerel	Market domestically 30% and allow to export 4 times of what's domestically distributed
131/2012	1/6 – 15/9/2012	Yellowfin tuna, Kingfish, Longtail tuna, Rabbitfish, Large Jacks (include: Giant Trevally, Blacktip, Trevally, Longfin Trevally, Greater Amberjack), Queenfish, Seabream (except; Santer-seabream)	100%
		Emperor, Mullets, Barracuda, Indian Mackerel, Crocker, Jobfish, Grouper (except; Spiny cheek Grouper)	Allow to export an equal amount to what's domestically distributed
157/2013	1/6/2013- 30/9/2013	Yellowfin tuna, Kingfish, Longtail tuna, Jobfish, Seabream (except; Santerseabream), , Large Jacks (include: Gaint Trevally, Blacktip Trevally, Greater Amberjack)	100%
		Emperor, Croaker, Barracuda, Queenfish, Groupper (except; Spinycheek Grouper)	Allow to export an equal amount to what's domestically distributed
		Indian Mackerel	40% for domestic market and 60% for export
309/2013	1/10/2013- 31/5/2014	Yellowfin tuna, Kingfish, Longtail tuna, Rabbitfish	100%
		Emperor, Mullets, Large Jacks (include: Gaint Trevally, Blacktip Trevally, Greater Amberjack)	Allow to export an equal amount to what's domestically distributed
		Indian Mackerel	30% for domestic market and 70% for export
	15/12/2013- 15/2/2014	Jobfish, Groupper (except; Spinycheek Grouper), Seabream (except; Santer-seabream)	100%
	1/10 – 14/12/2013 and 16/2 – 31/5/2014	Jobfish, Groupper (except; Spinycheek Grouper), Seabream (except; Santerseabream)	Allow to export an equal amount to what's domestically distributed

Source: Ministry of Agriculture and Fisheries

During the period 2000-2014, on average around 44% of the total fish landings were exported to international markets. For the EU market the average share in total export in

terms of quantity and value during the period from 2000-2014, was about 0.3% and 0.8% respectively.

Figure 1 shows quantity (ton) and gross value of fish exports ('000 RO) to the EU during the period 2000-2014. It is noted that the quantity and value of fish exports experienced a considerable decline (about 88%) after 2005 and 2007 respectively. This raises an important question: are SPS measures responsible for the apparent declines? The coefficient of variation (CV) estimates for quantity (64.57%), total value (59.18%) and unit value (31.50%) of fish exports to the EU suggest that the variation in export quantity relative to unit price is the dominant factor contributing to the variation in the total value during 2000-2014. These findings have bearings on the formulation of empirical model discussed below.

