Erasmus University Rotterdam

MSc in Maritime Economics and Logistics

2012/2013

An analysis of the impact of non-tariff barriers on Greek ports' trade flows

by

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Acknowledgements

The overall procedure of conducting researches and writing research papers normally requires dedication, motivation and hard work on behalf of the author. After finishing the current research and paper, I am able of realizing that the overall process was a really challenging one. As a matter of fact, the current research paper couldn't have been finished without the aid of some persons. Consequently I would like to thank them for their contribution on my work, which lifted a lot of weight from my shoulders and limited my anxiety.

Starting with, I would like to thank God for keeping me healthy and in good shape, as well as for helping me to overcome all the difficulties appeared during the various steps of this research. It is worth referring that a lot of steps of the research conducted from May to August required some extra inspiration and a lot of work needed to be done. Although a lot of people may believe that it is a personal issue, I am sure that my belief to God helped me to fulfill the requirements of the current thesis paper.

I would like also to thank my supervisor Dr. Koen Berden for his willingness to help me in the current research paper, as well as for his willingness to take over the responsibility of my thesis project. It must be mentioned that he facilitated my work a lot by offering me the basic guidelines of the research and the paper layout.

Furthermore, I owe many thanks to Mr. Achim Vogt, who was the first one who introduced me to the world of my basic methodological tool of GSIM (Global Simulation Model). I must not also forget Mr. Joey van Elswijk, who dedicated a lot of personal time in order to read my paper more than once. His suggestions, remarks and corrections proved out to be issues of crucial significance, which allowed me to improve the quality of the research paper.

Last but certainly not least, I must not forget to thank my family, who provided me a lot of support during the overall research procedure. My parents, my grandparents and my brother spent a lot of time with me, whereas they tolerated me by offering me a lot of support, especially during the long nights I spent writing.

All in all, this research paper concludes a year in MEL, which offered me a lot of chances, experience, knowledge over the maritime economics and logistics and friends. It is obvious that I would like to publicly express my thanks to the overall class of the MEL 2012-13, Board and Professors (especially the unforgettable Prof. Dr. E. van Asperen) for sharing a lot of time together. I strongly believe that I will never forget all the simple things I learnt and lived during the year 2012-13. I am hoping that this year will be one more step in my academic career.

Abstract

Non-tariff barriers (NTB's) and Non-tariff measures (NTM's) constitute a really significant chapter of the international economics' theory. According to the theory, NTB's are considered to cause deviations from the ideal scenario of laissez-faire and trade liberalization among different countries. However, the recognition, estimation and identification of NTB's of the Greek economy are a rather difficult process, as a lot of individual characteristics must be taken into consideration.

Generally speaking, seaborne trade covers an extremely large part of both worldwide and Greek international trade. The exchange of trade flows to/from the Greek ports certifies the importance of Greek ports as trade and transport flows' gateways. That's why the Greek ports can be considered as connecting points of Greece with the countries abroad. For the sake of this analysis, the author has distinguished the following categories of NTB's; government intervention on seaborne trade (incl. taxes, subsidies, quotas), restrictive practices in shipping (incl. maritime employment and environmentally friendly shipping), technical barriers to trade, road and maritime transport, retail and distribution costs and time costs (incl. congestion).

The Global Simulation Model (GSIM) is used to assess the impact of NTB's to Greek trade flows, as well as to the micro-economic performance of Greece. Given the fact that the ports are the gateways of Greece with the outside world, it is obvious that these effects on Greek international seaborne trade also affect the Greek port and maritime industry. Two different scenarios are analyzed; the current scenario (2008-2011) and the future one. After describing each scenario in an analytical way, the NTB's tariff equivalents are calculated and inserted in indexes. The current model will be also adjusted so as to provide outcomes for four different categories of cargo (Containers, Dry Bulk, Liquid Bulk and Ro-Ro).

According to the outcomes of the GSIM model, the initial hypothesis that the Greek ports' throughput value will incur positive rates of growth comes true. It must be also referred that all the largest Greek ports can incur significant rates of export value growth above 10%. Since the removal of NTB's increases competition by offering better prices and freight rates for the consumer, it can be easily referred that the consumer surplus increases, whereas the producer surplus remains stable. As a a fact, the ports of Heraklion and Piraeus appear significant exports' value growth. These ports could have been benefitted by the relatively larger containerization shares. On the other hand, the ports of Patras, Volos and Igoumenitsa appear the largest growth rates of cargo volumes, although they are based on subsidies to increase their income.

Last but definitely not least, the Greek ports appear significant perspectives for developing and increasing their trade and transport flows. Despite the existence of growth in both Containers and Ro-Ro, Greeks appear huge competitive advantage in carrying liquid and dry bulk cargo, probably because of their tradition in bulk shipping, oil and gas carriage. In order to achieve this target, the Greek ports could move towards more efficient practices in shipping. Characteristic examples of these practices include public-private partnerships, corporatization of port authorities, labor efficiency practices and investments in infrastructure.

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List of Abbreviations

AGV's: Automated Guided Vehicles

BRICS: Brazil, Russia, China, South Africa

FOB: First-on-Board

GATT: General Agreements on Tariffs and Trade

GDP: Gross Domestic Product

GMO's: Genetically Modified Organizations

GSIM: Global Simulation Model

ISO: International Standardization Organization

JIT: Just-in-Time

LNG: Liquefied Natural Gas

NAFTA: North Atlantic Free Treaty Organization

NSRF: National Strategic Reference Framework

NTB's: Non-Tariff Barriers

NTM's: Non-Tariff Measures

Ro-Ro: Roll on/Roll-of

ROGP: Rest of the Greek ports

ROW: Rest of the World

SOLAS: Safety of Life at Sea

SSS: Short-Sea Shipping

TBT: Technical Barriers to Trade

TEN-T: Trans-European Network of Transport

TEU: Twenty-Foot Equivalent Unit

VAT: Value-Added Tax

WTO: World Trade Organization

1. Introduction

During the last years, Greece is surviving a deep recession, which has significantly affected the Greek economy and society. According to 2012 Annual IMF Report, the growth of the Greek economy is highly dependent on the structural reforms the government has promised to apply on the years to come. As a matter of fact, Greek economy needs to become more competitive in order to achieve its survival and development in a rapidly changing environment.

Imports and exports are widely considered to be indicators of the microeconomic performance of the economy. Apart from the reforms needed to be done in other critical sectors of the Greek economy such as the labor market, it is obvious that facilitating the trade and transport flows is an issue of priority. All measures to be taken to improve trade and transport efficiency will be definitely beneficial to the national economy. Thus, it can be easily referred that the removal of non-tariff barriers (NTB's) could be listed as a pro-competition reform, which decreases the profit margin of the companies (indicator of increased market power due to anticompetitive environment) and the deadweight losses incurred by these barriers.

To begin up with, some definitions of NTB's should be provided to explain their significance for the local, regional, national or world economy. McCarty (1999) believes that countries participating in particular trade blocks are planning to abolish all scourges (NTB's) they have implemented in the past in order to apply trade liberalization policies. In addition to this, Kirk (2011) includes product standards, technical certifications and regulations as technical barriers to trade. Most of these technical barriers have been applied in order to guarantee the consumers' safety. Coughlin and Wood (1989) have listed labeling and packaging requirements, quotas, export restraints and import levies as parameters reducing trade volumes to be imported and exported.

Goods and services are mainly exported and imported through sea worldwide. Compared to other means of transport (rail, road, air), sea transportation is chosen as an attractive means of goods' and services' transportation because of the low costs it incurs. It has been also estimated that approximately 90% of world transportation of goods and services between different countries is conducted through sea (Haralambides 2007).

As far as the Greek case is concerned, part of the structural reforms to be planned will be applied to the transport sector, as well as to the port industry. The basic notion behind the reforms should be the facilitation of the trade flows to/from the Greek ports. It must be also referred that the Greek ports haven't yet managed to take advantage of their geographical position, as well as of their proximity to the developing Asian markets. Every policy maker must take the fact that Greek ports must be integrated in the world supply chain into consideration. Thus, the removal or the reduction of NTB's will generate more value added. The importance coming from the reduction of NTB's on trade gains significance in case attention is paid on the following characteristic data:

Table 1: Maritime Economic Indicators for Trade and Transport Flows in Greece, 2011

Indicators	Absolute figures
Gross Domestic Product	292,300,000.000 (in 1000$)
Overall Value of Imports	60,832,154.195 (in 1000$)
Overall Value of Exports	31,711,069.888 (in 1000$)
Gross value added by Trade	263,295,999.497 (in 1000$)
Maritime Transportation of goods	135,470,000.000 (in tons)
Maritime Transportation of passengers	79,183,000.000 (in humans)

Source: Compiled by the author, Data retrieved from Hellenic Statistical Authority (2012)

Furthermore, Greek ports haven't been modernized yet. The need for structural reforms in the Greek port industry is related to a number of problems they enhance. Apart from the lack of investments, most of the Greek ports are also suffering from the lack of adequate infrastructure and haven't implemented a corporate strategy in terms of internationalizing their activities (Thomopoulos 2002). In addition to this, Greek port authorities and the Greek government haven't implemented or at least created a master plan dedicated to the connection of the ports with the global logistics' chain and the traditional trade routes from Asia to Europe.

The following paper aims at investigating the existence and the impacts of NTB's on the Greek port industry, as well as on the Greek economy in general. It will also provide a simulation minimizing the NTB's and quantifying their impacts in terms of GDP growth, non-tariff revenues and trade flows' decreases/increases. The main research questions this research focuses on are provided below.

- ***In which way do the NTB's of the Greek ports affect the micro-economic performance of the overall Greek economy?***

This paper research follows a rather radical approach in terms of quantifying the NTB's. The current analysis examines the impacts of the following NTB's; government intervention in trade, restrictive practices in shipping, technical barriers to trade, transport costs and time costs. Time saving and trade inefficiencies are also listed as critical parameters in this analysis. It is obvious that this assumption is really heroic, but the quantification of the remaining NTB's is really difficult. As a consequence, the research emphasizes on the sub-questions provided below:

- *Which are the NTB's of the Greek economy, especially related to the various Greek ports' trade flows?*
- *In which way will the NTB's be quantified for the ports under examination?*
- *How will the subsidies over the various products be derived and which will be the values given to the subsidies' matrix of GSIM?*
- *Which is going to be the impact of a possible abolition or limitation of NTB's?*

In this way, the given research investigates the existence and the impacts of NTB's in the ports of Piraeus, Thessaloniki, Patras, Heraklion, Volos, Kavala, Igoumenitsa, Alexandroupoli, Agioi Theodoroi and Elefsina. These ports have been chosen as benchmarks due to their geographical position in the Greek periphery. The author

has decided to provide estimations about the imported and exported value of cargo of the following categories; Containers, Ro-Ro, Dry Bulk and Liquid Bulk. Passenger transportation will not be taken into account as the author wants to emphasize on the movement of goods rather than passengers. Passenger transportation is heavily affected by tourism and requires more parameters to be included in our analysis, leading to doubtful results.

Following this step, the author will make use of the GSIM approach by running multiple models for each category of sea transportation. GSIM matrixes' inputs must take exports into consideration. Thus, 4 GSIM Models will be used and the results over the value of imports/exports, the shares of transportation and the gains from reducing the non-tariff barriers will be interpreted. Emphasis must be given on the value of cargo volumes traded to/from the Greek ports during the crisis' years of the Greek economy (2008, 2009, 2010, and 2011). An average approach of the cargo value traded/year is proposed to include how recession has affected trade and transport flows. The sum of the quantified NTB's included above will be calculated as a percentage of the average freight rates.

Last but not least, the forthcoming paper will hold the structure provided below. After the introduction to the topic, the second chapter will provide a solid analysis of the NTB's examined in the research. Consequently, the third chapter will include the multiple GSIM approach and the assumptions provided by the author. On the other hand, the NTB's examined will be quantified in the following chapter through the use of equations provided in the literature. It must be mentioned that calculating the sum of the NTB's in a multimodal transport procedure will be the main challenge of the research.. Before writing the literature list and the appendices, the concluding chapter will analyze the outcomes of the research and will propose more topics for further research. The layout of the research paper's main body has been designed to present and interpret the outcomes of the current research.

2. Identification of Non-Tariff Barriers

2.1. Definitions, Explanations and Overview of the NTB's sub-categories

Liberalization policies are being prevented by the existence of barriers in various sectors of the economy. Since a huge volume of goods is transported from sea, the removal or reduction of NTB's affecting the sea transport of goods can have significant impacts on economic variables related to the macroeconomic stability such as GDP growth, consumption, imports and exports. The current research aims at analyzing the barriers the author perceives as the most important, as well as their footprint to the growth pattern of the Greek economy. However, the purposes of NTB's and their sub-categories must be fully explained in order to familiarize ourselves with their meaning. That's why we examine a definition of non-tariff measures (NTM's) at first.

'Non-tariff measures (NTM's) consist of all measures (apart from tariffs) causing impacts in trade flows and the movement of goods and people from a country to another' (Staiger 2012)

According to the WTO (2006), NTM's are divided in three categories. Such kinds of measures are levied on goods imported or exported from/to a country or region, as well as inside the country/regional economy. NTB's levied on imports or exports are directly applied on the 'entrance points' of the goods in the country. On the contrary, NTM's developed 'behind the entrance points' include taxes, quotas and legislation and are characterized as NTB's. As a fact, NTM's are a broader term than NTB's. The clauses provided below offer us an overview of what is perceived as NTB's.

The current paper uses McCarty (1998) approach to clarify the acts which could be included in the current analysis. According to him, NTB's prevent any trade block from committing itself to trade liberalization. This means that NTB's are becoming deterrent factor in the overall process of exchanging trade flows. McCarty (1998) also makes a generalization claiming that NTB's include both private and public measures causing allocation of goods and services in a way that reduces the world income. As a matter of fact, total welfare is reduced due to their inauguration.

