EFFECTS OF NON-TARIFF BARRIERS ON BRAZILIAN FISHERIES EXPORTS TO THE EUROPEAN UNION

Pedroza Filho, Manoel Xavier[1]
Melon Barroso, Renata[2]
Valladão Flores, Roberto Manolio[3]

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ABSTRACT

Non-tariff barriers (NTBs) affect particularly developing countries because of their market dependence on developed countries and their minor influence over the international trade forums. NTBs have an increasing importance in world trade of fishery products due to the rise of the international transactions of these products. World exports of fishery products doubled between 1998 and 2008, from US$ 51.5 billion to US$ 101.9 billion. This article aims to analyze the impact of NTBs implemented by EU on the Brazilian exports of fishery products. The methodology used was based on the inventory approach integrated to the ARIMA model. The data used refer to technical barriers obtained from the TRAINS/UNCTAD database and to the Brazilian exports collected on the ALICEWEB database. Results showed that these measures presented negative impact only for fresh fish. We can suppose that NTBs imposed by Europe still do not have relevant effects on Brazilian exports. Even for fresh fish, it is not possible to state accurately that the reduction in volume was caused by the introduction of the NTB because other factors can be involved. However, the rapid increase in the number of NTBs to seafood imports in the European market represents a potential risk to the growth of Brazilian exports. Moreover, given that much of the Brazilian aquaculture is being developed within complex ecosystems like the Amazon, there is a possibility of emerging new NTBs related to environmental constraints. These results emphasize the need to incorporate other variables in the NTB analysis in order to improve measurement of its effects.

Key words: non-tariff barriers, fishery products, export, Brazil, European Union

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1 Agricultural Engineer (Universidade Federal Rural de Pernambuco, UFRPE, Brazil); Master in Management and Rural Development (Universidade Federal Rural de Pernambuco, UFRPE, Brazil); PhD in Economy and Management (INRA, France). Researcher at Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation). Researcher in Economics and innovation management in aquaculture and fisheries. ***Postal address:*** 103 Sul, Av. JK ACSO 1 - Lote 17 1° piso, Palmas-Tocantins, Brazil. Postal code: 77015-012. ***Phone***: +55 63 3218 2933; ***e-mail:*** manoel.pedroza@embrapa.br

2 Doctor of Veterinary Medicine (*Universidade Federal Fluminense*, UFF, Brazil); Master in Animal Pathology (*Universidade Federal Fluminense*, UFF, Brazil); PhD in Molecular Genetics (Fundação Oswaldo Cruz - Ministério da Saúde, FIOCRUZ, Brazil). Researcher of the Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation). ***Postal address:*** 103 Sul, Av. JK ACSO 1 - Lote 17 1° piso, Palmas-Tocantins, Brazil. Postal code: 77015-012. ***Phone***: +55 63 3218 2933; ***e-mail:*** renata.barroso@embrapa.br

3 Bachelor in Economics (Pontificia Universidad Católica de São Paulo, PUC-SP, Brazil); Master in Applied Economics (Universidade de São Paulo,USP, Brazil). Researcher at Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation). ***Postal address:*** 103 Sul, Av. JK ACSO 1 - Lote 17 1° piso, Palmas-Tocantins, Brazil. Postal code: 77015-012. ***Phone***: +55 63 3218 2953; ***e-mail:*** roberto.valladao@embrapa.br

RESUMEN

Las barreras no arancelarias (BNAs) afectan en particular a los países en desarrollo debido a la mayor dependencia de estos en relación con los mercados de los países desarrollados, así como también a su menor influencia en los foros del comercio internacional. Las BNAs tienen una importancia creciente en el comercio mundial de pescados debido al aumento de las transacciones internacionales de esos productos. Las exportaciones mundiales de pescados se duplicaron entre 1998 y 2008, pasando de 51,5 a 101,9 miles de millones de US$. Este artículo intenta analizar el impacto de las BNAs creadas por la Unión Europea sobre las exportaciones brasileñas de pescados. Se basa en el método de inventarios integrado al modelo ARIMA. Los datos se refieren a barreras técnicas obtenidas en la base de datos TRAINS/UNCTAD y a las exportaciones brasileñas recolectados en la base de datos ALICEWEB. Los resultados indican que esas medidas presentaron impacto negativo solamente para pescados frescos. Se supone que las BNAs impuestas por la Unión Europea todavía no tienen efectos relevantes sobre las exportaciones brasileñas. Incluso para pescados frescos, no es posible certificar con exactitud que la reducción en el volumen fue causada por las BNAs, porque podrían estar involucrados otros factores. Sin embargo, el rápido aumento en el número de barreras no arancelarias a las importaciones de mariscos en el mercado europeo representa un riesgo potencial para el crecimiento de las exportaciones brasileñas. Por otra parte, dado que gran parte de la acuicultura brasileña se está desarrollando dentro de los ecosistemas complejos como el Amazonas, existe la posibilidad de nuevos obstáculos no arancelarios relacionados con las nuevas exigencias medioambientales. Estos resultados acentúan la necesidad de incorporar otras variables en el análisis de BNAs, con el objetivo de perfeccionar la medición de sus efectos.
Palabras clave: barreras no arancelarias, pescados, exportaciones, Brasil, Unión Europea

RÉSUMÉ

Les barrières non-tarifaires (BNTs) affectent particulièrement les pays en voie de développement, étant donnée non seulement leur plus forte dépendance vis-à-vis des marchés des pays développés, mais aussi leur moindre influence au sein des instances du commerce international. Les BNTs présentent une importance grandissante dans le commerce mondial des produits de la mer à cause de l'augmentation des transactions internationales de ces produits. Entre 1998 et 2008, les exportations mondiales des produits de la mer ont doublées, en progressant de 51,5 à 101,9 billions de dollars américains. Cet article tente d'analyser l'impact des BNTs créés par l'Union Européenne sur les exportations brésiliennes des produits de la mer. La méthodologie est basée sur celle d'inventaire, intégrée au modèle ARIMA. Les données concernant les barrières techniques ont été obtenues auprès de la base de données TRAINS/UNCTAD et celles des exportations brésiliennes ont été recueillies dans ALICEWEB. Les résultats montrent que ces mesures présentent des impacts négatifs uniquement pour la catégorie poissons frais. Il est supposé que les BNTs mises en place par l'Europe n'a pas encore d'effets significatifs sur les exportations brésiliennes. Même pour des poissons frais il n'est pas possible d'affirmer avec exactitude que la réduction du volume a été causée par les BNTs, parce que d'autres facteurs peuvent être en cause. Néanmoins, la forte augmentation du nombre de BNTs pour l'importation des produits de la mer dans le marché européen s'avère un risque potentiel pour le développement des exportations brésiliennes. De plus, étant donnée que l'aquaculture brésilienne se développe essentiellement dans des écosystèmes sensibles tels que l'Amazonie, il existe un risque d'émergence de nouvelles BNTs liées à des contraintes environnementales. Ces résultats mettent en évidence le besoin d'intégrer d'autres variables dans l'analyse des BNTs afin d'améliorer la mesure de leurs effets.
Mots-clé : Barrières non-tarifaires, produits de la mer, exportations, Brésil, Union Européenne