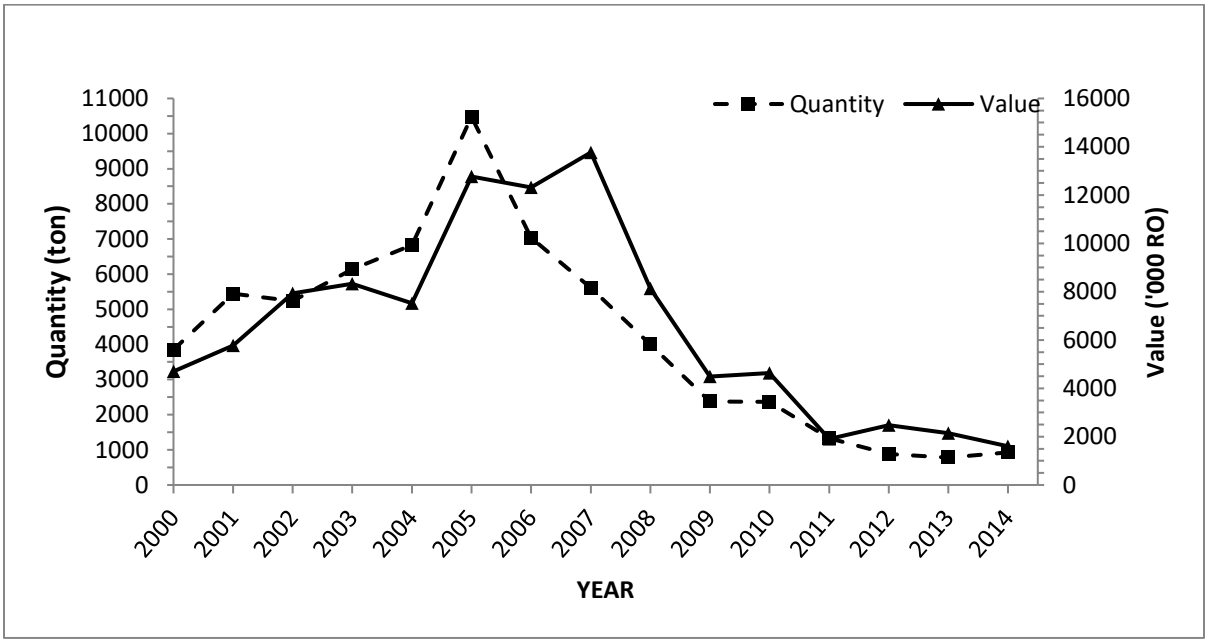

Figure 1: Total quantity and value of fish exports to the EU: 2000-2014.

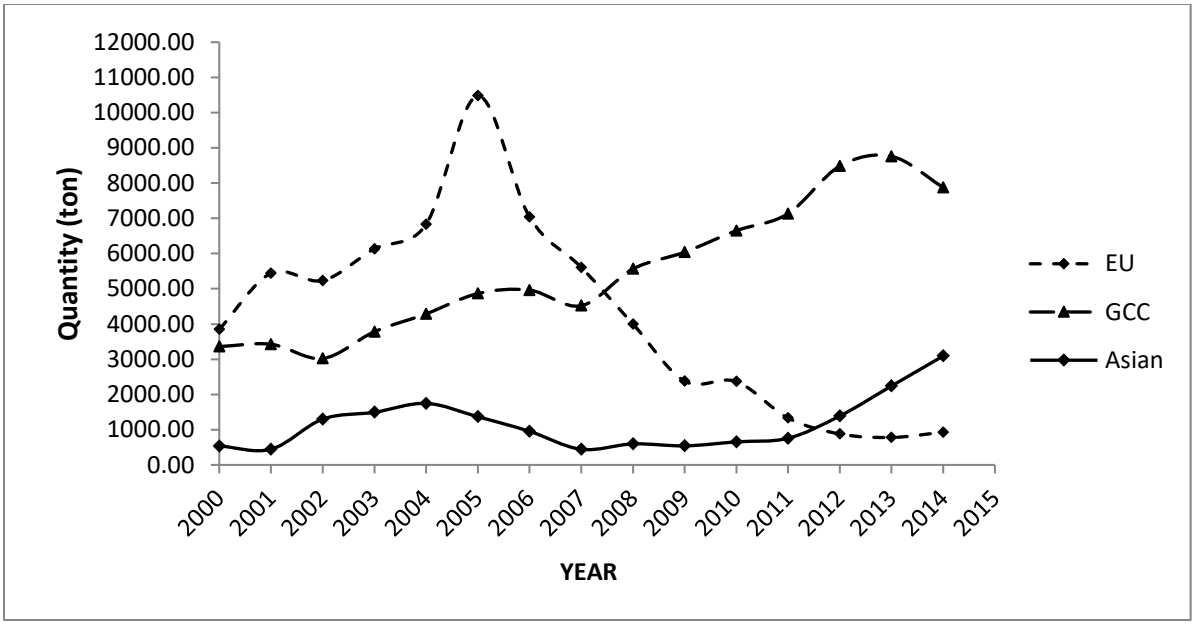

Figure 2: Total quantity of fish exports to the EU, GCC, and Asian markets: 2000-2014.

Figure 2 shows the fish export quantity (ton) to the EU, GCC, and the Asian countries (includes Thailand, Korea, Viet Nam, China, India, Sri Lanka, Malaysia, and Bangladesh) during the period 2000-2014. While the quantity of fish exports to the EU experienced a considerable decline after 2005, the same was not the case for the GCC and Asian countries. A continual positive trend in quantity of fish exports is observed for the GCC countries and a gradual increase of the same is observed in the case of Asian countries. This, perhaps, signal the occurrence of export diversification towards countries with non-stringent SPS measures. However, lower food safety standards may not be the sole driver for this apparent shift in trade flow which may be due to geographical proximity, species preferences in these markets, economic conditions etc.

For Asian countries, the coefficient of variation (CV) estimates for export quantity (64.84%) and total value (50.39%) are similar to the EU market. However, for the GCC, the coefficient of variation (CV) estimates for export quantity (34.46%), and total value (37.03%) indicate that the GCC markets were relatively stable during the period 2000-2014.