In case NTB's are implemented by the government, they obtain the following important characteristics. First of all, they aim at protecting the domestic industry by motivating the consumers to purchase locally produced goods and services. Since these types of barriers are imposing financial burdens in goods imported, it is obvious that the goods produced domestically maintain a competitive advantage. In addition to this, developed countries use NTB's to support their domestic industry and to let it grow in a highly competitive or internationalized world market. This protectionist policy is focused on newly established industries, which are struggling to establish a solid consumer basis and to increase their growth rates. Furthermore, a particular category of NTB's widely known as technical barriers have been designed to guarantee the safety and the reliability of these products imported.

On the opposite, the implementation of all-these barriers has been blamed for causing serious impacts in the welfare, the social optimum and the competitiveness of the country. Starting with, the NTB's create trade distortions similar to the ones caused by tariffs, taxes and quotas. According to the IMF Report for Greece (2013),

tariffs and NTB's are preventing resources from being allocated between producers and customers. Another issue that can be also taken into account is the fact that protectionism is a common source of trade disputes inside the WTO (Tang 2011). Given the significance of ports as transit hubs, it can be easily referred that non-tariff barriers in the ports could be blamed for various trade distortions and inefficiencies across the whole supply chain.

Due to the limited time of the forthcoming research, the author is obliged to put emphasis on particular topics rather than analyzing the overall impact of all the NTB's to trade in the Greek economy and ports. In general, Greece is suffering from structural economic problems and daring reforms need to be done to achieve macroeconomic stability. The port industry must not be exempted from this general trend. The initial hypothesis the author considers as the most important refers to whether the internationalization of the Greek economy is positively affected by the following NTB's or not:

- Government intervention in seaborne trade
- Restrictive practices in shipping
- Technical Barriers to Trade
- Transport costs (both road and maritime)
- Time inefficiencies

2.2. Government intervention in seaborne trade

2.2.1. Basic concepts, general overview and introduction on interventionism in shipping

Seaborne trade is recognized as one of the most internationalized activities in the world. It can be defined as the 'sea branch' of moving the goods and services from one country to another. Sea routes are more and more becoming promising ways to transport cargo consisting of goods worldwide. Thus, maritime transportation is a really important element of the seaborne trade. However, the governments have the tendency to intervene even in this sector because they tend to believe that the economy doesn't reach the social optimum. Additionally, intervention policies could be targeted to the protection of the interests of particular groups such as the farmers.

Tariffs are considered to be the most characteristic examples of protectionism. However, the GATT (General Agreement on Tariffs and Trade), which has been evolved from the Uruguay Round, has formally reduced or even forbidden the implementation of tariffs on behalf of the contracting parties (Pournarakis 2004). The basic notion behind this agreement is the belief that the liberalization of trade positively affects both importers and exporters. Industrialized countries have managed better results in decreasing the tariffs compared to the developing ones (Pournarakis 2004).

The need for obeying the rules and regulations of the 1994 GATT has created the need for finding new forms of protectionist policies to support the domestic industry (Pournarakis 2004). Given the fact that Greece has signed and ratified the GATT Agreement as a member of the European Economic Community (Ayenagbo et all. 2010), thus being a member of the WTO (Pournarakis 2004), emphasis was given on NTB's. The current research analyzes the practices followed by the Greek government causing an impact on the movement of goods and services through the sea:

- Quotas on Greek products
- Variable Import Levies and Subsidies on Greek products
- Greek taxation system (mainly in shipping companies)

2.2.2. Quotas on Greek products

Quotas can be considered as a means of protecting the national industry of each country. According to Coughlin and Wood (1989), any limitation in the quantity of a product imported at a given time is described under the term ‘quotas’. In this way, the government of a country arranges the quantity of the product which will be imported in the country. Although quotas are not directly related to the domestic maritime industry, the existence of a prosperous and well-equipped port sector affects the capability of the government to apply the rules and regulations related to quotas. In case the transport of goods and services is conducted through sea, customs maintain the responsibility of controlling and checking them.

Quotas have been evaluated as the most effective measure of protectionism (Pournarakis 2004). However, quotas applied in many imported goods can significantly reduce trade and transport flows. For instance, quotas had been implemented in agricultural products domestically produced in France during the 1930’s (Pournarakis 2004). The current analysis considers that the NTB’s (including quotas) cause impacts similar to the implementation of tariffs. Quotas tend to increase the product prices, as the quantities demanded by the customers are significantly reduced (Pournarakis 2004).

Being a member of the World Trade Organization, the European Union and the Tokyo Round means that Greece is enforced to submit to the rules and regulations of all these organizations. Thus, Greece seems to follow a rather liberal approach in these issues. In the past, Greece has established quotas in agricultural products such as grapes and tobacco (Frangiadis 2007). The author believes that any possible implementation of quotas must be done after careful planning, as well as in such a way that will respond to local customers’ and producers’ needs.

2.2.3. Variable Import Levies and Subsidies on Greek products

GATT Regulations and the Uruguay Round are focusing on the liberalization, internationalization and facilitation of trade flows. That's why direct price support mechanisms are formally forbidden according to GATT. On the contrary, countries which have signed the GATT Agreement follow indirect price support mechanisms by providing aid to the producers (Pournarakis 2004). Instead of subsidizing domestically produced goods and services in a direct way, a country can offer technical, financial or price-setting aid to domestic producers. For instance, the country maintains the possibility to intervene in the price-setting mechanism by buying particular quantities of the given product or to facilitate the procedure of loan granting to local producers.

This NTB's have been designed in order to support the importers so as to make their products available to foreign markets of goods. In case of the existence of both tariffs on foreign goods and subsidies on locally produced goods, local producers tend to be motivated to produce huge quantities of products, which are made available to foreign markets. As a consequence, domestic products are becoming more and more competitive even in foreign countries. However, foreign countries also tend to react on these measures by implementing protectionist policies to support their domestic industry. One of the targets of the GATT Agreement is to moderate these type of conflicts between the countries-members of the WTO (General Agreement on Tariffs and Trade 1986).

The most widely known example of variable import levy is considered to be the Common Agricultural Policy. Through the Common Agricultural Policy, the European Union has financed the Greek farmers with billions of euros so as to internationalize their activities (Pournarakis 2004). However, the effectiveness of the Common Agricultural Policy has been questioned for the following reasons. First of all, the European consumers were enforced to finance this program, whereas they were not given the possibility to buy cheaper products imported from countries like the United States. In addition to this, corruption and bureaucracy in Greece affected the absorption of these packages negatively (Frangiadis 2007).

To sum up, it is obvious that goods and services exported through sea are also affected by variable import levies and subsidies. As the tariff revenue from subsidies and levies is imposed on the shipping companies, the ship owners and the logistics' service providers tend to incorporate these tariff revenues in their voyage costs and transfer them to their customers. In this way, these policies create a significant barrier to shipping trade.

2.2.4. Greek taxation system

The Greek taxation system is a really significant factor which contributes to the competitiveness of both Greek and foreign products in the Greek and foreign market. Taxes are generally considered as a really important barrier which creates distortions in the goods' market of a particular country. The current analysis distinguishes the overall taxation system into two categories of taxes levied in the customers; the direct taxes and the indirect taxes. Indirect taxes are incorporated in the price of the final product, whereas direct taxes are levied either in individuals or in corporations.

Due to the complexity of the Greek taxation system, emphasis is given on two types of taxation; the value added tax (VAT) and the tax levied on the shipping companies. Shipping companies are chosen in this analysis because they are intermediaries in the overall procedure of transporting the goods and services from one country to another. As the current analysis examines the impact of NTB's in the imports/exports of Greek ports, the author has decided to apply the Greek tonnage tax regime for shipping, although the Dutch tax regime is harmonized with the EU guidelines (Ernst & Jung 2012). It must be also referred that the Greek tonnage tax regime is also dependent on the age of the ship.

As far as the value added tax is concerned, it must be mentioned that these types of taxes are mainly implemented in the European Union and in Japan. The author considers that indirect taxes such as VAT are being levied to the consumer. The major advantage incurred by the implementation of the VAT is its nature; no allocation of the tax is required as the consumer on the destination country will be the only responsible for paying it (Pournarakis 2004). For the sake of this analysis, the author will however consider that the shippers and the logistics service providers will be forced to pay the costs incurred by the VAT.

2.3. Restrictive practices in shipping

According to the basic economic theory, a world free of barriers is considered as the safest way to maximize the social (both producers and consumers) welfare. However, building such a world or an economic system seems to be impossible nowadays. Following the general trend of the Greek economy, the domestic shipping and maritime industry is also characterized by the existence of restrictive practices. It must be referred that each one of the restrictive practices consists of a special case on its own and must be separately examined. The current analysis distinguishes these restrictive practices into two large categories; maritime employment and safety-environmental standards.

As far as the environmental standards are concerned, the governments and the ports are offering incentives to the shipping companies to improve their 'green profile'. Although it seems that these standards could not be categorized as restrictive practices, the existing Greek port authorities might force them to shift towards 'green shipping' in the future. For the time being however, it is doubtful whether the Greek ports have applied an environmentally friendly strategy or not. These strategies may also include reduced port fares for ships generating less CO_2 emissions, handling 'dangerous' cargo carefully and cold ironing. The Greek Ministry of Shipping and the existing port authorities also maintain the responsibility of controlling and implementing the safety standards as described in the certificates of registration, seaworthiness etc.

However, the author believes that the most significant restriction practices are applied in the maritime employment field. The cruise industry is considered as a significant source of income for the Greek shipping industry and the economy in general. Diakomichalis (2009) has estimated that the revenues of the cruise industry consist the 2% of the Greek GDP. The cabotage regime is a characteristic type of protectionist policy, being implemented by national governments in order to support and protect the domestic industry and labor market of seafarers (Stefanidaki and Lekakou 2012). Although cruise tourism is not discussed in this analysis, it still remains a really important barrier to trade. According to the law makers, the deregulation policy and the abolition of cabotage had been designed in 2010 in order to increase the cruise traffic in Greek ports and to reduce the cruise services' price (Stefanidaki and Lekakou 2012).

It is obvious that the cabotage practice can be also put in a more general framework including the existence of labor practices in the overall maritime industry. These practices are defined by an agreement signed between the Seafarers' Union and the Ship owners' Union every year. This agreement *de jure* affects the seafarers' wage and their working hours. For instance, Spanish seafarers gain a 25% increase on their wage in case of job outside normal hours (Harding 1990). The term and the definition of 'normal hours' are discussed in the Agreement signed between the Seafarers' and the Ship owners' Union. Based on the research carried by Harding (1990), well-known examples of restrictive practices are the following: limitations on entry (for dock workers), job demarcation, restrictive hours, and restrictions on output and work sharing.

2.4. Technical Barriers to Trade

In addition to taxes, quotas, subsidies or restrictive practices, state interventionism in shipping also takes the form of establishing technical barriers to trade. These policy measures are levied during the process of carriage of goods through sea. Technical Barriers to Trade have been designed to achieve and formulate strategies related to improve the quality of the products imported/exported, to guarantee the consumer's safety or to take measures aiming at protecting the environment. Given the fact that approximately the 80% of the goods moved to/from the European Union are handled in European ports (Van Elswijk 2012), it can be easily referred that these technical barriers to trade are applied from the pertinent services of the Greek ports (e.g. customs):

Technical Barriers to Trade are defined as all the procedures generated abroad to control whether products imported/exported conform to standards and technical regulations (Kirk 2011)

According to the European Commission (2010), the free movement of the goods can be limited or even prevented by a number of "active" or "passive" measures. Based on the findings provided by the European Commission Report (2010), the current report includes the following measures; *National Reclamations such as Import Permissions and System of Control, Price Control, Obligation of the Importer to Provide Storage facilities, Security Standards, Technical Regulations, Limitations in Advertising, Geographical Indications and Quality Labels, Limitations on Imports of Goods for Personal use, Limitations on Distance Sales, Obligation to use the National Language in the front size of the packages etc.* However, the evolution of the technological progress and relevant decisions of the European Courts have significantly reduced the range of application of the majority of the measures referred above (European Commission 2010). Thus, the current analysis considers that the following technical barriers to trade are still in force in both the European Union and Greece:

- National Reclamations such as Import Permissions and System of Control
- Security Standards
- Technical Regulations
- Geographical Indications and Quality Labels
- Obligation to use the National Language in the front size of the packages

Price control measures continue to exist and be applied until today, although their range of application is limited due to its protectionist nature. They are usually taking the form of implementing maximum or minimum prices or profit margins (European Commission 2010). It must be also referred that the research considers that these price and quality control measures are firstly implemented in ports and terminals, as they are hubs of the global supply chain. Ports' authorities maintain the responsibility of applying these strategies in practice.