RESUMO

As barreiras não-tarifárias (BNTs) afetam particularmente os países em desenvolvimento devido à maior dependência destes com relação aos mercados dos países desenvolvidos e também à sua menor influência nos fóruns de comércio internacional. As BNTs apresentam uma importância crescente no comércio mundial de pescados devido ao aumento nas transações internacionais. As exportações mundiais de pescados dobraram entre 1998 e 2008, passando de 51,5 para 101,9 US$ bilhões. Este artigo visa analisar o impacto das BNTs criadas pela União Europeia sobre as exportações brasileiras de pescados. A metodologia correspondeu à abordagem de inventário, integrada com o modelo ARIMA. Os dados se referem a barreiras técnicas obtidas na base de dados TRAINS/UNCTAD e a exportações brasileiras coletadas na base de dados

ALICEWEB. Os resultados mostraram que estas medidas apresentam impacto negativo apenas para peixes frescos. Supõe-se que as BNTs impostas pela Europa ainda não têm efeitos relevantes sobre as exportações brasileiras. Mesmo para peixes frescos, não é possível afirmar com exatidão que a redução no volume foi causada pelas BNTs, porque outros fatores podem estar envolvidos. No entanto, o rápido aumento do número de BNTs às importações de pescados no mercado europeu representa um risco potencial para o crescimento das exportações brasileiras. Além disso, dado que grande parte da aquicultura brasileira está sendo desenvolvida dentro de ecossistemas complexos, como a Amazônia, existe a possibilidade de surgirem novas BNTs relacionadas a restrições ambientais. Estes resultados enfatizam a necessidade de incorporar outras variáveis na análise de BNT a fim de aprimorar a mensuração dos seus efeitos.
Palavras-chave: barreiras não-tarifárias, pescados, exportação, Brasil, União Europeia

1. INTRODUCTION

The implementation of non-tariff barriers (NTBs) has sharply increased since that WTO (World Trade Organization) rules provided a strong reduction on the use of tariffs as protection measures. Unlike tariff barriers, NTBs are difficult to control by WTO and others regulation organizations of international trade. According to Leamer (1989, pp. 51-82), cited by Miranda (2001), NTBs have redistributive effects which can be just supposed. Thus, reaction against this type of barrier is less direct compared to a tariff measure which effects on redistribution of income are equivalent.

NTBs affect particularly developing countries because of their dependence to the markets of developed countries and their minor influence in international trade forums (WTO, World Bank, etc.). According to UNCTAD (2005), 40% of the exportations from developing countries are submitted to NTBs. Several researches have showed illegitimate protection measures which are characterized as NTBs (European Commission, 2000; USTR, 2001). In Brazil, relevant export agricultural products like beef and cotton have suffered from the emergence of NTBs implemented by developed countries (Miranda, 2001; Viegas, Jank, & Miranda, 2007).

NTBs have an increasing importance in seafood world trade due to the rise of international transactions of these products. According to FAO (Food and Agriculture Organization of the United Nations), world exports of seafood doubled between 1998 and 2008, from US$ 51.5 billion to US$ 101.9 billion (FAO, 2010). Production from aquaculture has strongly increased compared to fishing. Between 2000 and 2008 catching volume decreased 4.1% while aquaculture production increased 62.1%.

Data also shows a trend in reallocating aquaculture from developed countries to developing countries. Between 2000 and 2008 European Union (EU), the United States (USA) and Japan reduced their share in the world aquaculture production. In the same period, production increased strongly in Asia, Latin America and Africa (which grew 135%). The result of this aquaculture production rearrangement is the increasing of seafood importation in developed countries (Table and Figure Nº 1).

As a result, that increasing importation is supposed to be the cause of the implementation of BNTs by developed countries in order to protect local production (and/or consumers) face the competition of developing countries fish exportations. Thus, many measures have been created to difficult the access in these markets. For example, in 2008 the European Union banned all importations of fisheries from Fiji Islands due to some problems related to production and to the lack of information from Fiji authorities (Agritrade, 2009).

The Kenya fishing sector was also concerned to non tariff measures by EU at the end of the 1990's. In 1997, Spain and Italy banned importation of fish from Kenya claiming Salmonella contamination. In 1998, all EU countries banned chilled fish importations from Victoria Lake declaring poor sanitary standards. A third ban by EU happened in 1999 following complaints concerning the use of pesticides to kill fish in the Victoria Lake. As a result, Kenya fisheries exports decreased 68% in 1999. In

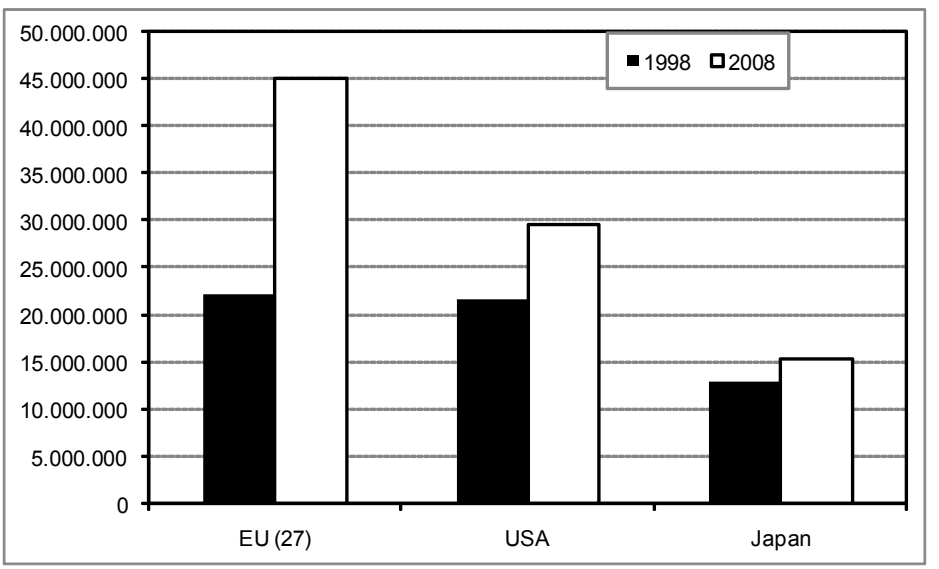
Table 1

Fish Production (aquaculture and fishing) by region/countries quantity (thousand tones) by year (2000 and 2008) and percentage of growth in the period

Country (es)	Aquaculture			Fishing		
	2000	2008	Rate of growth 2000/2008 (%)	2000	2008	Rate of growth 2000/2008 (%)
EU (27)	1,395	1,278	-8.4	6,761	5,205	-23
	4.3	2.4		7.1	5.7	
USA	456	500	9.6	4,760	4,357	-8.4
	1.4	0.9		5	4.8	
Japan	763	732	-4	5,193	4,429	-14.7
	2.3	1.4		5.5	4.9	
Asia (without Japan)	27,637	45,93	66.2	43,956	46,936	6.8
	85.2	87.4		46.5	51.8	
Africa	400	940	135	6 816	7,363	8
	1.2	1.8		7.2	8.1	
Latin America	799	1721	115.4	26,091	21,943	-15.9
	2.5	3.3		27.6	24.2	

Source: FAO (2010); own calculations

Figure 1
Importations of seafood by EU, USA and Japan, 1998 and 2008 (US$ 1,000)



Source: FAO (2010); own calculations

order to reach EU requirements, all Kenya fish industries implemented systems of quality control, through six certifications carried out by Kenyan and European institutions. These advances enabled also Kenyan authorities to obtain their entry in the list of institutions authorized by EU to control processing fish industries in exporter countries (Abila, 2003).