4. Institutional and regulatory status

Following the SPS Agreement and the EU ban, the safety and quality of fish products received strategic priority in Oman. This priority is exemplified with the issuance of the

Quality Control Regulations for Omani Fishery Export in 1997 (the Ministerial Decision (MD) No. 4/97). The MD No. 4/97 was replaced by the MD No. 136/1998 following the European ban in 1998. In addressing the EU concerns the authority adopted various measures. For example, the MD No. 12/98 was issued relating to the '*Conditions and Specifications for Commercial Fishing Vessels Prepared to Store Fishery Products*'. In 1999 the 'Quality Control Section' was established (Zaibet, 2000), and was extended to the 'Fish Quality Control Center (FQCC)' under the Ministry of Agriculture and Fisheries in 2002. In 2004 '*Conditions and Specifications Regulations for Marine Aquatic Resource Transportation and Marketing*' was issued in accordance with the MD No (29/2004) (ESCWA, 2007).

In 2009 as an update of the MD No. 136/1998, a revised version of the quality control regulation was introduced by the MD No. 12/2009. The revised regulation (MD No.12/09) introduced several changes and modifications in terms of scope and aims. For example, the revised version covers both domestic and export markets of fish and fishery products to ensure consumer safety (MAF, 2011). New articles dealing with the approval process of seafood establishments, responsibilities of the authority (FQCC) and inspectors, and maximum limits of contaminants in fishery products have been added. Also, Chapter 14 comprising Articles (82) and (83) was added to deal with non-compliant behaviour along with the reference to penalties associated with such behaviour (MAF, 2011).

The Quality Control Regulation provides legal power and responsibility to the Fish Quality Control Center (FQCC) in relation to inspection, assessment and implementation of seafood safety, scientific analysis of fish and seafood products, approval of seafood establishments, and takes action against non-compliance. The authority conducts training for their own staff and company employees. For instance, in May 2011, the Ministry of Agriculture and Fisheries organized a symposium on seafood quality and safety and invited international experts to discuss various facets of seafood quality and safety program. . In 2011, the *Public Authority for Consumer Protection* was established under the Royal Decree No. 26/2011 (Qatan, 2010). Further details on various aspects of the national food control system can be found in Qatan (2010) and Al-Busaidi et al. (2016).

5. Empirical approach

5.1 Model

The empirical assessment of the impact of SPS measures requires a model that captures the prevailing situations between Oman and the importing countries in the EU. It is worth noting that the trade flow is unilateral rather than bilateral as the country of reference (Oman) does not import fish from the EU countries selected for the study. To address the issue at hand the basic argument and key factors of the gravity model promoted by Anderson and van Wincoop (2003) was followed and a log-linear specification of the following panel regression model (1) was considered:

$$ln(V_{ijt}) = \alpha_0 + \alpha_1 ln(V_{ijt-1}) + \alpha_2 ln(GDP_{it}) + \alpha_3 ln(GDP_{jt}) + \alpha_4 DNTB + \alpha_5 DBAN + \alpha_6 ln(ER_{ij}) + \alpha_7 \ln(Dist_{ij}) + e_{ij} \quad (1)$$

where, V_{ij} indicates the monetary value of total fish exports from country 'i' (i.e. Oman) to country 'j' from the EU, the nominal gross domestic products (GDP) for country 'i' and country 'j' are used as proxies to measure the supply and demand capacities of the exporting and importing countries respectively, *DNTB* represents a country-specific dummy variable that takes the value '1' when a SPS notification is reported to the WTO and '0' otherwise, a policy variable '*DBAN'* representing export ban on key species introduced by the Ministry of Agriculture and Fisheries in Oman is constructed as dummy variable which assumes value'1' when there is ban and '0' otherwise, ER_{ij} is the exchange rate per Omani Rial (RO), the variable $Dist_{ij}$ is the distance measure between Muscat and the EU capital cities of the considered paired used as a proxy variable for trade costs, and e_{ij} is the error term.