2.5. Transport Costs

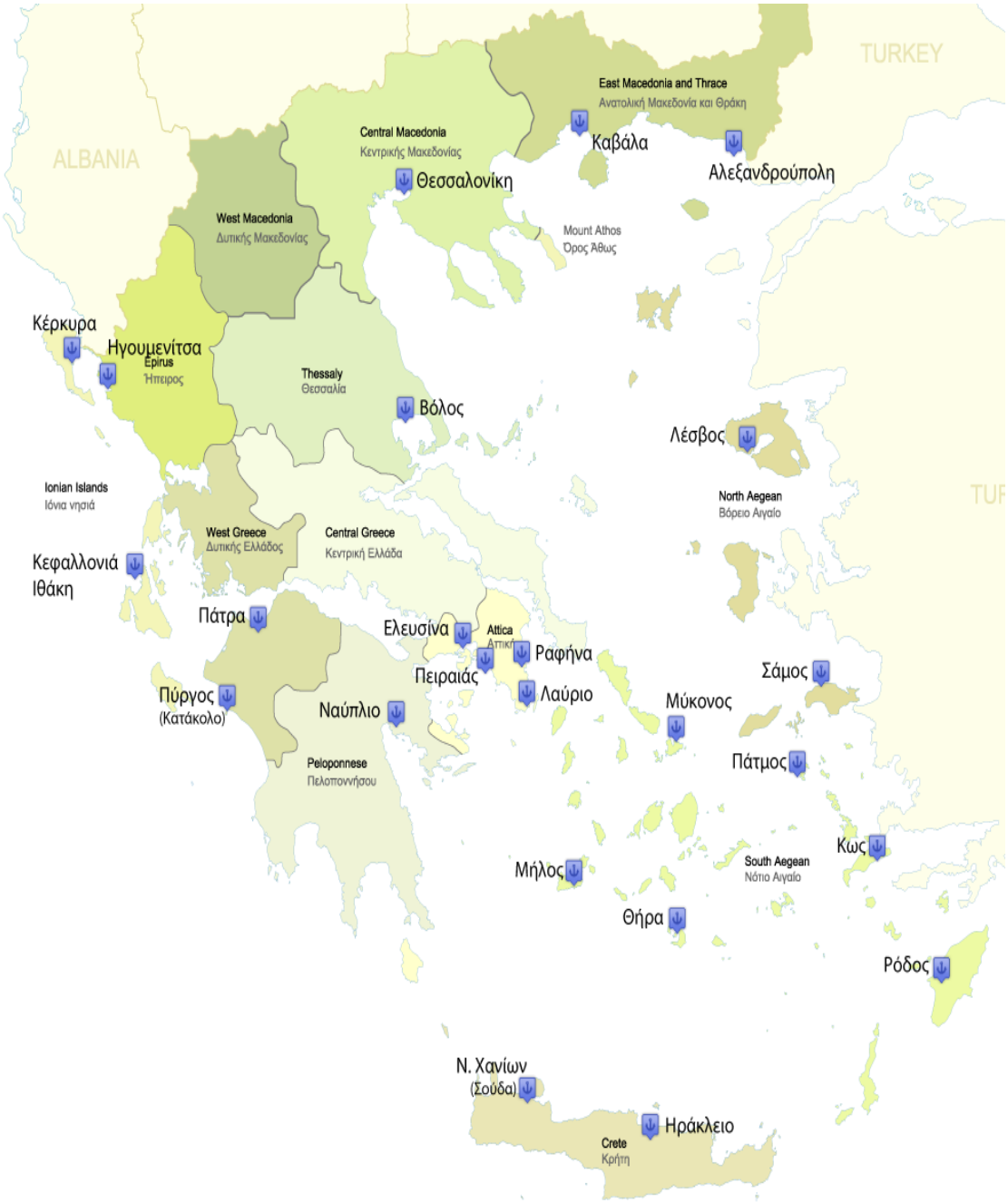
The free movement of the goods and services can be considered as a consequence of the liberalization of trade. The European Union is particularly interested in creating a free-zone market including its members so as to increase the trade and transport flows among them. Furthermore, the increase of the movement of goods transported from other continents to the European Union is also a matter of priority. Due to its geographical position, it is obvious that Greece can become a transit hub by connecting producers with customers. In this way, transportation can generate value added and maintain its significance for moving goods and passengers inside Greece, as well as from Greece to the neighboring countries.

It is obvious that transportation as a mode is not considered as a NTB. In reality, it is nothing more than a simple human activity designed to carry goods, services and passengers. In addition to this, the transportation activity is a crucial element of the supply chain integration and logistics. However, apart from generating value added, transportation costs create a barrier for every importer/exporter. No matter which the transportation mode used to carry the goods is, the logistics service providers tend to pass the costs incurred in the final customers' price. According to Haralambides (2007), transportation costs have significantly decreased during the 20th century.

The current research distinguishes the different modes of transport used to carry goods; sea transport, road transport, rail transport and barge transport. Barge transport is not included in the current analysis as it is doubtful whether huge amounts of goods or services are transported through the Greek rivers. That's why the current research pays attention in the remaining three modes of transport; sea transport, road transport and rail transport. Emphasis is also given on the concept of intermodality i.e. the development of rail-road transport corridors, as well as of the SSS (short-sea shipping) (Kapros and Panou 2007).

To begin with, the first element of the transport costs as a barrier incurred is considered to be the maritime transport costs. Maritime transport costs are extracted during the journey from the port of origin to the port of destination. In theory, the shippers and the logistics service providers can move the goods to the customers or to the ports through short-sea shipping, rail or road transportation modes after the arrival or before the departure of the goods in the Greek ports. However, road transportation by truck seems to be the most cost-efficient for distances smaller than 500 km inside the EU (Van Elswijk 2012). Furthermore, the 98% of the cargo handled from Greek ports is transported in its final destination by trucks (Van Elswijk 2012). These facts referred above force us to conclude that road transportation is preferred to transport the goods and services from the ports-gateways to the customers. The maps provided below offer us an overview of the geographical position of the Greek ports and their hinterland.

Figure 1: Map of the geographical position of the largest Greek ports



Source: ELIME (2013)

Figure 2: Map of the Possible Hinterland of the Greek ports

Source: Ypourgeio Naftilias (2012b)

During the current analysis, another important detail must be taken into consideration. In contrast to inter-modal and multi-modal approaches, door-to-door supply chain approaches and JIT (just-in-time) inventory models will not be examined at this model. It must be however referred that the carriage of the goods through trucks generates costs, which are defined under the general term 'freight costs'. The freight costs consist of all the costs incurred during packing, palletizing, loading/unloading, freight insurance and carriage of goods, thus being associated with the physical movements of goods (Anderson and Van Wincoop 2004). In this case, the author is focusing on the truck transportation via the Greek road network from the ports to the customers.

As far as the transportation of goods between different countries (from Greece to importing countries or from exporting countries to Greece) is concerned, a number of barriers are generated. More specifically, these barriers are associated with the policy applied, differences in language and in currency, as well as asymmetries in information sharing and transactions. In addition to this, the transportation costs also include costs generated by the distribution of the goods in both retailers and customers. Based on the facts provided above and the multi-modal approach, the author pays attention on the following categories of transport costs:

- Ocean and Maritime Transportation Costs (related to long-sea ship transport)
- Road Transportation Costs (related to road carriage of the goods)
- Transaction, Retail and Distribution Costs incurred by barriers like asymmetric information etc.

The movement of the goods and services in the Greek periphery is expected to be also facilitated by future investments in the road and rail infrastructure. These investments aim at upgrading the current rail, road and short-sea shipping connections with the customers' needs and integrating them with the Trans-European Network. The development of the rail infrastructure connecting all the Greek ports is also a matter of crucial importance. Given the fact that rail transport is environmentally friendlier than the road one, it can be referred that the government must seek a more balanced approach in transporting goods handled from/to Greek ports. As a matter of fact, emphasis must be given on facilitating the rail transport among the Greek ports.

To sum up, the costs incurred in the transport sector could be considered as a significant barrier, because their existence will reduce the possibilities for optimizing the supply chain. Given the inter-modality approach, the reduction of these costs will bring the products closer to the customers. As a consequence, a balanced approach must connect the ports with the existing transport (rail, road etc.) infrastructure of the country resulting to the unification of the market.

2.6. Time inefficiencies and their identification as a trade barrier

Time costs as a non-tariff barrier cannot be determined unless the definitions of supply chain and logistics are provided. Understanding the basic concepts of logistics and supply chain management will also help us to understand why time is such an important factor in the overall procedure of trade internationalization. As the process towards trade internationalization is going on, it is obvious that the importance of costs generated by time inefficiencies is also increasing. Given the fact that internationalization is connected with bringing the products from producers to customers at the right time, Chopra and Meindl (2013) pay significance to the satisfaction of the customers' needs. That's why producers and customers must come closer in order to respond to the needs of each other. This overall procedure is summarized at the basic meaning of Logistics.

Supply Chain Management is called the coordination of all the parties involved in satisfying the customer's requests and orders in a direct or indirect manner (Chopra and Meindl 2013).

According to Chopra and Meindl (2013), the global supply chain consists of suppliers, manufacturers, distributors, retailers and customers. Based on the definitions provided above, it is obvious that the optimization of supply chain and the coordination of these parties is a crucial factor for matching the international production with the customer's needs and orders. Various techniques like JIT (just-in-time) production have been evolved nowadays to move the goods and services produced closer to the customers. Thus, one of the targets of the optimization of the supply chain must be the minimization of the period of time needed to move the goods to the customers, which results to significant costs. For the purposes of this research, these costs will be defined under the term 'time costs'.

During that research, emphasis is given on the factors that may affect time costs. To start up with, a main cause for inefficiencies is the existence of inadequate infrastructure in Greek ports. Unfortunately, the lack of storage places and quay cranes or the small number of electric vehicles and AGV's (Automated Guided Vehicles) can result to inefficiencies in handling during the loading/unloading process. Specifically, aged and inadequate equipment in Greek ports has led to increased waiting times in the docks. During this period of time, goods are maintained inside the ships as there is not enough space for storage. As a matter of fact, the initial target of coordination between the members of the global supply chain is not achieved and goods may be delivered in bad condition by the customers.

Despite the importance of the Greek port industry, we can also observe that the lack of adequate infrastructure is mainly caused by the lack of investment. Specifically investments in port infrastructure are a very small percentage of the overall investments made in transport infrastructure (European Commission 2012). In general, improvements in the quality of infrastructure have been made for the ports of Piraeus and Thessaloniki. The smaller peripheral ports are struggling to upgrade the quality of the services offered to the customers without being adequately funded by the state. Apart from the ports included in the TEN-T project (Piraeus, Thessaloniki, Patras, Igoumenitsa), the rest of the Greek ports have not managed to

develop intermodal transport with railway or the road transport (European Commission 2012).

It is also worth referring that these inefficiency problems are not limited in the smaller Greek ports. Issues have been mentioned in the largest Greek ports of Piraeus, Thessaloniki, Patras and Igoumenitsa, which are included in the European Union's TEN-T project (European Commission 2012). Some examples of the biggest problems to be referred are the following; the ports of Patras and Igoumenitsa own inadequate infrastructure, whereas road and rail access to the port of Piraeus is limited (Lioukas 1995). These problems can lead to increased congestion road and rail congestion. Given their significance as gateways in the mainland Greece, we can summarize that the lack of inadequate infrastructure constitutes a barrier in transit trade.

On the other hand, the customs are evaluated as another common source of inefficiencies in maritime transport. Despite the overall liberalization process in the developed countries, customs are still responsible for the implementation and collection of revenues generated by taxes and import quotas in the least developed countries (Widdowson 2011). On the contrary, the developed countries put emphasis on border and on customers' protection. The customs' authorities have embraced a shift to control the quality requirements of the products imported/exported, to prohibit the entrance of forbidden substances into the countries, as well as to enforce the compliance with the property laws (Widdowson 2011).

The Greek customs are also facing a lot of challenges in handling goods delivered at an international level. Despite being a developed country, Greece has not managed to modernize the services provided by customs. Like the overall equipment in Greek ports, custom's equipment has not been modernized, thus being characterized by the lack of automation technology. Furthermore, the customs in the Greek ports have not paid attention to issues related to bureaucracy and excessive use of documentation. This complexity of the overall system in the customs can hamper international trade and increase the waiting time of vehicles, trucks and ships carrying goods.

As the facilitation of trade takes place under the scope of the minimization of goods' waiting time required in the customs, the overall process of trade in the ports need to be simplified. However, the terrorist attacks have challenged the capability of the developed countries to apply security standards in the goods imported or exported to protect customers. For instance, container scanning has evolved as an effective technique which guarantees container controlling and checking before moving it to warehouses. It must be though referred that these techniques incur significant costs of installation and implementation, whereas it can be also proved out to be a cause for creating huge waiting queues.

To sum up, the following analysis divides time costs into the following categories; the maritime costs when carrying the goods from one port to the other and the costs of congestion in front of the docks and the customs. Thus, the time costs will be calculated at an aggregate level.

3. The Data and the Model

3.1. Description of the Global Simulation Model (GSIM)

Before starting the overall research process, the author was obliged to find out the best method for quantifying the impacts of non-tariff barriers to trade in the Greek trade flows. The methodology followed must be fully coordinated with the research question of the paper. As a matter of fact, the optimization of the trade policy to be followed in the future cannot be achieved without the definition of changes in the values of the tariff barriers:

In which way do the non-tariff barriers of the Greek ports affect the micro-economic performance of the overall Greek economy?

Generally speaking, trade flows consist of imports, exports, re-imports and re-exports. The current analysis doesn't distinguish itself the value of imports with the value of re-imports, as well as the value of exports with the value of re-exports. However, the author uses exports as a significant indicator of the micro-economic performance of the Greek economy, being also a good way to measure the performance of the Greek maritime industry. Given the fact that the reduction of a trade deficit or even better, the creation of a trade surplus is a matter of top priority for the Greek government, it can be easily referred that the increase of the net value of the cargo exported of Greek ports seems to be a necessity.

As a matter of fact, the main research question will be particularly answered through the use of the GSIM model, as developed by Francois and Hull (2003). The GSIM model attempts to quantify the trade policy changes through the use of a partial equilibrium approach. Specifically, the GSIM model provides us the changes in producer surplus, consumer surplus and tariff revenue as outputs. The overall process of the policy changes in NTB's is translated into values, which are assigned as inputs in the Excel Sheet of GSIM. It is obvious that these policy changes must be oriented to pro-competition reforms, which will allow the country to improve the exogenous characteristics of the Greek port sector.