According to OECD (Organisation for Economic Co-operation and Development), the analyzes of the NTBs relevance in different agricultural sectors is justified by many reasons: a) the use of NTBs by developed countries has increased in the last years as result of the reduction of tariff barriers; b) the quantification of economic impacts of the NTBs is used by OECD as base for realize political trade reforms with their countries members; c) adequate techniques for measurement of NTBs impacts can support resolution of commercial disputes in the WTO (Beghin and Bureau, 2001, p. 21). The knowledge of NTBs can be also strategic for exports firms by allowing them to forecast transactions costs (e.g. certification), meet the requirements or seek other markets.

Given the recent development of the Brazilian aquaculture, the analysis of the current and potential NTBs is critical face to its internationalization process. This article aims to analyze the impacts of NTBs implemented by EU to the Brazilian seafood exportations. Moreover, this article explores potential NTBs that can affect Brazilian seafood exportations in the future. For this, the article uses a qualitative and quantitative approach, based on the UNCTAD's (United Nations Conference on Trade and Development) inventory method.

2. THE CONCEPT OF NTBS

According to the Brazilian Ministry of Development, Industry and Foreign Trade, NTBs are defined as all measures and political economic initiatives affecting trade between two or more countries – excluding the tariff measures. With tariff barriers, NTBs are the two basic groups of measures that constitute the international trade barriers. NTBs are restrictions to entry of imported products based on technical, sanitary, environmental and labor requirements which result on measures as quantitative limitations (quotas and imports contingency), customs valuation policies, minimum prices. Generally, NTBs aim to protect important sectors of the State as national security, environment conservation, animal, vegetal and human health. However, the lack of clear and real reasons in order to justify the implementation of these measures is the principal element that characterizes a NTB.

Hillman (1991) points out that NTB is *«any governmental measure, excluded the tariffs, which prevents the entry or discriminates imports in a country, by applying different measures in its domestic production and distribution».* This definition is endorsed by several authors who highlight the discriminatory character of the NTBs concerning the imports (Henson & Wilson, 2005; Beghin & Bureau, 2001). As the measures implemented directly by government, these concepts include also initiatives carried by private sector (e.g. quality standards). Indeed, over the last years the influence of private standards in international trade is increasing.

The largest database on NTBs available for public consultation is the Trade Analysis and Information System (TRAINS) which belongs to UNCTAD (United Nations Conference on Trade and Development) and it is available through World Integrated Trade Solution (WITS) software. Information available in TRAINS is organized by categories of NTBs, classified by product or group of product according to the Coding System of Trade Control Measures (TCMCS). Additional information about description of every NTB and indication about concerned countries is also available. However, there are no measurements about restriction level of NTBs (UNCTAD, 2005).

The TCMCS identifies over 100 different types of NTBs, which are broadly classified into six chapters, from 3 to 8 (Chapters 1 and 2 are reserved for tariff and para-tariff measures respectively), according to the intent or immediate impact of the measures:

A. Chapter 3. Price control measures: Measures intended to control the prices of imported articles for the following reasons: (i) to maintain domestic prices of certain products when the import price is lower than the determined price; (ii) to establish the domestic price of certain products because of price fluctuations in the domestic market or price instability in the foreign market; and (iii) to counteract the damage caused by the application of unfair practices in foreign trade. The measures adopted at first can be administrative fixing of prices and voluntary restriction of the minimum price level of exports or price investigation to subsequently obtain one adjustment

mechanisms as: suspension of import licenses, application of variable charges, antidumping measures or countervailing duties.

B. Chapter 4. Finance measures: Measures that regulate the access and the cost of foreign exchange for imports and define the terms of payment. They may increase the import cost in a similar mode as tariff measures.

C. Chapter 5. Automatic licensing measures: Openly granted approval of applications for imports or monitoring import trends of specified products, sometimes through a register inscription. They may be applied to signal concern over import surges and to persuade trading partners to reduce export growth. They may also be applied for environmental purposes. Sometimes they are the precursor of import restraints.

D. Chapter 6: Quantity control measures: Measures intended to restrain the quantity of imports of any particular good, from all sources or from specific source of supply, through restrictive licensing, fixing of predetermined quotas or prohibitions.

E. Chapter 7: Monopolistic measures: Measures that create a monopolistic situation by giving exclusive rights to one economic operator or a limited group of operators for social, fiscal or economic reasons.

F. Chapter 8: Technical measures: Measures referring to product characteristics such as quality, safety or dimensions, including the applicable administrative provisions, terminology, symbols, testing and test methods, packaging, marking and labeling requirements as they apply to a product.This chapter includes measures based on SPS (Sanitary and Phytosanitary Agreement) as limits of chemical residues, no disease area and restrictions related products authorized for treatments.

Sometimes the distinction between a NTB and a legitimate measure is difficult to evaluate (Segerson, 1999). Therefore, several authors say that the term «barriers» could be not used to describe any measures restricting international trade, but just for measures which aim principally to correct market inefficiency. Baldwin (1989) and Mahé (1997) have limited the definition of NTB just for the reducing economic welfare measures either to import or to export to others countries. Consequently, they highlighted that restrictive trade measures generating positive global effects in terms of economic welfare should not be considerate as NTB.

3. METHODOLOGY

3.1. THE IMPACT OF NTBS

The European market was selected to analyze the effects of NTBs over Brazilian fisheries exports. This market was chosen by its importance as the largest world importer for these products. According to Agritrade (2009), the European market of fisheries has an annual turnover of around 12 million tones and 55 billion Euros. In 2008, the EU accounted for 43.5% of the world imports of fisheries. The main NTBs in the international seafood market are sanitary measures or technical barriers.

Several analytical models for measuring NTBs have been developed over the last years. However, there is no consensus between experts concerning an ideal model to evaluate NTBs impacts (Beghin & Bureau, 2001; Bigsby & White, 2000; Roberts, Josling & Orden, 1999; Ganslandt & Markusen, 2000; Henson & Loader, 2001; Maskus & Wilson, 2000; Popper, Greenfield, Crane & Malik, 2004). According to Beghin (2006), this difficulty is caused by the heterogeneity of the restrictive measures implemented and by the lack of data.