5.2 Data

Data for this study were collected from various sources. Export quantity and value data were obtained from the Ministry of Agriculture and Fisheries (MAF) Statistics Book (various years). Ten countries were selected from the EU namely Belgium, Cyprus, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and United Kingdom (UK). The selection of a country from the EU Member-states was based on the frequency of fish imports from Oman during the study period. To avoid small sample size of specific countries, it is decided to select a country which has imported fish products from Oman more than half of the period of

2000-2013. In this context, the number of country-specific observations (T) in the data set were 14 for France, Germany, Greece, Italy, 13 for the UK, 11 for Belgium and Portugal, 10 for the Netherlands, and 9 for Cyprus. As the number of time period varies from country to country the panel data derived for this study was unbalanced. Data for the Gross Domestic Product (GDP), population size, and exchange rate were obtained from the International Monetary Fund (IMF) Statistics database. Data for distance were obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII, 2006). To measure the impact of NTBs this paper employs a simple dummy variable method based on the SPS notifications pertaining to Oman registered under the Rapid Alert System for Food and Feed (RASFF).[1] The notifications of bilateral dimension for the period 2000-2013 are presented in Table 3.

[1] In trade literature, we mainly distinguish between three methods to measure and estimate the non tariff barriers effects. The inventory method (or frequency method) accounts only for the absence or presence of the measure and estimate the frequecy the measure is applied. The price- gap method estimates the difference between the observed (high) price of imports induced by the non tariff measures and the price (world price) that would prevail in the absence of the NTB distorting effects. The quantity gap method estimates the differecen in the observed bilateral trade flows and a normal trade value of trade flows that is usually estimated using gravity modeling techniques . All measures have their advantages and limitations (Disdier et al. 2008; and Minetti and Salvatici (n.d.).

Table 3: Fish and Fish products Notification detail: 2004-2013				
Year	No. of cases	Country	Species	Reasons
2004	1	Cyprus	Fresh Seabream (Pagruspagrus) and Grouper Epinephelus spp.)	Listeria innocua (presence /25g)
2005	6	France (1) & Italy (5)	Fresh and Chilled Tuna Loins (Thunnusalbacares)	carbon monoxide treatment
2006	5	Italy	Fresh Grouper fillets Epinephelus spp.), and Fresh chilled tuna	unauthorised use of colour E 122 and lead in sliced fresh chilled tuna
2007	2	Italy	Frozen fish and Fresh Grouper fillets Epinephelus spp.)	abnormal colour of frozen fish and parasitic infestation with tapeworms
2008	1	UK	Frozen shark fillets	cadmium
2009	1	Italy	Seabream	cadmium
2010	1	Germany	Jack mackerels	high aerobic plate count (8.0x10E6 CFU/g)
2011	1	Spain	Chilled Snapper and Grouper	absence of health certificate(s) for and poor hygienic state
2013	1	Spain	Unnamed	poor temperature control
Source: The Rapid Alert System for Food and Feed (RASFF)				

Each notification provides information on the notifying country, the affected product, the reasons, and the action taken. There were no records of dismissal of exports of fish and fish products to the EU by the Authority and custom office in Oman for the period 2000-2013. It is worth mentioning the principle of mutual recognition of SPS and TBT regulation among EU member states (Article 30) of the treaty (EU Commission, 2002). Data on export ban of some selected species were obtained from the MAF (see Table 2 for the specific species, date and extent of ban).

6. Results and discussion

Two conventional models namely the fixed effects and the random effects are generally considered for panel data covering the period 2000-2013. To decide between the two a formal test developed by Hausman (1978) is conducted. The estimated χ^2 test value (38.25, 8 df) suggests that country-specific effects are correlated with regressors, thus the fixed effects model is pursued. The term 'fixed effects' accommodates time-invariant unobserved country-specific heterogeneity by allowing the intercept to vary across countries not with respect to time (Gujarati, 2003). To allow for the intercept to differ across countries, the widely used dummy variable technique (termed as the Least Square Dummy Variables (LSDV) model) is used by including country-specific dummy variable to the model (1) and the dummy-variable trap is avoided by dropping one country dummy and treating the corresponding country as a reference country.

The potential 'time effects' is also experimented by introducing time dummies for each year (less one to avoid the dummy-variable trap) but failed to generate any outputs due to 'near singularity problem' which, perhaps, reflects the lack of degrees of freedom. To address the potential consequences of the economic downturn experienced by the EU countries as reported by FAO (2012) and as reflected by the lower nominal GDP figures of countries such as Greece, Spain, and the UK during 2009-2011, year-specific dummy variable was sequentially introduced to the model to capture such potential time effects. This experimentation at least partially attends to the issue of time effects. The 'near singularity problem' was also experienced with the distance variable and, therefore, the distance variable has been omitted from the model. Because of the geographical proximity of the EU countries it is expected that the omission of the distance variable would not undermine the validity of empirical results. In examining Africa's fish exports to the EU, Kareem (2014) found no significant influence of the variable 'distance' used as a proxy for the trade costs on the extensive margin of fish exports.