In general, the GSIM model consists of four matrices. The value of the trade flows of the Greek ports will be assigned in the first matrix, whereas the forthcoming two matrices will include the tariff equivalents of the non-tariff barriers. In addition to this, the elasticities and the subsidies extracted from the current research will be introduced in the last matrices. As far as the exports are concerned, the y-axis and the x-axis will include the points of origin and destination in each one of the first three matrices, respectively. It must be however referred that it may be difficult to assign value for the variable incurred in the given analysis as ROGP (Rest of the Greek Ports). More specifically, the lack of data could prevent the author from extracting reliable outcomes for these ports.

Since this research aims at analyzing the exogenous characteristics of the Greek port sector and economy, the author is forced to use one more variable to fully explain the reaction of the global trade to the liberalization attempts of the Greek economy and maritime industry. This variable is also called ROW (Rest of the World) and describes the difference between the world exports carried from the

maritime sector and the Greek ones. Due to the complexity of a dynamic approach, this survey emphasizes on a rather static one. This means that the existing survey doesn't pay attention to the liberalization scenarios of the ROW countries. The ROW variables are only affected by the standardization of technical barriers to trade. In order to facilitate this analysis, the author assumes an initial 50% tariff-equivalent of the NTB's for the ROW variable.

The given GSIM will be conducted at two steps. First of all, the author will include the reduction of NTB's on his analysis by keeping the subsidies 'tariff-equivalent' constant and equal to 1. During this analysis, the amounts referring to the tariff revenue of the NTB's will not be taken into consideration. Consequently, a new GSIM approach will be conducted, including the possible change of the subsidies 'tariff-equivalent' and keeping the NTB's constant. The outcomes of the two GSIM matrices will be aggregated to provide a combined approach.

In addition to this, the author considers 12 points as transit hubs of goods, whereas goods are exported to each one of the 5 continents of Earth. These 12 points are referring to the 10 major Greek ports (Piraeus, Thessaloniki, Patras, Heraklion, Volos, Igoumenitsa, Kavala, Alexandroupoli, Elefsina and Agioi Theodoroi) + the ROGP and the ROW. The ROGP (Rest of the Greek Ports) describes the value of the exports conducted by the remaining Greek ports. As the initial and simplest form of the model is applied at a scale of 25*25, it is obvious that this form is appropriate for assigning and examining all the given data. Given the fact that the four categories of cargo (Container, Dry Bulk, Liquid Bulk, Ro-Ro) will be taken into account, it can be easily referred that the current research requires the use of 4 GSIM simulations.

Last but not least, the outcomes provided by GSIM are emphasizing on the following fields; the growth in the export value from each one of the ports, the welfare effect (consumer surplus, producer surplus, subsidies' revenue and tariff revenue) and the trade values' and quantities' change. According to these outcomes, a new policy needs to be proposed.

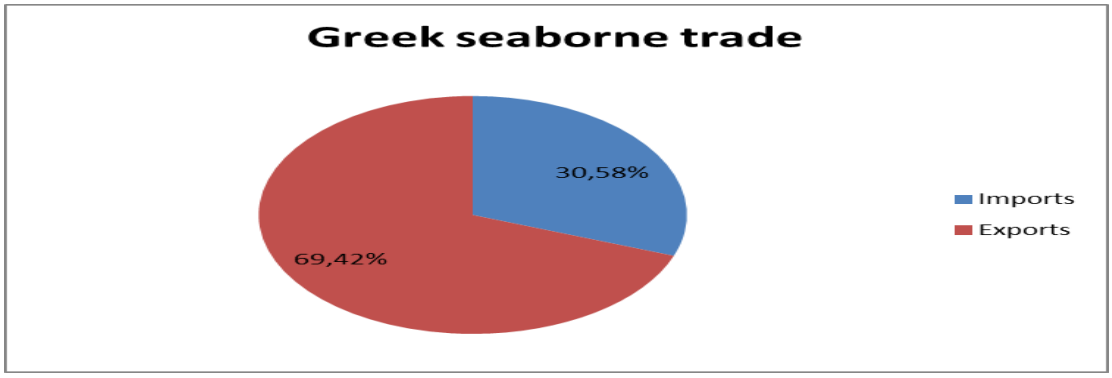
3.2. Assumptions

3.2.1. Assumptions on the value of cargo flows

The current research has been based on a number of assumptions. They have been used them in order to facilitate the overall research procedure, as it is obvious that all the necessary data cannot be extracted from the databases available either on the Internet or in other sources. In addition to this, time limitation forces the author to make a lot of simplifications to develop the necessary framework required to run the GSIM model.

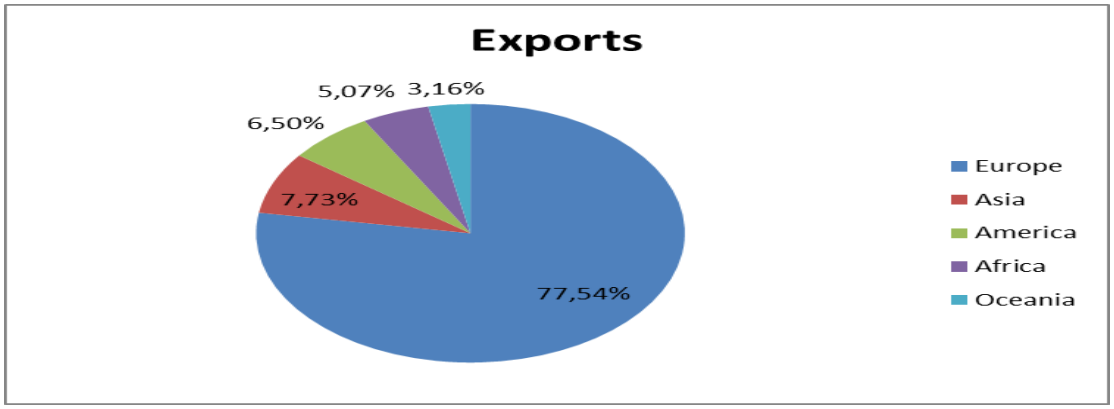
To begin with, the current research focuses on the trade flows handled through the Greek ports. The majority of the countries traded with Greece are members of the World Trade Organization (WTO), whereas they have also signed the 1986 GATT agreement. However, the countries examined in this analysis have established a different approach in terms of non-tariff barriers. Multiple products are exchanged in these trade flows and, as a result, it is necessary to establish an average approach to calculate, quantify and estimate the barriers and the trade flows. Since the period of the crisis' years (2008-2011) is analytically examined, the dependent variables' values used in this analysis are calculated as the average value of the variables for each one of the years' examined (2008, 2009, 2010, and 2011). In case the ports' databases don't provide data for the given period, the examination of the period 2007-2010 is the 'second-best' alternative option. The graphs provided below offer us an indication of the allocation of Greek seaborne trade per type (imports/exports), as well as per place of origin/destination (Europe, Asia, America, Africa, and Oceania). In case no data are provided for this allocation, the author uses this average to facilitate his research.

Figure 3: Allocation of Greek seaborne trade



Source: Compiled by the Author, Data retrieved from the Hellenic Statistical Authority (2011 and 2012)

Figure 4: Allocation of exports per continent of destination



Source: Compiled by the Author, Data retrieved from the Hellenic Statistical Authority (2011 and 2012)

Last but not least, the author assumes that the definition of the value of container cargo is conducted via a simple equation. It must be referred that the author has also simplified the current analysis by assuming that the value of the cargo loaded/unloaded is exactly the same in the both the ports of origin and destination.

$$(3.2.1) VCV = QCV * TP$$

Where:

VCV: Value of Cargo Volumes

QCV: Quantity of Cargo Volumes

TP: Price/ton

As a matter of fact, the facilitation of the current analysis forced the author to aggregate the medium values of the products carried by a 40ft container and take the general average. The general average of the typical product carried by a container was achieved through the use of Rodrigue (2013). In any case the author was forced to divide the overall value carried through a container with the net weight tonnage of the 40 ft. container so as to find out the value of 1 ton of container cargo handled. As far as dry bulk and liquid bulk cargo is concerned, the author uses the price of oil (about US$ 150/barrel) and the price of iron ore (about US$ 180/ton) in 2008 as a benchmark of the relevant cargo loaded/unloaded in Greek ports just before the beginning of the crisis (Index Mundi 2013). Due to the different types of vehicles carried in Ro-Ro, the 'average' type of vehicle carried via a Ro-Ro is a US$ 15,000 car, which weighs 1.5 tons. As a matter of fact, the table provided below indicates us the average values of categories of cargo per ton.

Table 2: Average value of cargo handled in world ports

	Container	Liquid Bulk	Dry Bulk	Ro-Ro
Value of 1 ton	US$ 500	US$ 150	US$ 180	US$ 1,000

Source: Compiled by the author

3.2.2. Assumptions on the calculation of transport and time costs

The estimation of transport and time costs can be considered as a really difficult process because it takes a lot of different parameters into consideration. Using the equations provided in chapter 3 means that a lot of assumptions must be made before estimation.

First of all, the calculation of the distance among the examined ports, as well as of the days of journey is also a matter of crucial significance. It can be easily referred that both the distances and the sea journey days will be useful tools in estimating the freight rates, the transport costs and the time costs. On the other hand, the distances and the sea journey days are affected by the technical characteristics of the ships used in the current model. As a consequence, the identical type of the ship used is a Handy size vessel or a bulk/Ro-Ro vessel of a similar size, deadweight (15,000 tons) and average speed (14 knots/hour). The tables provided below offer us an overview of the distances and the journey days of the ships travelling from the Greek ports to the foreign ones and vice versa.

Table 3: Distances among Greek and foreign ports in km

	Europe	Asia	America	Africa	Oceania
Piraeus	4,590.14	13,960.58	12,395.34	6,729.86	15,369.58
Thessaloniki	4,933.07	14,215.89	12,788.24	8,003.27	15,624.83
Patras	4,360.88	14,239.18	12,090.38	7,882.39	15,648.21
Heraklion	4,610.50	13,673.49	12,399.01	6,663.56	15,082.53
Volos	4,828.08	12,901.32	12,374.24	7,889.27	15,510.83
Kavala	4,904.98	14,198.72	12,771.14	7,986.18	15,607.73
Igoumenitsa	4,291.96	14,359.83	12,000.24	7,960.88	15,768.85
Alexandroupoli	4,849.48	14,074.72	12,647.17	7,862.20	15,483.75
Elefsina	4,586.98	13,912.40	12,393.98	7,717.67	15,366.43
Agioi Theodoroi	4,584.73	13,955.20	12,391.64	7,715.44	15,364.16
ROGP	4,654.07	13,949.13	12,425.14	7,641.07	15,482.69

Source: Compiled by the author, Data retrieved from Sea Rates (2013)

Table 4: Average Days of travelling for every ship arriving at the Greek ports

	Europe	Asia	America	Africa	Oceania
Piraeus	16.08	37.43	34.92	24.51	39.71
Thessaloniki	17.13	37.85	35.55	24.98	40.11
Patras	15.41	37.89	34.83	24.76	40.15
Heraklion	16.11	36.97	34.92	21.25	39.24
Volos	16.96	37.66	35.37	24.78	39.93
Kavala	17.09	37.82	35.52	24.93	40.08
Igoumenitsa	14.70	38.07	34.32	24.89	40.34
Alexandroupoli	17.00	37.63	35.33	24.73	39.88
Elefsina	16.08	37.45	34.92	24.51	39.70
Agioi Theodoroi	16.07	37.43	34.92	24.50	39.69
ROGP	16.26	37.62	35.06	24.38	39.88

Source: Compiled by the author, Data retrieved from Sea Rates (2013)

Again, both the distances and sea journey days were extracted by following a simple average approach. This average approach is based on the assumption that the vast majority of the cargo traffic in the Greek ports will be transported in the following ports in each one of the five continents. Thus, the distances and the days of sea are provided on the forthcoming table.

Table 5: Ports of connection with Greece

Europe	Asia	America	Africa	Oceania
Rotterdam	Shanghai	South Louisiana	Richards Bay	Port Hedland
Antwerp	Singapore	Houston	Durban	Dampier
Hamburg	Guangzhou	New York	Mombasa	Newcastle
Amsterdam	Nigbo	Tubarao	Dar Es Salaam	Hay Point
Marseille	Tianjin	Itaqui	Port of Beira	Gladstone
Novorossiysk	Qingdao	Vancouver	Djibouti	Melbourne
Primorsk	Qinhuangdao	Huntington	Suez Canal	Auckland
Le Havre	Hong Kong	Long Beach	Lagos	Adelaide
Bremerhaven	Busan	Santos	Walvis Bay	Fremantle
Algeciras	Shenzhen	Beaumont	Cape Town	Sydney

Source: Compiled by the author

Furthermore, it must be referred that every single economic factor of the maritime sector acts on a fully globalized environment. Although no assumption that the shippers, the ports and the employees are parts of a fully competitive market is made in this research, it must be referred that the overall target of the majority of the governments is to minimize the economic impacts of the barriers examined so as to integrate the ports as parts of the global supply chain. This assumption is necessary as the various trade flows (mainly exports) handled in the Greek ports consist an important component of this analysis. The calculation of transport costs takes the possibility of existence of alliances and conferences into consideration. For the sake of the current analysis, the spot rates are defined by the basic mechanisms of supply and demand. However, the competition authorities of Greece, the European Union and the rest of the developed countries allow the existence of price-fixing agreements (PFRA=1). On the contrary, the cooperation among the shippers is not permitted, especially on technology and know-how issues (CA=0).