Accordingly, the inventory-based approach has been used by several authors with regard to their best capacity in estimating NTBs effects. This approach uses different analytical elements in order to correct limitations related to data availability. This methodology was used by several authors to evaluate the impact of NTBs on the Brazilian exports, as for example: Mendes, Coelho & Campos, 2009 (mango); Bellonia & Silva, 2007 (beef); Viegas, Jank & Miranda, 2007 (agricultural products); Castilho, 1994 (wood). The next section describes how this approach was used on this article. The data used on this methodology refer to catalogs of technical barriers (identification and description) obtained from the database TRAINS/UNCTAD.

3.2. INVENTORY-BASED APPROACH

This approach is based on the analysis of the number and the frequency of restrictive measures in a given market. This method is recommended by UNCTAD and it enables to realize both quantitative and qualitative

assessments of the NTBs incidence. Common measures include the number of regulations and policies, which can be further elaborated to indicators such as the number of national regulations pages. According to Miranda (2001), this approach enables estimate the volume of exports submitted to NTBs and the frequency of NTB over products and countries. These analyses can also take into account the frequency and the number of complaints reported by exporters for perceived discriminatory regulatory practices (Beghin, 2006). This approach is often used to calculate the coverage and frequency of trade, as well as the index of trade restriction (Viegas, Jank & Miranda, 2007; Miranda, 2001; Laird, 1997).

According to Laird (1997), a problem related to the analysis of coverage ratio concerns to the endogeneity of the import value weights. The more restrictive is a BNT, the lower the weight assigned to this measure in the calculation of the coefficient. Unlike if a NTB is very restrictive and it impedes all imports of a product, its weight on balance is zero and, consequently, the proportion of coverage of trade will be underestimated. Moreover, these authors say that these coefficients do not assess efficiently how much the value of the imported items is affected by NTBs. Thus, the frequency ratio does not present the relative value of concerned products and consequently, does not represent the importance of the NTBs comparatively between various items of exports.

A methodological alternative to overcome those problems is the integration of the ARIMA model, in order to improve the analysis of the impacts of NTBs. In this model, named as auto-regressive model of moving average, the endogenous variable is explained by their lags in time. Thus, this univariate model is able to explain the variable through passed values. The AR (p) process is generated from the error term present and past values, as it is shown in $Y_t=\alpha_0+\alpha_p Y_{t-p}+\varepsilon_t$. The MA (q) process is generated by a moving average of error terms current and lagged $Y_t = \varepsilon_t + \beta\varepsilon_{t-q}$. The term of integration I(d) serves to differentiate the time series to make it stationary in (d) differentiation.

According to Mendes, Coelho & Campos (2009), the insertion of exogenous factors in the model was widespread from known data and the interventions were integrated in the econometric models through dummy variables in the inventory approach. This approach use information of NTBs imposed on certain exported products, countries or exporters, and the date on which each restrictive measure has been implemented. Therefore, outliers can still arise, whose effect on the series can be changes in its level or in the development of the trajectory. The analysis of intervention uses the series as an indicator that there is presence or absence of the event through the pulse or step variable. Pulse has value 1 at the moment of the event or intervention and 0 on the others periods of the series. In this case, it is admitted the evidence of the occurrence of the event. The step outlier has value 0 in the previous period to the event and 1 after that.

4. RESULTS AND DISCUSSION

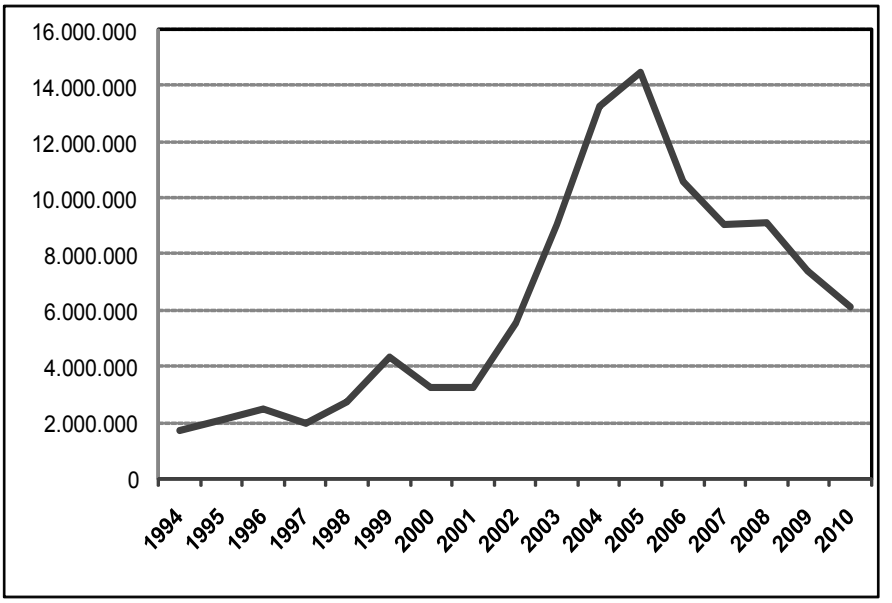
4.1. MAIN NON-TARIFF BARRIERS AND THEIR IMPACTS ON BRAZILIAN EXPORTS OF FISHERIES TO EUROPEAN MARKET

Annual series of export values, between 1990 and 2010, were analyzed in order to identify the non tariff barriers effects on the Brazilian seafood exports to EU. Data were collected at ALICEWEB database of the Brazilian Ministry of Development, Industry and Foreign Trade. The analytical model took into account the effects of the measures since 2004 because EU has implemented NTBs since this date. For the impacts analyses by ARIMA model, the introduction of seasonal variables was not necessary because there are seasonal variations just between months and seasons for the analyzed products. Therefore, because data used are annuals seasonal variables were not necessary in the modeling.

The five more important groups of seafood exported by Brazil were analyzed, according to HS (harmonized systems) classification: a) Fish, fresh or chilled (HS 0302); b) Fish, frozen (HS 0303); c) Fish filets and other fish meat, fresh, chill or frozen (HS 0304); d) Crustaceans, live, fresh, chilled or frozen, etc. (HS 0306); e) Molluscs and aquatics invertebrates, live, fresh, chilled or frozen, etc. (HS 0307)[4]. Figures 2 to 6 present the series that will be analyzed.