Initial experimentation of Model (1) without the lagged dependent variable exhibits significant autocorrelation indicated by the low Durbin-Watson (DW =0.84) value. The low D-W value may also indicate specification error (Gujarati, 2003). To rectify the problem of autocorrelation a lagged dependent variable was added to the model. The use of lagged

dependent variable can also be justified due to technical, regulatory and administrative rigidities affecting fish supplies (Bose and Galvan, 2005; Bose and Redkar, 2004).

The empirical results from the LSDV model along with relevant diagnostics are presented in Table 4.[2]

Table 4: Results from the empirical models.		
LSDV model		
Variable	**Coefficient**	**t-value**
$\boldsymbol{lnV_{t-1}}$	0.58	8.89
$\boldsymbol{ln(GDP_i)}$	-0.28	-0.67
$\boldsymbol{ln(GDP_j)}$	1.71	1.18
$\boldsymbol{DNTB}$	-0.06	-0.24
$\boldsymbol{DBAN}$	-1.02	-4.88
$\boldsymbol{ln(ER_{ij})}$	0.82	2.57
$\boldsymbol{D_{2009}}$	-1.02	-4.55
$\boldsymbol{D_{2010}}$	-0.91	-3.25
Constant	-13.08	-1.16
Fixed Effects	Yes (F=3.67; p=0.00)	
Diagnostics and Criteria		
R^2	0.91	
SSR	55.73	
F-test	58.33 (p=0.00)	
Normality	1.34 (p=0.50)	
Autocorrelation	2.19	
MAE	0.609	
RMSE	0.819	

The coefficient of the variable with regard to the effect of SPS measures (DNTB) carries an expected sign but its associated t-value suggests that the fish exports to the selected EU markets have not been significantly influenced by such measures. This result is consistent with the results obtained from the qualitative survey by Qatan et al. (2015) where the industry representatives and the management authority reported that rejections from the EU market had become rare after the adoption of the HACCP system. Furthermore, it is reported by the authority that the highest number of notifications that were launched in 2005 and 2006

[2] With particular reference to model (1), it is argued by Nickell (1981) that the parameter estimates from the OLS regression are less satisfactory due to simultaneity bias. To remedy this bias the first-differenced GMM is also pursued to eliminate unobserved country-specific effects, and simultaneity bias through the use of appropriate lagged instruments. However, it is found that the LSDV method provided statistically superior and persuasive results as the empirical estimates produced by the GMM method are not only statistically insignificant but also theoretically inconsistent. In addition, the consistently lower value of the forecast performance measures (i.e. MAE and RMSE) and SSR indicates the superiority of the LSDV model over the GMM model (for GMM case, MAE=1.05, RMSE=1.34, and SSE=162.14). Therefore, it is decided to discuss the empirical results based on the LSDV model.

involved only two establishments. The Competent Authority (CA) also provided evidence to the EU that four of the notifications in 2005 were due to samples send to Italy for analytical purpose by the establishment. In 2006, three notifications for unauthorized colorants and two for high levels of lead (Pb) involving the second establishment. The use of colorant was known to the CA as the concerned establishment informed the CA and it is specified in the accompanied health certificates. To address the high levels of Pb, the CA increased the frequency of sample analysis from one every six month to one sample every three shipments (EC, 2006). In this context, the border notification results are indeed relatively minor (see Table 3) which provides support to the inference drawn from the empirical results.

Further support for this result can be derived from the following example. In promoting sustainable fisheries and strengthen its access to lucrative markets such as the EU, the USA, and Canada, Al-Marsa Fisheries Company in Oman received third party certification for several fish products from 'Friend of the Sea' in 2011 (Muscat Daily, June 25, 2011). This proactive strategy followed by Al-Marsa Fisheries Company illustrates that a well-managed firm has the ability to seek for private third party certification to create competitive advantage in the market. In comparison with other international study, Neeliah et al. (2011) concluded that SPS measures adopted by the EU have not acted as major barriers for Mauritian exports of fish and fishery products. Kareem (2014) also drew the same conclusion for Africa's fish exports to the EU at the extensive margin.

The coefficient of lagged dependent variable (i.e. lagged export value) is statistically significant at the 5% level and carries expected sign. The share of the desired adjustment which is completed in one period is about 42% and the average lag is about 1.4 years.[3] This is not unusual. In explaining the export behavior of New Zealand's live rock lobster to Japan, Bose and Galvan (2005) introduced the lag structure into the model and it was found to be significant. They suggested that 39 per cent of the gap between the actual and desired level was covered in each period.