Another proxy that needs to be taken into account refers to the level of containerization. Although the level of containerization differs from one country to the other, the author assumes that the level of containerization is about 60% per average. It is obvious that this assumption is really heroic, as there are different levels of containerization in the major shipping route. Furthermore, the port efficiency of the Greek ports is also recognized as another determinant of maritime transport costs. In order to find out the port efficiency indexes, the author has generated an average approach based on the existing data for the forthcoming countries importing goods from Greek ports. These countries have been classified into the 5 continents acting as points of destination for the cargo exported from the Greek ports. The table provided below offer us an overview of the average port efficiency rates of these 5 continents per average.

Table 6: Port efficiency Rates

	Port efficiency rates
Greece	4.28
Europe	4.29
Asia	3.94
America	4.63
Africa	2.78
Oceania	5.31

Source: Compiled by the author, Data retrieved from Clark et al. (2001)

Last but not least, the time costs, especially those referred to congestion, require the existence of a few more assumptions. Due to the integration in the TEN-T network, the ports of Piraeus, Thessaloniki, Patras and Igoumenitsa aim at increasing their infrastructure. This increase causes impacts similar to the increase of the container scanners from 1 to 2. On the other hand, maritime transport time costs of carrying 1ton of cargo are defined by the interest rate and the depreciation rate. In both scenarios, the depreciation rate during transit procedures remain at the same level (3%), whereas the author assumes that the interest rate declines from a global average of 3% to a global average of 2%, maybe because of the world economic crisis.

3.2.3. Assumptions on the calculation of freight rates, technical barriers to trade and elasticities

The freight rates of the container cargo have been also estimated through the use of the World Freight Rates (2013) However, this website includes particular information for the container cargo handled in the ports of Piraeus (Drapetsona Bay), Thessaloniki, Patras, Volos, Elefsina and Agioi Theodoroi. The author assumes that the freight rates for container cargo handled in the ports of Heraklion, Kavala, and Igoumenitsa etc. take the average values of the freight rates required to handle the containers of the rest ports. Additionally, the author uses a benchmark port for every continent to calculate a representative freight rate for the cargo imported and exported to/from the Greek ports; Rotterdam for Europe, Port of South Louisiana for America, Shanghai for Asia, Richards Bay for Africa and Sydney for Oceania. Given the fact that a wide range of products are carried by containers, the author uses agricultural products' carriage as a benchmark for defining the freight rates.

Road vessels are carried on sea as two types of cargo; Containers and Ro-Ro. However, Ro-Ro vessels appear the advantage of obtaining specially shaped places and platforms for loading and disembarking vessels. Thus the cost of carrying vessels from one port to another via Ro-Ro vessels is smaller compared to the carriage through Containers (Universal Cargo, 2013). It must be however referred that the exact calculation of Ro-Ro freight rates faces two major disadvantages. First of all, the freight rates are calculated on the basis of units (vessels), whereas data of the Greek ports referring to Ro-Ro cargo are provided in metric tons. Secondly, there are many categories of vessels of different sizes transported through vessels and it is not easy to extract the representative vessel type so as to identify the average vessel rate. Thus, the author assumes that carrying cargo in Ro-Ro vessels is 20% cheaper than carrying cargo in containers.

As far as the transportation through bulk carriers is concerned, the average daily freight spots for carrying a particular quantity of cargo in the period 2008-2011 is US$ 21,500 (RS Platou, 2012). Given the average days of journey from the port of origin to the port of destination, the overall average freight rates for an identical ship can be easily calculated. Including insurance costs and crew members' costs, the average freight rates can be increased by 40% (Freight Insurance Center, 2013). As a consequence, the table provided below offers an overview of the freight rates for the following categories of cargo: Container, Dry and Liquid Bulk and Ro-Ro.

Table 7: Freight rates for container exports of 1 ton of cargo from Greek ports

	Europe	Asia	America	Africa	Oceania
Piraeus	55,15648	54,21296	177,7792	188,7963	107,6083
Thessaloniki	59,07639	58,13241	181,6991	192,7157	111,5329
Patras	55,32731	54,38333	177,95	188,9667	107,7838
Heraklion	56,30694	55,36343	178,9296	189,9468	108,763
Volos	57,79815	56,85463	180,4208	191,438	110,2551
Igoumenitsa	56,30694	55,36343	178,9296	189,9468	108,763
Kavala	56,30694	55,36343	178,9296	189,9468	108,763
Alexandroupoli	56,30694	55,36343	178,9296	189,9468	108,763
Elefsina	55,4125	54,46852	178,0352	189,0519	107,869
Agioi Theodoroi	55,0713	54,12778	177,694	188,7111	107,5282
ROGP	56,30694	55,36343	178,9296	189,9468	108,763

Source: Compiled by the author, Data retrieved from Sea Rates (2013)

Table 8: Freight rates for Dry/Liquid Bulk exports of 1 ton of cargo from Greek ports

	Europe	Asia	America	Africa	Oceania
Piraeus	32,2672	75,11555	70,06678	49,18942	79,6747
Thessaloniki	34,36617	75,94832	71,32897	50,13255	80,48339
Patras	30,9127	76,03059	69,89019	49,68105	80,55763
Heraklion	32,32539	74,19048	70,07481	42,63163	78,74361
Volos	34,02504	75,56906	70,97781	49,7252	80,11617
Igoumenitsa	34,28992	75,89414	71,28483	50,03423	80,42118
Kavala	29,50001	76,39581	68,87081	49,94593	80,95094
Alexandroupoli	34,10932	75,51488	70,90356	49,62487	80,02386
Elefsina	32,2672	75,14164	70,06678	49,17738	79,66667
Agioi Theodoroi	32,24914	75,10753	70,06678	49,15531	79,64259
ROGP	32,63121	75,4908	70,35313	48,92976	80,02807

Source: Compiled by the author, Data retrieved from RS Platou (2012)

Table 9: Freight rates for Ro-Ro exports of 1 ton of cargo from Greek ports

	Europe	Asia	America	Africa	Oceania
Piraeus	44,12519	43,37037	142,2233	151,037	86,08667
Thessaloniki	47,26111	46,50593	145,3593	154,1726	89,2263
Patras	44,26185	43,50667	142,36	151,1733	86,22704
Heraklion	45,04556	44,29074	143,1437	151,9574	87,01037
Volos	46,23852	45,4837	144,3367	153,1504	88,20407
Igoumenitsa	45,04556	44,29074	143,1437	151,9574	87,01037
Kavala	45,04556	44,29074	143,1437	151,9574	87,01037
Alexandroupoli	45,04556	44,29074	143,1437	151,9574	87,01037
Elefsina	44,33	43,57481	142,4281	151,2415	86,29519
Agioi Theodoroi	44,05704	43,30222	142,1552	150,9689	86,02259
ROGP	45,04556	44,29074	143,1437	151,9574	87,01037

Source: Compiled by the author

In terms of technical barriers to trade, the assumption that the countries will be members of the World Trade Organization (WTO) makes the prediction that the technical barriers to trade will be standardized in the forthcoming years even more realistic and relevant to the topic. On the other side, the effects of government intervention in seaborne trade are limited to the effects caused by the financial burden levied by the taxation system, as well as to the effects caused by the existence of subsidies. Maritime employment and restrictive practices in shipping are also examined as restrictive practices in shipping.

The last assumption to be made in the current research refers to the value of the elasticities. The elasticities play a really important role on the overall GSIM, and that's the reason why the model is really sensitive to fluctuations and changes on tariff-equivalents (Francois and Hull 2003). The table provided below summarizes the author's assumptions on elasticities, which are common for all the different categories of cargo.

Table 10: Elasticities

	Europe	Asia	America	Africa	Oceania
Composite Demand	-0.80	-0.50	-0.60	-0.30	-0.70
Industry Supply	1,5	1,5	1,5	1,5	1,5
Substitution	10	10	10	10	10

Source: Compiled by the author

3.3. Methodology, NTB's equivalent and Description of scenarios

Based on the GSIM, the author must quantify the tariff-equivalent of NTB's during the period 2008-2011, the tariff equivalents after the reduction of NTB's and the tariff-equivalent of subsidies. The GSIM model has been designed to provide the outputs generated globally under the constraint of the differences between the tariff-equivalents of NTB's before and after reduction, the subsidies and the elasticities provided as inputs. The current methodological approach requires the following prepositions so as to provide the outcomes needed for the research. As the elasticities have been already provided by an assumption above, emphasis must be given on the rest determining inputs of GSIM.

In the current research, the overall procedure of the GSIM requires some kinds of hypothesis testing. Although the main research question is a quite straightforward one, being adjusted to the outputs of the GSIM matrixes. However, the author believes that hypothesis testing adjusted to the growth rates of the throughput value of the Greek ports. Since our initial hypothesis is based on the belief that the reduction of NTB's will have positive effects on Greek seaborne trade, the hypothesis tests to be conducted on the current research are the following:

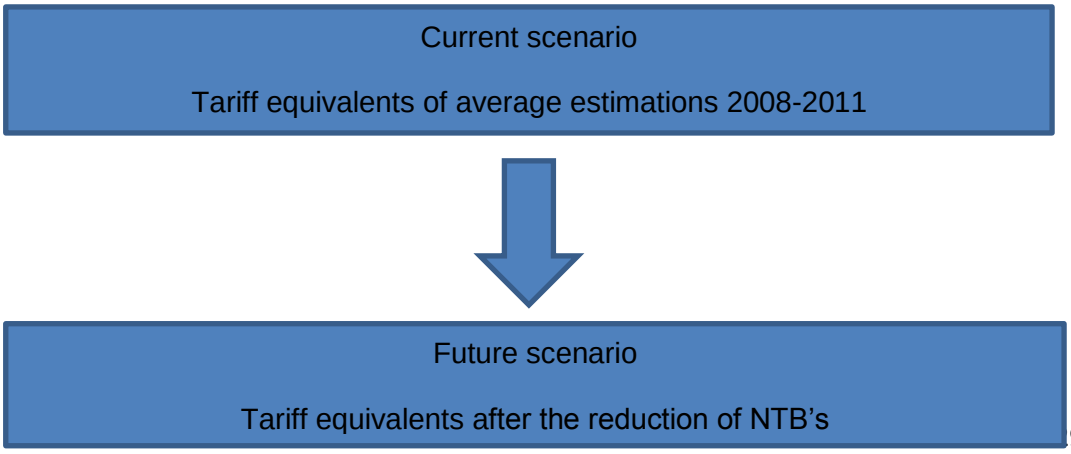
$$\boldsymbol{Ho}: \boldsymbol{g} > \mathbf{0}$$

$$\boldsymbol{Ha}: \boldsymbol{g} \leq \mathbf{0}$$

Where:

g: growth in throughput value of Greek ports' trade flows

The distinction between the different values of NTB's before and after their reduction requires the use of two different scenarios. It can be referred that if our initial hypothesis comes true, the tariff equivalents of NTB's before their reduction should be larger than the ones after the reduction. In order to facilitate this analysis, FOB and CIF prices are accepted under the general term 'freight rates'. Since the trade flows include both imports and exports, the author reaches the conclusion that there are two moves in general; one trip from the port of origin to the port of destination and one trip with the exactly opposite trip. In order to facilitate the current way of thinking, the calculation of the tariff equivalents will be conducted at two steps; at first the author calculates these tariff equivalents from Greek ports to their final destinations (i.e. the 5 continents of Earth) and vice versa and then he calculates the average equivalent of every possible combination of sea journeys (imports with exports). The same method is carried out in the case of subsidies.



In general, the author believes that the taxation system in Greece must remain unchangeable. This preposition is much more than an assumption; the growth of an economy or of a particular sector of an economy is positively correlated by a stable taxation system (Giannitsis 2007). As a matter of fact, the overall tax burden levied by these three categories remains stable at a percentage of a 25% of the overall FOB price. The same approach is used in the case of quotas; the impacts by implementing a quota on a particular product are equal to implementing a 3.4% tariff or tax on the FOB price. Aggregating these two facts, a tariff equivalent of 28.4% exists in both scenarios.

As far as restrictive practices in shipping are concerned, the author has made reference to particular practices like job demarcation, restrictive hours and restrictions in the output handled in the Greek ports. According to the 2012 IMF Report and Pallis et al. (2013), the liberalization of the labor market is considered as a necessary step towards the overall process of trade liberalization. During the current analysis, restrictive practices in shipping affect three variables; cargo handling efficiency, shippers' expenditure for salaries and expenditure for making the shippers' friendlier to the environment. However, shippers' expenditure for the crew has remained unchanged despite the world economic crisis as the shippers keep the same strategy in terms of maritime employment. As a result, the existing scenario refers to the labor handling cost as source of inefficiencies. On the contrary, the future scenario is based on the fact that the labor handling cost reaches the amount of the more efficient port in Greece; the port of Elefsina. However, this ideal amount of labor handling costs is aggregated with the increase caused by installing filters and environmentally friendly equipment in shipping.

Another important element that needs to be taken into account is the standardization of technical barriers to trade (TBT). Given the fact that TBT's impact cannot be calculated for every single product in full accuracy, the differences between the two scenarios are summarized in the procedure of standardization of trade. As a consequence, the standardization of trade in the second scenario is equal to the reduction of NTB's per 2.5%.

The transport costs' differences between the two scenarios can be also considered as other tariff equivalents' differences. In theory, the transport costs have been divided by the author in the road transportation costs, the maritime transportation costs and the transaction/distribution costs. The author has already mentioned that transaction/distribution costs and road transportation costs remain stable in the current analysis. On the other hand, two scenarios have been developed to describe liberalization processes in ocean transportation. Although it doesn't take the economies of scale in cargo carriage via larger ships into consideration, the carriage of 1 ton of cargo is the benchmark quantity for calculating the ocean transport costs. During the future scenario, the author assumes that a fully liberalized approach is enhanced on maritime transportation; no kind of co-operation agreements or self-regulation is permitted. This approach is much more different than the current situation; the author assumes that PFRA's exist. It must be though referred that the effectiveness and the validity of this approach is questioned; Haralambides (2006) claims for example that shipping needs some kind of self-regulation.