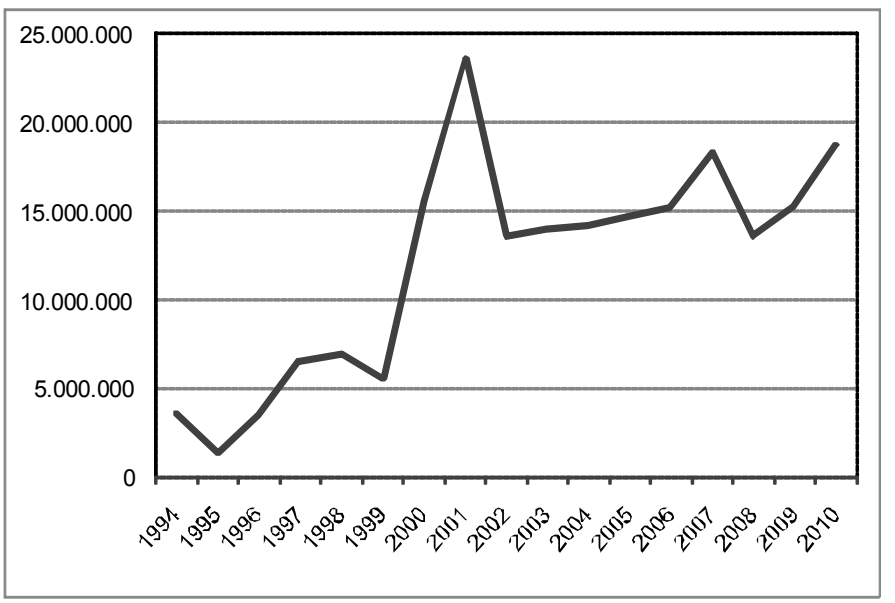
4 Subsequently group names will be abbreviated as Fresh fish, Frozen fish, Filets fish, Crustaceans and Molluscs.

Figure 2
Brazilian fresh fish exports to EU, 1994-2010



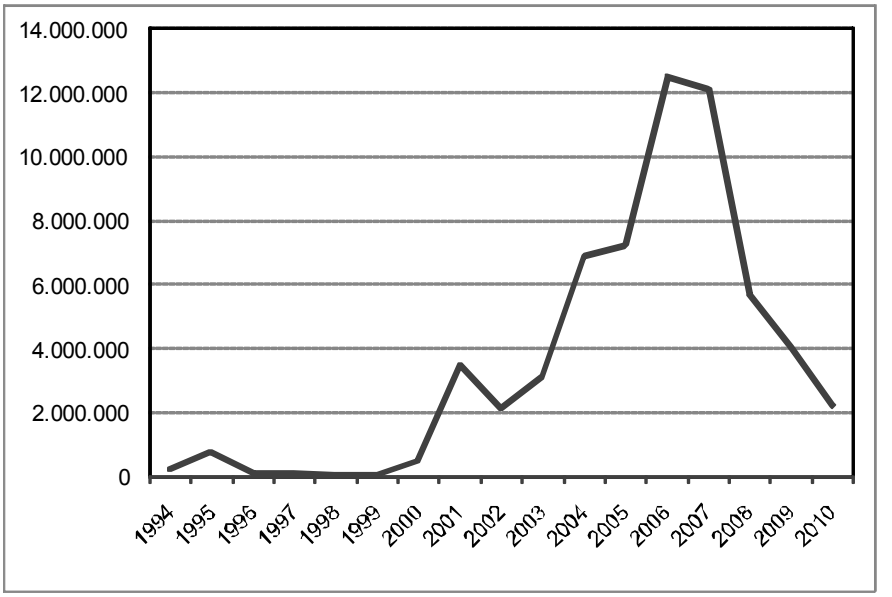
Source: Own calculations

Figure 3
Brazilian Frozen fish exports to EU, 1994-2010



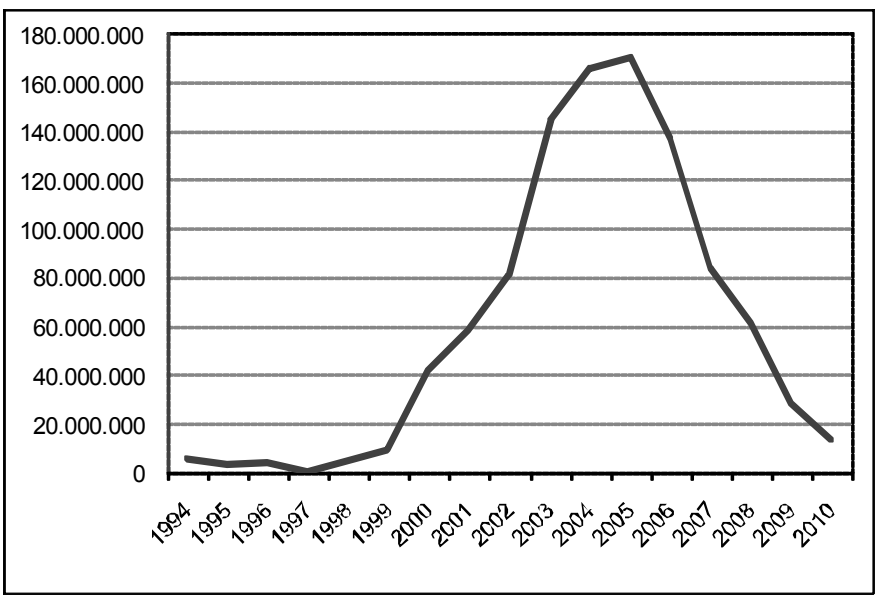
Source: Own calculations

Figure 4
Brazilian fish filet exports to EU, 1994-2010



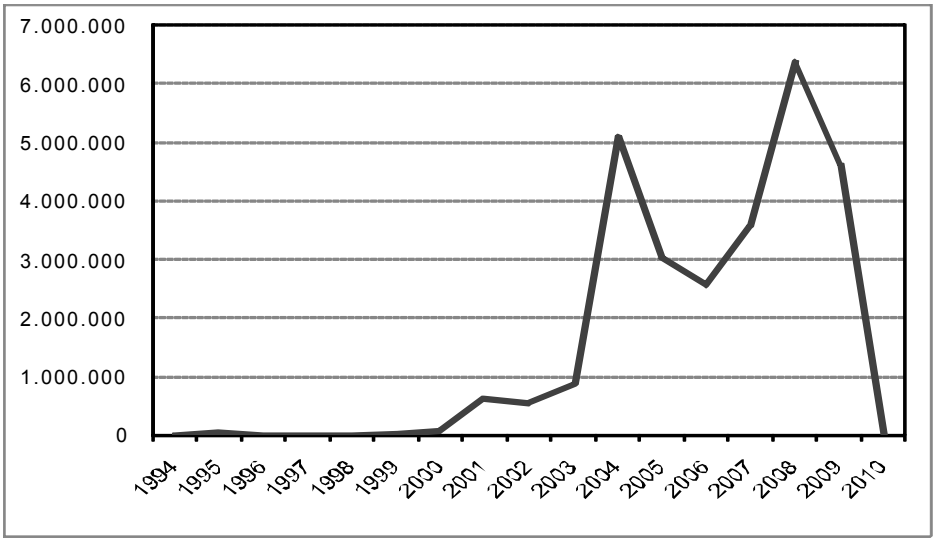
Source: Own calculations

Figure 5
Brazilian crustacean exports to EU, 1994-2010



Source: Own calculations

Figure 6
Brazilian molluscs exports to EU, 1994-2010



Source: Own calculations

The first step to develop ARIMA method was the verification the occurrence of a standstill in the series, what is essential to ensure many of the basic properties of the model and consequently unit root tests were performed. For this article, the unit root test chose was the augmented Dickey-Fuller test (ADF). Results for the exports value of the analyzed products are presented in the Table 2.