The estimated coefficient of the policy decision variable (DBAN) is found to be significant with expected sign. Generally speaking, the ban represents a non-tariff barrier imposed by the Ministry of Agriculture and Fisheries on fish exports, which results in lower volume of exports and consequently the value of exports. The larger variation in export

[3] $Average\ lag = \frac{(Coefficient\ estimate\ of\ lagged\ dependent\ variable)}{(1-Coefficient\ estimate\ of\ lagged\ dependent\ variable)}$.

quantity is also depicted in the CV estimate presented earlier. Moreover, this result, perhaps, indicates that the fish exports to the EU have been facing competition from the domestic market. This result is in line with the negative (although statistically insignificant) coefficient of Oman's nominal GDP which indicates that the increase in domestic capacity will reduce the fish export value from the EU. The negative sign of the DBAN variable may be attributable to the fact that there is demand for those popular species in the domestic market which led to the export ban on those key species. The negative impact of the ban on fish exports could be due to the fact that it hinders regularity of exports to the EU markets which may not be favored by the EU traders. The higher the extent of competition the greater will be the irregularity of supply. Furthermore, the central wholesale fish market is expected to promote fierce competition among buyers and enhance local demand. Consequently, to counteract such supply uncertainty sourced from the domestic ban the EU traders may look for other competitive sources of supply.

The coefficients of the year-specific dummy variables D_{2009} and D_{2010} are found to be significant with expected signs. This result is consistent with the negative trend experienced in both volume and value of fish exports due to economic downturns faced by the EU countries in 2009 (EC, 2009; FAO, 2012).

It is found that the coefficient of the variable ER_{ij} (Euro per Omani Rial) exerts significant positive influence on the value of fish exports. This is consistent with the industry perception (Qatan et al., 2015). It is also observed from the data that the Omani Rial (RO) experienced depreciation against Euros during the study period, which, perhaps, stimulated the demand for Omani fish in some of the selected EU countries. This is consistent with the finding in case of Egypt for agricultural exports (Hatab et al., 2010). The policy implication of this finding is that the importing countries may try to adopt appropriate hedging strategy to reduce uncertainty emanate from such currency fluctuations.

7. Concluding comments

With particular reference to SPS measures adopted by the EU, the main purpose of this study is to examine the potential influence of such measures on the exports of Omani fish and fishery products. The graphical exposition presented with regard to both volume and value of fish exports to the EU exhibit downward trends since mid-2000s. Along with a brief

overview of the fisheries sector, institutional arrangements and regulatory measures in response to the SPS Agreement, the study further considered other potential factors to explain this downward trend. It may be true that restrictions enacted by the SPS Agreement do act as a barrier to fish trade and prevent many local seafood establishments from accessing lucrative markets due to their inability to comply with such mandatory requirements. However, the empirical result of this study with particular reference to SPS measures offers no support for such perception in the case of establishments who hold quality control (QC) number. Although establishments' compliance with the mandatory measures exerted upward pressure on costs (both fixed and variable), the adoption of the HACCP system has made each company a potential global competitor in the seafood business with warranted access to lucrative markets such as the EU. In addition, the adoption of the HACCP system has given them greater freedom to diversify and/or breaking into new market outlets in a scenario when unpredictable circumstances experienced in a particular market due to economic downturns, currency fluctuations, lack of supply of preferred species etc. Therefore, further study should be carried out to identify the trade diversification potential. Apart from the public sector role, a strong commitment from the private sector may be helpful in such efforts.

The empirical findings further suggest that the irregularities in fish exports to the EU influenced by the recent ban together with domestic market competition, financial crisis in the EU, exchange rate fluctuations etc. are exerting significant influence on the fish exports to the EU. It is important to note that seafood processors would never complain if this regulatory change brings economic gain for their enterprises. However, any regulatory measures in response to the adjustment to domestic market conditions as mentioned earlier should be responsive to adverse economic impact on the local seafood enterprises. In addition, given the rise of recent national interest in the development of small and medium enterprises (SMEs) in Oman, obligation to secure public health, and the potential technical and financial hurdles faced by small companies, it is, perhaps the time to initiate measures similar to those suggested by Taylor (2001) to promote safety in small seafood companies. Further study should be carried out to identify the costs and benefits of such measures.

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