Furthermore, time costs are calculated on the basis of the existing congestion in docks and in the customs, as the author has already assumed that distribution centers are located at a negligible distance from ports. Cargo checking is conducted

at many levels and not only in customs; container scanners or other relevant cargo are used in the checking process. The current scenario is based on the existence of 1 container scanner per port. On the other hand, the future scenario refers to investments made to the ports integrated in the TEN-T (Piraeus, Thessaloniki, Patras and Igoumenitsa) to increase the number of scanners from 1 to 2.

Last but not least, two more important details on GSIM inputs need to be emphasized. To start up with, the subsidies described in chapter 3 are allocated per ton of cargo handled in these ports so as to calculate them as a percentage of freight rates. Furthermore, the tariff-equivalents of NTB's are also calculated as a percentage of non-tariff barriers. Since the freight rates have different values for every category of cargo, it is obvious that the tariff-equivalents will also take different values.

4. Quantification of Non-Tariff Barriers

4.1. Introduction to estimations

The estimation of NTB's is considered as the most significant part of the current research. Due to the limited time needed for our research, it includes elements of a meta-analysis as it uses the findings of previous researches. The main difficulty in calculating the costs generated by the barriers is the fact that every Greek port appears its own problems, strengths and opportunities. In addition to this, goods are carried in various types of ships and we are forced to take a general average to facilitate our calculations. In every one of the four categories we examine (Containers, Dry Bulk, Liquid Bulk, and Ro-Ro) the costs generated will be calculated for every one of the eight categories of ports.

Another important detail that needs to be taken into consideration is the nature of the barriers to trade. The barriers' impacts could be calculated and allocated at a multiple level, i.e. in more than one parts of the global supply chain. Furthermore, there is a significant possibility of calculating the same barriers more than once. Variables such as the days of journey define both transport costs and time costs. As a fact transport costs have a greater interpretation than time costs. However, the current analysis has decided to distinguish these terms in order to provide a solid analysis of the barriers examined.

Despite the existence of all these issues, the calculation of the overall costs of the given analysis will be calculated at an aggregate level. As the non-tariff barriers' equivalents are between 0 and 1, the non-tariff barriers must be calculated in accordance to the goods' and services' price. However, the estimation of a general or a weighted average of all the products and their elasticities requires a lot of time and data. That's why we are forced to estimate the barrier's costs as a percentage of the freight rates. Following this procedure, we will aggregate all the costs generated by non-tariff barriers. The equation provided below offers us a simple tool for the overview of our calculations.

$$(\mathbf{4.1})\ \boldsymbol{NTBC = GISC + RPC + TBC + RMC + TC}$$

Where:

NTBC: Non-Tariff Barriers' Costs

GISC: Government Intervention in Shipping Trade Costs

RPC: Cost incurred because of the application of Restrictive Practices in Shipping

TBC: Technical Barriers to Trade Costs

RMC: Road and Maritime Transport Costs (including Distribution, Freight Costs etc.)

TC: Time Costs

4.2. Reasoning for choosing the current model of NTB's presentation and calculation

During the current analysis, the author has used a simple linear model to define and calculate the NTB's applicable to cause impacts on Greek sea trade flows. A simple linear model is also used in the majority of the NTB's calculated as tariff-equivalents in the given analysis. As the simple linear model is evaluated as the simplest and most effective function of calculating dependent variable, the author believes that despite its disadvantages, it is a useful tool for estimating values and tariff-equivalents. The usage of the linear model comes side by side with the assumption that each one of the categories of NTB's used in this approach doesn't affect each other. As a matter of fact, the following linear econometric model could be used to explain this approach.

$$(\mathbf{4.2.1})\ \boldsymbol{NTBC} = \boldsymbol{a} + \boldsymbol{b} * \boldsymbol{GISC} + \boldsymbol{c} * \boldsymbol{RPC} + \boldsymbol{d} * \boldsymbol{TBC} + \boldsymbol{e} * \boldsymbol{RMC} + \boldsymbol{f} * \boldsymbol{TC} + \tilde{e}$$

However, this regression model needs to be simplified a bit more so as to gain a status of a simplified aggregation. That's why the following assumptions must be made to aggregate the different values of NTB's:

$$(\mathbf{4.2.2})\ \boldsymbol{a} = \mathbf{0}$$

$$(\mathbf{4.2.3})\ \boldsymbol{b} = \boldsymbol{c} = \boldsymbol{d} = \boldsymbol{e} = \boldsymbol{f} = \mathbf{1}$$

It is obvious that the approach provided in the current paper attempted to be focused on the particular characteristics of the Greek economy and maritime industry. That's why the author follows a method of calculation of the NTB's adjusted to the monetary costs of carrying 1 ton of cargo from Greece to abroad or vice versa. More specifically, the values extracted from the calculations of NTB's equations will be re-calculated as a percentage of freight rates. This way of thinking appears the advantage of taking the forces of supply and demand in Greek maritime industry seriously into consideration, as the equilibrium point of them (the freight rates) will be incorporated in this research.

On the other side, the existing literature has revealed too many different approaches for the existence of NTB's and their impact on trade flows. McCarty, Adam (1999) focuses on technical aspects of NTM's and NTB's, as well as on the regulations implemented to protect the customers. European Commission (2010) also proposes a list of existing and past regulations and technical standards used to ensure the quality of the products in the market. On the other side, Pournarakis (2004) and Coughlin and Wood (1989) concentrate on the 'direct' NTB's like taxes, quotas, subsidies and variable import levies. Additionally, Anderson and van Wincoop (2004) propose a way of quantification of trade costs like freight costs, time costs, information costs, currency costs, transaction costs, distribution costs etc.

It is also worth referring that the current research emphasizes on the trade flows of Greek ports on a world basis. Since Greece exchanges trade flows through sea with the majority of the countries abroad, it is almost impossible to find out exact data referring to particular categories of trade costs. For instance, the evaluation of the infrastructure, as well as of the particular categories of NTB's in developing countries creates an extra difficulty in their calculation and aggregation as factors limiting trade between the foreign countries and Greece.

Thus, it can be easily referred that the linear equation model is a necessary simplification for the quick estimation of costs incurred by NTB's. Given the fact that all papers had provided a different approach on NTB's, the author was forced to categorize the most relevant NTB's existing on the Greek port industry and economy on its own. As a consequence, part of the methodological structure of the research paper was based on the judging ability of the researcher rather than on pure evidence about the existence of NTB's or NTM's. However, a mixed hybrid model of NTB's presentation was selected, which also emphasized on some of the outcomes presented by the literature provided at the end of the paper.

4.3. Estimation of Costs incurred by government intervention in seaborne trade

4.3.1. Estimation of tariff-line quotas and costs incurred by taxation system

Quotas, subsidies, variable import levies and taxes levied on products are considered to be examples of protectionist policies. The policy applied in terms of these examples mark up the type of the government intervention in trade. It must be referred that government interventionism in trade also include practices like the existence of a sole importing agency or import payment requirements in advance. However, the author in principle considers that the Greek and the European authorities have managed to eliminate the impacts of finance and anti-competitive measures in the overall economy. This assumption is obviously heroic, but it allows us to facilitate the current research. Given the fact that interventionism creates barriers, the following equation provides us an overview of the barrier costs incurred at an aggregate approach:

$$(4.3)\ \boldsymbol{GISC = q + t}$$

Where:

q: Average Tariff-line quotas levied

t: Cost incurred by the taxation system

The trade policy in the European Union has remained unchanged since its last modification in 2004 (WTO 2006). As far as tariff quotas are concerned, there is a particular difficulty in calculating an average which will represent all the products imported on the Greek products. Although there is a categorization of the goods handled in Greek ports on the basis of their type of ship transport (Container, Dry Bulk, Liquid Bulk and Ro-Ro), there is limited data availability on the type of products handled in every port separately. That's why the author has decided to use the weighted average approach of the tariff-line quotas levied in all the products imported in the ports. **As a matter of fact, the impacts generated by the existence of average tariff-line quotas' have been estimated at a level of 3.4% of the final product price in the member-states of the European Union (WTO 2006).** The main disadvantage of this approach is the fact that different tariff-line quotas are levied on different products. For example, tariff quotas levied on agricultural products are the highest ones (WTO 2006).

Another way of government intervention in trade is the taxation system. Since it is difficult to estimate the tax burdens levied on different countries, the author pays significance to the Value Added Tax and to the shipping companies' Corporate Tax. As of 2012, the VAT in Greece rates at a level of 23% (IMF 2013). The author considers that the Greek model of taxation in shipping provides low financial tax burdens, reaching an average rate of 5% of the taxable income. As a fact, the overall financial tax burden (VAT+ corporate tax) is 25% of the FOB price. **As a consequence, the overall cost incurred by government intervention in trade in both the existing and the future scenario is 28.4% of the FOB price.**

4.3.2. Estimation of tariffs and subsidies to be introduced in the GSIM matrices

The estimation of both tariffs and subsidies is a crucial point of this analysis. Both values of tariffs and subsidies must be inserted as inputs in the GSIM matrices. That's why the author assumes that the regions used as destinations abroad have established their own tariffs in importing products. Although tariffs are not examined in this research, their identification is necessary to run the GSIM. In order to facilitate this analysis, the author has used an average analysis of the tariffs of all the countries maintaining trade flows with Greece. The tables provided below illustrate the countries included in the calculations as well as the average tariff-line quotas in the regions examined. Since the current analysis emphasizes on the NTB's of Greek ports, the author assumes that the tariffs exactly the same in both the existing and the future scenario.

Table 11: Countries maintaining trade flows with Greece

Europe	Asia	America	Africa	Oceania
Croatia	Iran	Argentina	Algeria	Australia
EU	Israel	Brazil	Cameroon	New Zealand
Iceland	Japan	Canada	Congo PR	
Norway	Jordan	USA	Cote d' Ivoire	
Russia	Korea	Uruguay	Egypt	
Switzerland	Kuwait		Ethiopia	
	Saudi Arabia		Morocco	
	Syria		Nigeria	
			Tunisia	
			Gabon	

Source: Hellenic Statistical Authority (2011)

Table 12: Average tariffs of the regions importing Greek products

Europe	Asia	America	Africa	Oceania
1.57%	6.87%	4.16%	10.75%	2.31%

Source: Compiled by the author, Data retrieved from World Bank (2013)

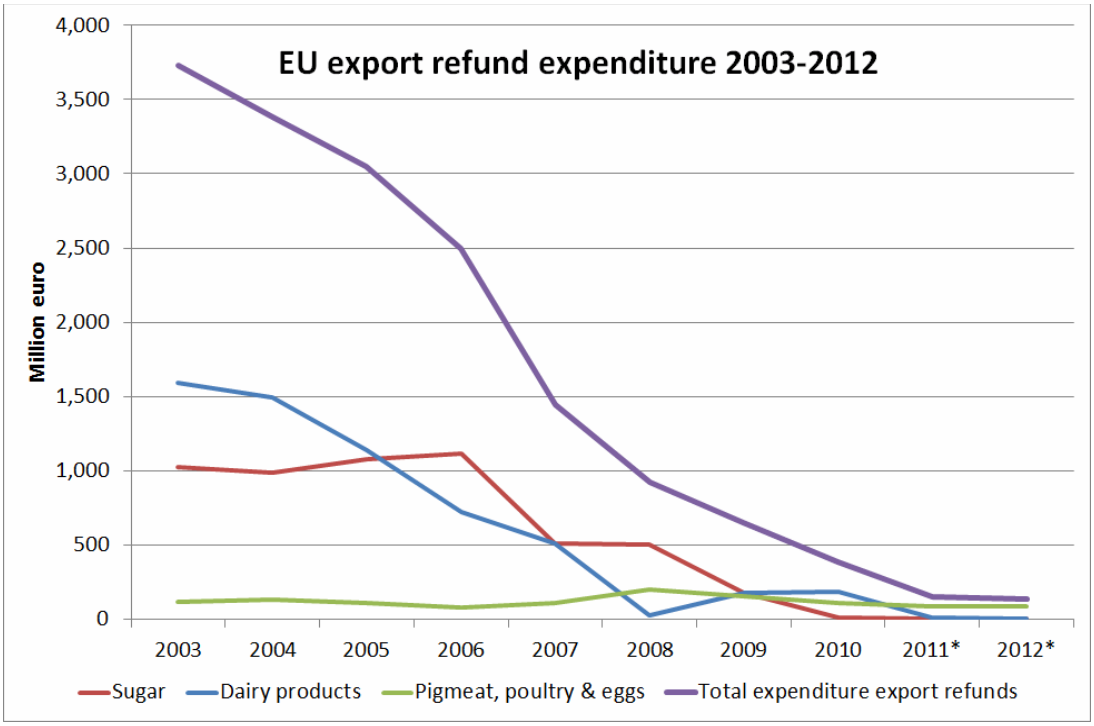
In addition to the existence of tariffs, another NTB to be quantified in this analysis is the government practice of subsidizing. The current research focuses on the subsidies provided by the European Commission authorities. It must be assumed that the European Commission doesn't provide subsidies for finally manufactured goods (European Commission 2010), whereas Greek agricultural products to be exported are subsidized on the basis of Common Agricultural Policy (Pournarakis 2004). This assumption is a necessity because the impacts caused by the NTB's in both the final good (which affect its final price and FOB) and in the raw material (which affect its cost of production) cannot be easily estimated. The author assumes that the subsidies to be examined in this case are the following:

- Subsidies provided to the Greek exporters

- Subsidies provided to upgrade the infrastructure in the Greek ports
- Subsidies to develop rail, road and hinterland connections between the Greek ports

According to Koukouritakis (2003), goods and services exported in other countries are subsidized at an average percentage of 12% of the FOB price in 2002. However, subsidies and the expenditure for subsidies provided to goods exported have dramatically declined since 2003 (Mattheus 2012). Following a simple analogy method and comparing the expenditure from 2003 till now, the author reaches the conclusion that the subsidies provided to Greek exporters before the beginning of the crisis reached an amount of 1.5% of the world price. On the other hand, the future scenario assumes that this practice of subsidizing the exports of the Greek products will be removed after 2013 (Mattheus 2012). The diagram provided below indicates us the evolution of the subsidies' expenditure provided by the European Union to exporters.