The analysis shows that the five series are no stationary, even at a significance level of 10%. The column «p value» has values greater than 10% on all products, which means that at a significance level of 10% the null hypothesis of a unit root in the series is not rejected. Thus, the next step (Table 3) is the unit root test with the first differences in order to verify if the series are integrated of first order, I(1).

Table 2

Unit root test for the total of Brazilian fisheries exports to the EU		
Series	**Statistics t**	**p-value**
Fresh fish	-1,877688	0,3347
Frozen fish	-1,581754	0,4730
Fish filets	-1,404403	0,5593
Crustaceans	-2,124016	0,2381
Molluscs	-1,969454	0,2966

Source: Own calculations

Table 3

Unit root test for the first difference of the Brazilian seafood exports to the EU		
Series	**Statistics t**	**p-value**
Fresh fish	-3,080306	0,0464
Frozen fish	-4,269452	0,0043
Fish filets	-3,165797	0,0416
Crustaceans	-1,843278	0,3498
Molluscs	-4,193888	0,0050

Source: Own calculations

According to the test, only the series of crustaceans is no stationary at a significance level of 5% (Table 3). The other four products are I(1) and so it is possible to start choosing the lags for the ARIMA modeling. For crustaceans it is still necessary to differentiate one more time to find the correct order of series integration (Table 4).

The series of the crustaceans is I(2), because at a significance level of 1% the null hypothesis of a unit root in the series is not rejected (Table 4). Consequently it is possible to develop ARIMA model for the series of the five analyzed products. The choice of the best model was based on the criteria of Akaike and Schwarz, using the Q test for verify the hypothesis of no autocorrelation in the series.

The models chosen were: ARIMA (1,1,1) for fresh fish; ARIMA (1,1,1) for frozen fish; ARIMA (1,1,1) for fish filets; ARIMA (2,2,2) for crustaceans; and ARIMA (0,1,1) for molluscs. In order to analyze the effects of NTBs on Brazilian exports, dummy variables were introduced in the modeling to represent the existence of barriers during the period analyzed. The analysis of the intervention was conducted by step variables, in other words, dummy variables that admit zero in the period prior to the event and one after it.

Results show that only the fresh fish item has presented significant impact of NTB at a significance level of 10% (Table 5). For the other four products the *p*-value shows that null hypothesis that the effects are different from zero cannot be rejected. This means that the inclusion of NTBs in 2004 had no significant effect on Brazilian exports for these four products.

For fresh fish, the implementation of the NTBs since 2004 had a negative effect on exports. Modeling results has shown that, on average, exports are reduced in US$ 1.88 million in a year with NTBs compared to years with no NTBs. This large effect of NTBs found upon fresh fish can be explained by the great vulnerability of this product to the NTBs once it is more perishable with consequent risks in sanitary terms. As a result, this kind of product faces greater requirements than other products, related to quality, packaging, transport and storage.

4.2. RELATION BETWEEN BRAZILIAN EXPORTS OF FISH AND EXCHANGE RATE

As it is shown in Table 5, non-tariff barriers had significant effect on national exports to Europe only for fresh fish. As presented in the methodology, were used auto-regressive moving average (ARIMA) models, which have one variable, in order to verify these effects models. Therefore, products export is explained by values from previous years in the same series. Thus, the effect of the barrier is verified by changing the behavior of the variable number of time from the moment where the barriers were applied to.

Table 4

Unit root test for the second difference of the Brazilian fisheries exports to the EU

Series	Statistics t	p-value
Crustaceans	-4,625451	0,0021

Source: Own calculations

Table 5

Results of intervention analysis of the NTBs of UE on Brazilian seafood exports

Series	Barrier effects	Standard deviation	p-value
Fresh fish	-1.876.254	1.000.463	0,0803
Frozen fish	287.229	1.910.791	0,8825
Fish filets	-577.018	1.359.872	0,6774
Crustaceans	-18.589.528	12.751.345	0,1728
Molluscs	96.625	273.022	0,7278

Source: Own calculations

Certainly there are other variables that influence the total fish exports to Europe and, thus, can better explain the movement of the series making clearer the reasons of the absence of effects of non-tariff barriers. An example of a variable that can influence the export is the purchasing power of foreign currencies on domestic products. This purchasing power is represented by the exchange rate between the national currency, the Brazilian Real, and the main international currency, the American Dollar. According to economic theory, the more the domestic currency is undervalued in relation to international currency, the higher the level of export of the country.

This way, it is interesting to see how the exchange rate is related to the volume of export of fish. For that, the value of the Brazilian Real against the American dollar each year will be used as the exchange rate, as showed below:

$$e_t = \frac{BR\$_t}{US\$_t}$$

Where e_t is the exchange rate for the year t, $BR\$_t$ is the value of the Real in the year t and $US\$_t$ is the value of the dollar in the year t. Figure 7 shows the behavior of the annual series of the exchange rate from 1994 to 2010. Although the modeling ARIMA has used time series with previous years, it was decided in the case of exchange, to start the series in 1994, the year of commencement of the Real Economic Plan.

As it is shown, both series behave in a similar way. This fact is confirmed by observing the correlation between two variables. Thus, Table 6 shows the correlation coefficient between the exchange rate and the quantity exported to the main categories of fish.

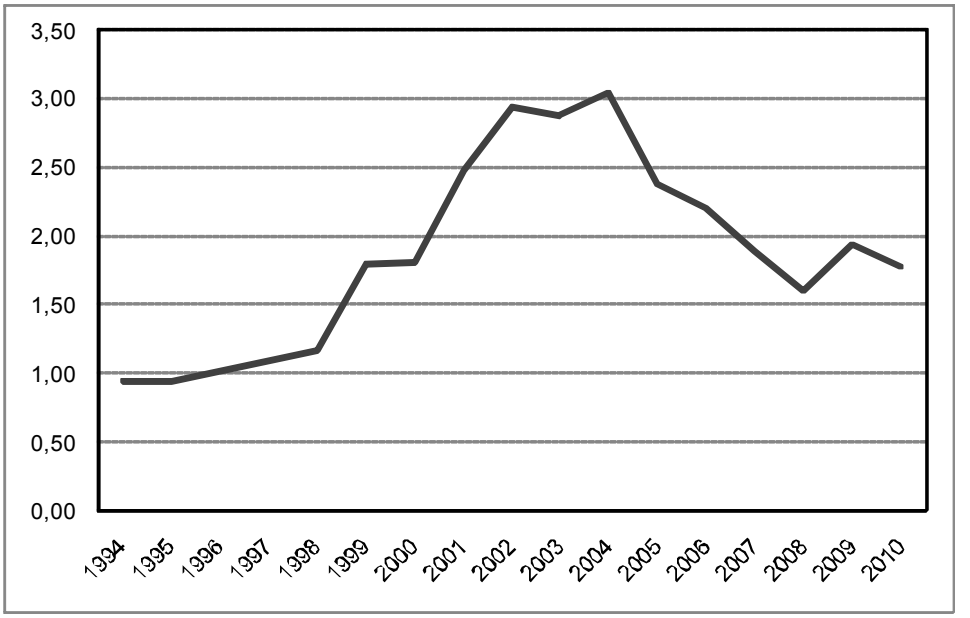
Table 6 shows that the correlation coefficient between the two sets presented in Figures 7 and 8 is 81.5% what explains how much the behavior of both are similar. Regarding the correlation between each type of fish and the exchange rate, Table 6 notices that, except for shellfish, the variables also show a reasonable correlation coefficient.