Figure 5: EU export refund expenditure



Source: Mattheus (2012)

As far as the second category of subsidies is concerned, the development of the infrastructure on the Greek ports will be also achieved through the subsidies provided by the National Strategic Reference Framework. Funds from the European Union will be also provided in the ports which will be represented in the GSIM model as ROGP (Rest of the Greek Ports). In theory, the author should have included the investments made by the Greek authorities but there is no clear distinction between the monetary amounts provided and the time plans of the manufacturing projects. In order to facilitate this research, these subsidies will be allocated per ton of cargo in

the Greek ports, assuming that there will be 100% utilization of the funds provided from the European Union. Furthermore, the scenarios remain the same as in the case of tariffs; all subsidies provided in the period 2007-2011 belong to the current scenario, whereas the subsidies provided after 2012 belong to the future scenario. It is worth referring that these subsidies are referring to the cargo carriage in all the final export destinations.

Last but not least, the European Union tends to subsidize the integration of these ports in the European and World supply chain. These rail, road and hinterland connections between the Greek ports will be established by the integration of the existing networks into the unified European market. Furthermore, the transport and time costs will be significantly reduced as a result of improving the existing infrastructure. As a matter of fact, the TEN-T strategy will be applied to achieve this methodological target. Among the 30 Priority Plans included in the Trans-European Network, the trade and transport flows of the Greek ports will be affected by the following ones (Ypourgeio Naftilias 2012b). Given the fact that the TEN-T strategy programs have not been fully completed, the author assumes that the same amount of subsidies will be provided in both the existing and the future scenario:

- Priority Plan 7: The TEN-T Network's Priority Plan 7 is based on the creation of the motorway axis Igoumenitsa/Patras-Athens-Sofia-Budapest. It aims at developing a motorway which will connect the port of Igoumenitsa with the Greek ports of Eastern Macedonia and Thrace, the Bulgarian and the Romanian ports, as well as with the Greek-Turkish borders (Kipoi). Part of this project will be the PATHE motorway (Patras-Athens-Thessaloniki-Evzonoi). This project aims at reducing the barriers related to time costs and increasing the cargo volume transported to/from Greece. All the 10 ports to be examined in this analysis have been affected by this priority plan. The European Union has provided financial support equal to US$ 4,646,252.57 for this project (European Commission 2012).

- Priority Plan 21: Subsidies are provided by the European Union to modernize the supply chains among the Mediterranean countries of the EU. Specifically, this project aims at facilitating the sea connections among the Mediterranean ports for specific types of cargo; Containers and Ro-Ro. In order to achieve this target, the European Union will provide funding to the following ports in the future scenario (Ypourgeio Naftilias 2012b):

  - Piraeus: US$ 3,717,002.06
  - Patras: US$ 8,097,754.48
  - Igoumenitsa: US$ 8,097,754.48

- Priority Plan 22: The TEN-T Network's Priority Plan 22 is based on manufacturing the railway axis Athens-Sofia-Budapest-Vienna-Prague-Dresden. This project aims at connecting the Greek ports with the developing countries of the South-Eastern Europe. The ports of Piraeus, Thessaloniki, Volos and Patras will be affected by this Priority Plan. The European Union has provided financial support equal to US$ 29,072,266.07 for this project (European Commission 2012)

To conclude, another critical observation that needs to be taken into consideration refers to the subsidies provided as part of the TEN-T strategy. Since these subsidies

aim at integrating the Greek ports into the European markets, the author estimates that they will affect the volume of the trade flows moving only to the European ports. In order to facilitate this analysis, these monetary amounts of subsidies will be allocated to the cargo handled in Greek ports, as seen in the Appendix. The tables provided below illustrates us the average subsidies allocated per ton of cargo exported from the Greek ports.

Table 13: Tariff equivalents of subsidies for Containers

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,058158	0,039717	0,022537	0,022098	0,027453
Thessaloniki	0,041749	0,023263	0,017644	0,017493	0,019307
Patras	0,110721	0,069703	0,031718	0,030743	0,042601
Heraklion	0,034411	0,015	0,015	0,015	0,015
Volos	0,125412	0,015	0,015	0,015	0,015
Igoumenitsa	0,106308	0,053005	0,026759	0,026077	0,034346
Kavala	0,020419	0,015	0,015	0,015	0,015
Alexandroupoli	0,042461	0,015	0,015	0,015	0,015
Elefsina	0,015608	0,015	0,015	0,015	0,015
Agioi Theodoroi	0,015539	0,015	0,015	0,015	0,015
ROGP	0,015	0,015	0,015	0,015	0,015
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,150277	0,107539	0,032793	0,03088	0,054178
Thessaloniki	0,155685	0,067723	0,021667	0,020429	0,035298
Patras	0,264763	0,109992	0,033615	0,031655	0,055498
Heraklion	0,019411	0	0	0	0
Volos	0,110412	0	0	0	0
Igoumenitsa	0,130908	0,038005	0,011759	0,011077	0,019346
Kavala	0,005419	0	0	0	0
Alexandroupoli	0,027461	0	0	0	0
Elefsina	0,000608	0	0	0	0
Agioi Theodoroi	0,000539	0	0	0	0
ROGP	0	0	0	0	0

Source: Compiled by the author

Table 14: Tariff-equivalents of subsidies for Dry/Liquid Bulk

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,086917	0,032839	0,034125	0,042242	0,031818
Thessaloniki	0,059262	0,021325	0,021734	0,024582	0,020968
Patras	0,182012	0,054128	0,057566	0,074881	0,051929
Heraklion	0,046905	0,015	0,015	0,015	0,015
Volos	0,192256	0,015	0,015	0,015	0,015
Igoumenitsa	0,159942	0,042724	0,044517	0,057053	0,041163
Kavala	0,024761	0,015	0,015	0,015	0,015
Alexandroupoli	0,057777	0,015	0,015	0,015	0,015
Elefsina	0,015984	0,015	0,015	0,015	0,015
Agioi Theodoroi	0,015867	0,015	0,015	0,015	0,015
ROGP	0,015	0,015	0,015	0,015	0,015
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,252494	0,077614	0,083206	0,118521	0,073173
Thessaloniki	0,259401	0,051837	0,055194	0,07853	0,048916
Patras	0,457785	0,078676	0,085588	0,120403	0,074254
Heraklion	0,031905	0	0	0	0
Volos	0,177256	0	0	0	0
Igoumenitsa	0,206304	0,027724	0,029517	0,042053	0,026163
Kavala	0,009761	0	0	0	0
Alexandroupoli	0,042777	0	0	0	0
Elefsina	0,000984	0	0	0	0
Agioi Theodoroi	0,000867	0	0	0	0
ROGP	0	0	0	0	0

Source: Compiled by the author

Table 15: Tariff-equivalents of subsidies for Ro-Ro

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,06759	0,045897	0,024422	0,023872	0,030566
Thessaloniki	0,047186	0,025329	0,018305	0,018116	0,020384
Patras	0,131642	0,083379	0,035897	0,034679	0,049501
Heraklion	0,037896	0,015	0,015	0,015	0,015
Volos	0,145435	0,015	0,015	0,015	0,015
Igoumenitsa	0,125334	0,062506	0,029699	0,028847	0,039182
Kavala	0,021392	0,015	0,015	0,015	0,015
Alexandroupoli	0,047391	0,015	0,015	0,015	0,015
Elefsina	0,015716	0,015	0,015	0,015	0,015
Agioi Theodoroi	0,015635	0,015	0,015	0,015	0,015
ROGP	0,015	0,015	0,015	0,015	0,015
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,18464	0,134424	0,040992	0,0386	0,067722
Thessaloniki	0,188625	0,084654	0,027084	0,025536	0,044123
Patras	0,319719	0,13749	0,042018	0,039569	0,069372
Heraklion	0,022896	0	0	0	0
Volos	0,130435	0	0	0	0
Igoumenitsa	0,157044	0,047506	0,014699	0,013847	0,024182
Kavala	0,006392	0	0	0	0
Alexandroupoli	0,032391	0	0	0	0
Elefsina	0,000716	0	0	0	0
Agioi Theodoroi	0,000635	0	0	0	0
ROGP	0	0	0	0	0

Source: Compiled by the author

4.4. Estimation of Costs incurred by Restrictive practices in shipping

Restrictive practices in the maritime and shipping sector is a common source of distortions for maritime and transport policy. However, the quantification of these restrictive practices is a really tough process, as it is not always easy to quantify, or at least estimate the cost of all the practices implemented to guarantee maritime employment or environmental, safety and security regulations. For instance, the cost of 'sustainable' or 'green' shipping is really high, because the shipping companies must incur significant costs to reduce CO_2 emissions. On the other hand, if shipping companies don't try their best to become 'greener', the damage in their profile cannot be easily translated into costs.

As a matter of fact, it can be easily referred that this analysis focuses on particular elements of the costs. These costs are generated by the restrictive practices which can be quantified in a direct or an indirect way. Using the research conducted by OECD (2006), the current research examines the costs incurred by the following aspects on restrictive practices in shipping:

- Restrictive practices in maritime employment
- Restrictive practices in dock labor handling costs
- Restrictive practices in safety and security regulations (incl. reduction of CO_2 emissions)

Maritime employment, restrictive practices in shipping and the need for reform have been evolved nowadays due to the pressure from the European Union (Romanos 2005). The deregulation of labor practices in the maritime employment is expected to increase efficiency in Greek ports. However, the Greek seafarers' organization are opposed to the implementation of this measure, as they think that it will lead to mass unemployment of the domestic labor force which is specialized in shipping. Their labor syndicate believes that those Greek seafarers and all laborers employed in shipping companies and ports will be fired. On the contrary, crew members and seafarers from developing countries will be hired due to reduced labor cost (Romanos 2005).

According to Pallis et al. (2007), the main barrier associated to the restrictive practices in maritime employment is the high wages of the Greek seafarers. Until now, the Greek ship owners provide high wages to the crew members associated with the high responsibility job positions of the vessel. For example, vessel officers are better paid than the inexperienced seafarers. These high wages are provided to these crew members in return to their experience, reliability, efficiency and loyalty (Pallis et al. 2007). The current research assumes that this policy has not changed despite the world economic crisis. Thus, the seafarer's labor costs remain the same. As a matter of fact, there will be no differences in tariff-equivalents related to labor shipping costs. The table provided below explains why this approach is followed by the Ship owners:

Table 16: Average seafarers' wage in Greek and South African-Asian shipping companies, 2008

	Greek	South African and Asian
Master	US$ 3,253.41	US$ 8,983.00
Chief officer	US$ 1,292.60	US$ 6,902.00
Second officer	US$ 1,491.04	US$ 4,050.00
Chief engineer	US$ 3,212.11	US$ 8,784.00
Second engineer	US$ 1,710.89	US$ 6,902.00
Third engineer	US$ 1,491.04	US$ 4,050.00
Able seaman	US$ 1,320.69	US$ 1,190.00
Oiler	US$ 1,401.83	US$ 1,178.00

Source: Compiled by the author, Data collected from Spathi et al. (2010) and Deloitte (2010)

On the other hand, restrictive practices in linear shipping and the abolition of anti-competitive measures have been also appeared in the European Union. The most characteristic example is the prohibition of shipping conferences in the sea routes across the European Union member-states. However, Haralambides (2007) believes that the non-existence of a mechanism of self-regulation will increase the freight rates and reduce the transport reliability.

Other barriers that need to be taken into consideration are the restrictions implemented on dock labor force. Given the fact that Greece is a member of the European Union, the Greek ports' authorities must invest in training the dock workers, as well as in improving their working conditions. The overall target of all these investments must be the increase in efficiency in cargo handling. That's why skilled personnel need to be hired. However, the Greek ports' authorities haven't applied a flexible system as they don't give emphasis on pooling, whereas the vast majority of all the dock workers are permanent employees (Pallis et al. 2013).

It is obvious that a lot of parameters must be taken into account to estimate the barriers in dock work. However, the wage is the only quantitative means of counting dock workers' efficiency. According to OECD (2013), the average wage of the Greek workers is the lowest among the 15 member-states of the 'old' European Union. The current research will also present a simple survey examining the productivity and the labor costs on the larger Greek ports. This survey uses the following equations to define both productivity and labor costs (Mankiew and Taylor 2011). It must be also referred that the cargo handled in the Greek ports are the ones imported and exported during the period of a year.

Given the fact that the labor handling costs are used as indicators for port and maritime employment efficiency, there must be a distinction between the current and the future scenario. The purpose of a well-organized maritime policy should be the reduction of the labor handling costs. The author believes that the labor handling costs could be reduced at the levels of the Port of Elefsina. The analytical calculations for the definition of handling costs are presented in the Appendix. Based on the estimates provided by the survey provided above, the amount of the labor handling costs in ports is relatively small compared to other NTB's like the transport costs. As a fact, the author believes that emphasis must be given on public

and private investments on Greek ports, which will increase berth productivity by developing the infrastructure.