Figure 9 shows the different type of fish distribution related to the total exports per year. In this context, molluscs have a very low participation relatively to the total, and thus the low correlation with the exchange rate behavior has no significant influence. Another interesting fact is that crustacean has the largest share in total exports; also it is the category that has a higher correlation with the exchange rate.

Figure 6
Brazilian molluscs exports to EU, 1994-2010

Source: Own calculations

Figure 7
Brazil: Exchange, 1994-2010



Source: Own calculations

Table 6

Coefficient of correlation in relation to the exchange for each type of fish

Variables	Correlation coefficient with respect to the exchange rate
Total exports	0,8150
Fresh fish	0,6746
Frozen fish	0,6803
Fish filets	0,4510
Crustaceans	0,8091
Molluscs	0,3565

Source: Own calculations

Then, the importance of the exchange rate on the level of fish exports to Brazil is highlighted. This may be a reason why non-tariff barriers imposed by Europe have not been effective in the export volume of most type of fish, since the purchasing power of Europe on the Brazilian product has great influence on these values.

4.3. MAINS NTBS FOR FISHERIES PRODUCTS IN THE EUROPEAN MARKET

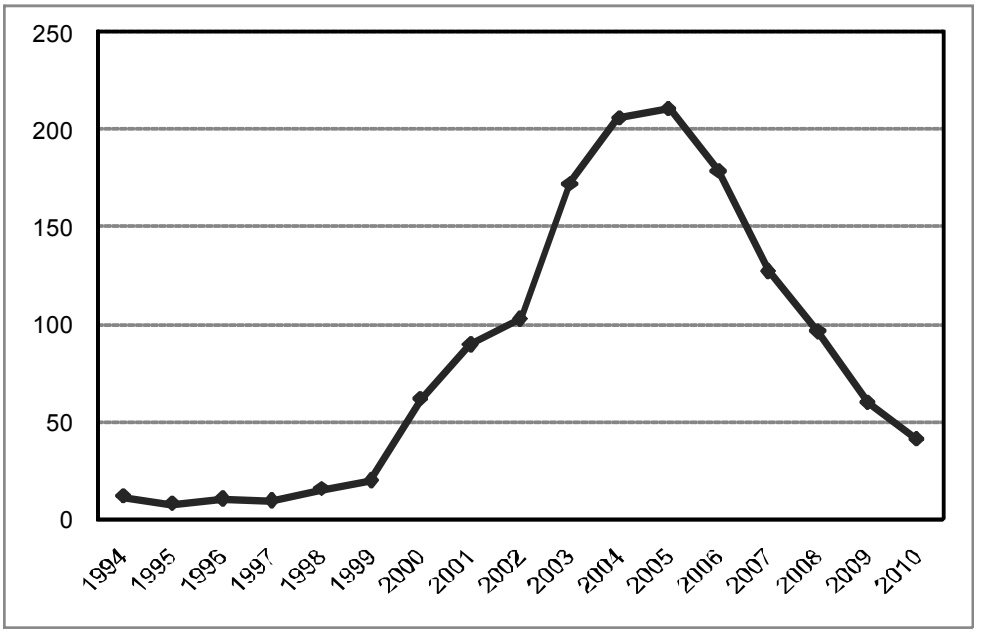
• Control of the production process by the country of origin:

The EU applies several rules related to animal products, because they are more susceptible to risks in terms of food safety. Therefore, the EU requires a rigorous control and monitoring of the production process by the exporter country. Thus, the EU monitors the system of control realized by the concerned authorities in the origin country. In Brazil, this control is carried by the Ministry of Agriculture. One of the mains requirements is the presence of the national authority of control in the fish-processing industries. Periodically the EU updates a list of countries and their respective control bodies able to control fish industry. The last list was issued on 2006 (Decision 2006/766/CE). Countries not included in this list are forbidden to export fisheries to EU.

• Labeling of fisheries products sold in the EU:

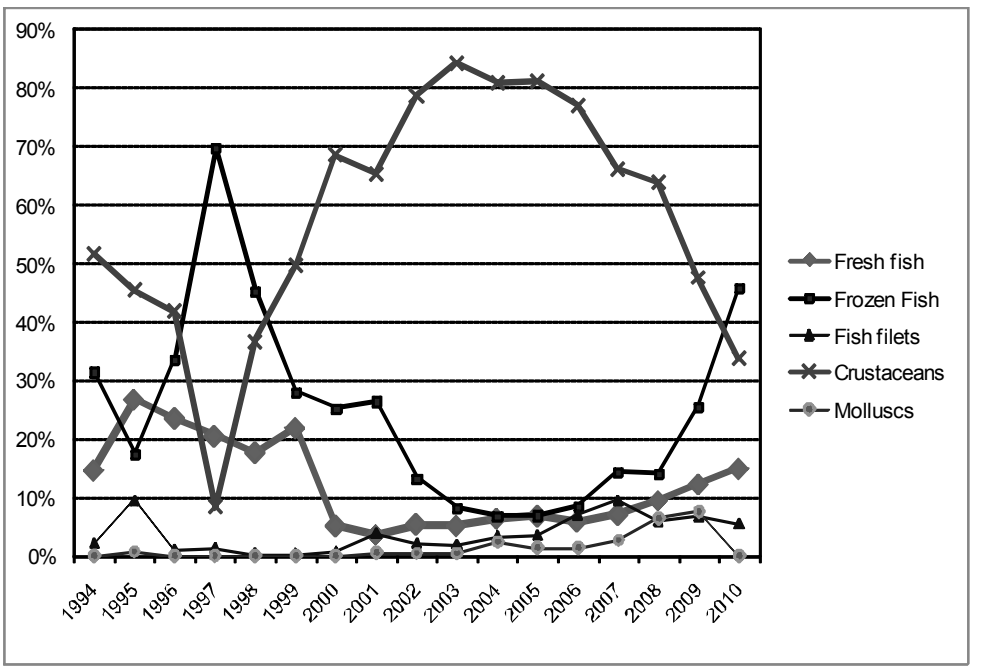
Since 2002 the EU has implemented rules related to labeling of fisheries sold in the retail

Figure 8
Brazil: Total exports, 1994-2010



Source: Own calculations

Figure 9
Brazil: Fish exports distribution by year, 1994-2010



Source: Own calculations

channels. These requirements are formulated in Commission Regulation (EC) No 2065/2001. For non-EU products marketed in the EU (except those landed by vessels flying the flag of a non-EU country, see Council Regulation 1093/94), the accompanying information required is: country of origin, scientific name and commercial designation of product, mode of presentation, freshness category, size category, product weight contained in the packaging, date of classification, date of dispatch, name and address of consignor.

• **Private standards and quality certifications:**

The European retail sector has faced an increasing pressure by consumers and authorities concerning the safety and quality control for all types of food. Consequently, supermarkets have transferred to the producers and exporters the responsibility in developing quality standards. Indeed, supermarkets have been capable to impose increasing requirements to the exporters, often with more efficient results compared to government initiatives. Currently, certification of quality for fish most required by the European market is the «Global GAP Integrated Aquaculture Assurance Standard-Aquaculture Base». Originally developed for fruits and vegetables, GlobalGAP has expanded and now includes animal products, including aquaculture, in its certification system. However, many other certifications have been developed in the market of fishery products in Europe (Table 7). Recently, some eco-labels have been used to certify organic fish production.

The requirement for certification can affect exporters in two ways. On the one hand, it requires a large investment for implementation and maintenance, and this has consequences in the final price of the product. Estimates indicate that the cost of each certification rise by more than 10% the price of the final product (Dey, Ahmed, Jahan & Rab, 2003). On the other hand, the certification does not guarantee access to other international markets, which requires producers to implement more than one quality certification. For example, HACCP (Hazard Analysis Critical Control Point) is one of the main certification for fisheries in USA but it is not widely used in EU. Besides, the large number of certifications has created a problem of identification by European consumers which, in view of the abundance of standards, has been unable to differentiate the certificate fish from other not certified.

• **Food safety and traceability:**

The various sanitary food crises in recent years increased the awareness of consumers about health risks. Food safety is more important for fisheries because these products are more susceptible to the pathogenic contamination. The main risks are related to the lack of hygiene during and after catching fish, inadequate refrigeration, insufficient processing control and inappropriate packaging. Indeed, the consumption of contaminated fish represents about 30% of all foodborne diseases in the world (Abila, 2003). The EU issued Decisions 2003/804 and 2003/858 with the objective to harmonize the conditions for imports of aquaculture products from countries not members. Given the importance of quality among consumers of fish, many European supermarkets are implementing additional measures to EU standards. Thus, beyond the certifications of quality already mentioned above (Table 6), many European retailers are controlling imported fisheries through tests carried in certified laboratories before the shipping of the products in the origin country. Moreover, some retailers require a third-party audit in the processing industry of the exporter.

5. CONCLUSION

Results of quantitative analysis of the effects of NTBs of European market on Brazilian seafood exports showed that these measures presented negative impact just for category of fresh fish. Consequently, it is to suppose that NTBs imposed by Europe do not have relevant effects on Brazilian exports of seafood. Even for fresh fish, it is not possible to state accurately that the reduction in volume was caused by the introduction of the NTB once other factors may have influenced.

In this sense, the analysis of Brazilian exports data for fresh fish to the USA shows a strong reduction of the exports volume in the same period verified in the exports to EU. However, in the USA case there were no NTB in the related period, i.e. from year 2004. This fact coincides with the adoption of NTBs by the EU, but the

Table 7

Main standards and certification schemes in fishery products market in the EU

Name	Type*	Market access issues addressed				
		Food safety	Animal health	Environment	Social/ ethical	Food quality
GlobalGAP	S, CS	x	x	x		x
Naturland	CS, L	x		x	x	x
Friend of the Sea	C, S			x		
Federation of European Aquaculture Producers (FEAP) code of conduct	C	x	x	x	x	x
Safe Quality Food (SQF)	S, L, CS	x				x
British Retail Consortium (BRC) (United Kingdom)**	S, L, SC	x				x
ISO22000	S	x		x		x
ISO9001/14000	S			x		x
Marine Stewardship Council (MSC)	C, S, L			x		
Fair-Fish (Switzerland)**	S, L		x	x	x	
Pêche responsable Carrefour (France)**	C, L			x		
SIGES Salmon/Chile	CS, L	x	x	x		x
Shrimp quality guarantee ABCC/Brazil	CS, C, L	x	x	x	x	x
Thai quality shrimp, GAP/Thailand	S, L	x				x
COC-certified Thai shrimp/Thailand	S, L	x	x	x	x	
International Federation of Organic Agriculture Movements (IFOAM) (United Kingdom)**	S, L	x	x	x organic	x	x
Soil Association (United Kingdom)**	S, L	x	x	x organic	x	x
Agriculture Biologique	S, L	x	x	x organic		
Bioland/Germany	CS, L	x	x	x organic		
Debio/Norway	CS, L	x	x	x organic		
KRAV/Sweden	C, L	x	x	x organic		
BioSuisse (Switzerland)**	C, L	x	x	x organic		
Irish Quality salmon and trout	C, L	x	x	x organic		x
Label Rouge (France)**	C, L	x				x
La truite charte qualité (France)**	C, L	x				x
Norway Royal Salmon	S, L	x	x			x
Norge Seafood/Norway	S, L			x		
Qualité aquaculture de France (France)**	S, L			x		x
The Responsible Fishing Scheme (United Kingdom)**	C, CS			x (responsible fishing	x (safety of fishers	

Source: Adapted from Washington and Ababouch (2011)
S = standard, C = code, G = guidelines, L = label, CS = certification scheme

fact that the U.S. did not adopt the barriers shows that there are other factors responsible and not only NTBs. Thus, that result emphasizes the need to incorporate other variables in the NTB analysis, such as exchange rate and the impacts of new international markets, in order to improve measurement of the real effects of NTBs.

The rapid increase in the number of NTBs to seafood imports in the European market represents a potential risk to the growth of Brazilian exports. Moreover, given that much of the Brazilian aquaculture is being developed within complex ecosystems like the Amazon, there is a possibility of emerging new NTBs related to environmental constraints.

Other potential NTB that can affect Brazilian exports of fish includes requirements related to carbon footprint and «social accountability». Although it is still only an emerging topic of discussion among European consumers, carbon footprint might be, the medium or long term, a basic element for the creation of new NTBs for the Brazilian seafood exports. Currently, various NGOs (Non-governmental Organizations) related to environmental issues has questioned the impact of CO_2 emissions generated in the chain of export of frozen fish from China – which is the largest exporter to Europe. NGOs highlight the long journey by sea fish made from China, since those fish are caught in several parts of the world (e.g. West Coast of Africa) to then be sent to China for processing and then be exported to Europe.

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