Table 17: Labor handling costs in the Greek ports per ton handled

	Current scenario	Future scenario
Piraeus	US$ 8.32	US$ 0.08
Thessaloniki	US$ 2.43	US$ 0.08
Patras	US$ 1.15	US$ 0.08
Heraklion	US$ 7.02	US$ 0.08
Volos	US$ 2.60	US$ 0.08
Igoumenitsa	US$ 0.20	US$ 0.08
Kavala	US$ 0.36	US$ 0.08
Alexandroupoli	US$ 1.09	US$ 0.08
Elefsina	US$ 0.08	US$ 0.08
Agioi Theodoroi	No data provided	No data provided
ROGP	No data provided	No data provided

Source: Compiled by the author

In addition to restrictive practices in maritime employment, the current research also examines environmental safety and security regulations. Environmental Safety and Security Regulations are divided into two categories; Safety and Security Regulations in ports and in shipping. It must be referred that green shipping creates a barrier for both ports' authorities and the shipping companies. The implementation of greener strategies in ports is conducted in two levels; reducing the CO_2 emissions by choosing friendlier modes of transport and making port operations more efficient. The author believes that these strategies are incorporated in the investment plans of the National Strategic Reference Framework. Additionally, the costs incurred by the application of safety regulations like SOLAS (Safety of Life at Sea) in both ports and shipping companies will be reduced because well-trained and experienced personnel will be hired year-by-year.

Although another option for cost reduction can also be the existence of economies of scale through training, the current analysis also refers to the costs generated by environmentally friendly measures. It must be referred that the costs incurred by the regulatory environmental barrier can be estimated by an ex-post approach. Technological innovation and compliance are the most significant issues that must be taken into consideration evolved in the cost estimation. The Greek shipping companies have been enforced by the state to apply these green strategies to reduce the CO_2 footprint by introducing a number of plants on every ship carrying cargo. The approach provided by Harrington et al. (2000) is used during this research. The table provided below offer us a quantification of the cost estimates when reducing the CO_2 emissions through the use of plants.

Table 18: Cost estimations of reducing CO_2 emissions

	Ex ante estimations
Number of plants	100.00 US$
Emissions before regulation	100.00 US$
Emissions after regulation	25.00 US$
Cost per plant	200,000.00 US$
Aggregate Cost	20,000,000.00 US$
Emission reductions	7,500.00 US$
Cost per emission unit	2,666.67 US$

Source: Harrington et al. (2000)

Since the cost per emission unit is US$ 2,666.67 and assuming that the 'benchmark' ship is a 15,000 tons one, the cost allocated per ton of cargo carried reaches an amount of US$ 0.1778. Last but not least, the outcomes of the costs generated by the restrictive practices in shipping are presented in the following table. It must be though referred that these costs will be translated into percentages of the freight rates to generate the tariff-equivalents in the tables provided below.

Table 19: Tariff-equivalents of Restrictive practices for Container shipping

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,15084356	0,15346883	0,046799634	0,044068661	0,077317432
Thessaloniki	0,041133184	0,041801125	0,013373761	0,012609245	0,021787299
Patras	0,020785393	0,021146184	0,006462489	0,006085729	0,010669507
Heraklion	0,124673787	0,126798512	0,039233301	0,036957725	0,064544031
Volos	0,04498414	0,045730665	0,014410753	0,013581423	0,023581677
Igoumenitsa	0,00355196	0,003612493	0,001117758	0,001052927	0,001838861
Kavala	0,006393528	0,006502488	0,002011964	0,001895268	0,00330995
Alexandroupoli	0,019358181	0,019688088	0,00609178	0,00573845	0,010021794
Elefsina	0,001443718	0,001468738	0,000449349	0,000423164	0,00074164
Agioi Theodoroi	0,046848362	0,04766499	0,014519344	0,013671691	0,023993697
ROGP	0,045820281	0,046601162	0,014419076	0,013582753	0,02372131
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,004673975	0,00475532	0,001450114	0,001365493	0,002395725
Thessaloniki	0,004363842	0,004434704	0,001418829	0,001337722	0,002311426
Patras	0,004659543	0,004740423	0,001448722	0,001364262	0,002391825
Heraklion	0,004578476	0,004656504	0,00144079	0,001357222	0,002370292
Volos	0,004460351	0,004534371	0,001428882	0,00134665	0,002338214
Igoumenitsa	0,004578476	0,004656504	0,00144079	0,001357222	0,002370292
Kavala	0,004578476	0,004656504	0,00144079	0,001357222	0,002370292
Alexandroupoli	0,004578476	0,004656504	0,00144079	0,001357222	0,002370292
Elefsina	0,00465238	0,004733009	0,001448028	0,001363647	0,002389936
Agioi Theodoroi	0,004681204	0,004762804	0,001450809	0,001366109	0,00239751
ROGP	0,004578476	0,004656504	0,00144079	0,001357222	0,002370292

Source: Compiled by the author

Table 20: Tariff-equivalents of restrictive practices of Dry/Liquid Bulk shipping

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,257847	0,110763	0,118744	0,169142	0,104425
Thessaloniki	0,070709	0,031995	0,034068	0,048471	0,030193
Patras	0,037202	0,015125	0,016454	0,023148	0,014275
Heraklion	0,217167	0,094621	0,100179	0,164666	0,08915
Volos	0,076414	0,034406	0,036631	0,052287	0,032453
Igoumenitsa	0,005833	0,002635	0,002806	0,003997	0,002487
Kavala	0,012203	0,004712	0,005227	0,007208	0,004447
Alexandroupoli	0,031956	0,014434	0,015373	0,021965	0,013621
Elefsina	0,002479	0,001065	0,001142	0,001627	0,001004
Agioi Theodoroi	0,080002	0,034351	0,036822	0,052487	0,032395
ROGP	0,079065	0,034176	0,036672	0,052729	0,032239
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,00799	0,003432	0,003679	0,005241	0,003236
Thessaloniki	0,007502	0,003394	0,003614	0,005142	0,003203
Patras	0,00834	0,003391	0,003689	0,005189	0,0032
Heraklion	0,007975	0,003475	0,003679	0,006047	0,003274
Volos	0,007577	0,003411	0,003632	0,005184	0,003218
Igoumenitsa	0,007518	0,003397	0,003616	0,005152	0,003206
Kavala	0,008739	0,003375	0,003743	0,005162	0,003185
Alexandroupoli	0,007558	0,003414	0,003636	0,005195	0,003222
Elefsina	0,00799	0,003431	0,003679	0,005242	0,003236
Agioi Theodoroi	0,007994	0,003432	0,003679	0,005245	0,003237
ROGP	0,007900	0,003414	0,003664	0,005268	0,003221

Source: Compiled by the author

Table 21: Tariff-equivalents for restrictive practices in Ro-Ro shipping

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,188554	0,191836	0,0585	0,055086	0,096647
Thessaloniki	0,051416	0,052251	0,016717	0,015762	0,027234
Patras	0,025982	0,026433	0,008078	0,007607	0,013337
Heraklion	0,155842	0,158498	0,049042	0,046197	0,08068
Volos	0,05623	0,057163	0,018013	0,016977	0,029477
Igoumenitsa	0,00444	0,004516	0,001397	0,001316	0,002299
Kavala	0,007992	0,008128	0,002515	0,002369	0,004137
Alexandroupoli	0,024198	0,02461	0,007615	0,007173	0,012527
Elefsina	0,001805	0,001836	0,000562	0,000529	0,000927
Agioi Theodoroi	0,05856	0,059581	0,018149	0,01709	0,029992
ROGP	0,057275	0,058251	0,018024	0,016978	0,029652
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,005842	0,005944	0,001813	0,001707	0,002995
Thessaloniki	0,005455	0,005543	0,001774	0,001672	0,002889
Patras	0,005824	0,005926	0,001811	0,001705	0,00299
Heraklion	0,005723	0,005821	0,001801	0,001697	0,002963
Volos	0,005575	0,005668	0,001786	0,001683	0,002923
Igoumenitsa	0,005723	0,005821	0,001801	0,001697	0,002963
Kavala	0,005723	0,005821	0,001801	0,001697	0,002963
Alexandroupoli	0,005723	0,005821	0,001801	0,001697	0,002963
Elefsina	0,005815	0,005916	0,00181	0,001705	0,002987
Agioi Theodoroi	0,005852	0,005954	0,001814	0,001708	0,002997
ROGP	0,005723	0,005820	0,001800	0,001696	0,002962

Source: Compiled by the author

4.5. Estimation of Technical Barriers to Trade

In contrast to taxes, quotas, subsidies or labor handling costs, the calculation of technical barriers to trade is a debatable issue. As mentioned in chapter 2, the European Union and Greece have followed a particular approach to distinguish the different categories of technical standards and to calculate their impacts. Apart from the categorization proposed by the European Commission (2012), the author believes that the technical barriers can be divided into the following sub-categories; production standards, quality standards and price measures. In addition to this, costs are generated by the mechanisms controlling whether the products are compatible to these technical measures or not. However these costs are incorporated in the general category of time inefficiencies, as the author believes that the customs are the only checking points. The table provided below offers us some examples of the subcategories of the technical barriers to trade:

Table 22: Examples of Technical Barriers to Trade

Production standards	Quality standards	Price measures
Security standards	Import permission	Maximum prices
Technical regulations	System of control	Minimum prices
	Country of origin	
	Quality Labels	
	National Language	

Source: Compiled by the author, Data collected from European Commission (2012)

The author believes that these are the most significant technical barriers to trade implemented by the European Union. Characteristic example of barriers in agricultural market is the policy followed by the European Union against Genetically Modified Organization (GMO's). Another occasion of technical barrier is the international certification and controlling system, which is known as International Organization of Standardization (ISO). Unfortunately, these costs incurred by technical barriers to trade cannot be easily calculated by an aggregate approach due to the different types of products imported and exported from/to the Greek ports.

It is obvious that the calculation of the technical standards would have been much easier for a single product in the market. In that case, the author would have made use of the Cournot approach of a monopolistically competitive market. This approach offers us two major advantages. First of all, it differentiates the price of the good to be available in the domestic market from the price of the same good to be available in the foreign market. In addition to this, it takes interaction among the producers into consideration. Maskus et al. (2000) proposes the following series of equations to explain and quantify the technical standards. It must be referred that these equations describe the demand and the cost of the firm, this homogeneous goods is produced in a market consisting of symmetric firms.

$$(4.5.1)\ p = a - b * q * n + d * q' * n'$$

$$(4.5.2)\ p' = a - b * q' * n' + d * q * n$$

$$(4.5.3)\ C = F + G + (w * x + MTBC) * q$$

$$(4.5.4)\ C' = F' + G' + (w' * x' + MTBC' + RMC) * q$$

Where:

p (p'): Product price of domestic (importing) firm

q (q'): Quantity of the product produced domestically (abroad and imported in the domestic market)

n (n'): Number of domestic (importing) firms

C (C'): Cost of the domestic (importing) firms

F (F'): Fixed Cost of the domestic (importing) firms

TBC (TBC'): Costs generated by Technical Barriers to Trade in the importing country

w, x (w', x'): Input prices of the firms

MTBC (MTBC'): Additional Costs generated by Technical Barriers to Trade in the importing country

RMC: Road and Maritime Transport Costs

It must be however referred that the existence of multiple products carried on sea makes this approach difficult to be applied in this case. That's why the author is engaged to simplify this analysis. As a consequence, another detail that needs to be emphasized is the fact that the technical barriers to trade are not harmonized in all the countries. That's why the author assumes that Chinese and Russian manufactures have been charged with extra barriers by the European Union authorities. Barriers are also levied in American manufactures from the European Union authorities, especially when referring to electrical and electronically equipment (Maskus et al. 2000). Given the fact that China joined the WTO in 2001 (Pournarakis 2004), the author believes that the world is moving towards a system of harmonization of the technical standards.

As a consequence, the harmonization of the policy in terms of technical standards is considered to be a step towards liberalization and globalization. In addition to this, the bilateral and regional agreements which have been signed among the members of various peripheral organizations like North Atlantic Free Trade Agreement (NAFTA), Mercosur and European Union are also movement towards harmonization of the technical standards. In spite of believing that each country must adjust the general framework of technical standards into the needs of the domestic market economy, the author predicts that the technical barriers to trade will be harmonized in the following decade. Maskus et al (2010). have estimated that a 1% increase of common technical standards among the countries increases the trade flows per 0.32%. **Last but not least, the standardization of technical barriers to trade is equal to the reduction of trade costs by 2.5% (Marcus et al. 2010).**

4.6. Estimation of Transport Costs

As emphasized on the chapter 2, the function of transportation has been evolved as a really important barrier to trade. Due to the technological progress, moving and distributing goods from the place of origin to the place of destination has become an issue of crucial significance. It is worth referring that the significance of import transport costs has grown due to the reduction of tariffs and the general process of trade internationalization. As a fact, the shippers and the logistics service providers are particularly interested in reducing transport costs and their impacts.

It is obvious that the transport costs differ from country to country. The modes of maritime, road and rail transportation preferred by logistics service providers are dependent on the particular characteristics of each country. Local geographical characteristics, trade imbalances, technological effects, competition and regulatory policy of the trading countries, as well as investments in infrastructure can affect transportation efficiency significantly (Micco and Perez 2001). According to the model provided in this survey, the author follows an aggregate approach to calculate the overall amount of transport costs. It must be also referred that transaction and distribution costs have been included in this type of categorization, as they can be considered as parts of the global supply chain connecting customers and producers.

$$(\mathbf{4.6.1})\ \boldsymbol{RMC = MTC + RTC + TDC}$$

Where:

RMC: Road and Maritime Transportation Costs

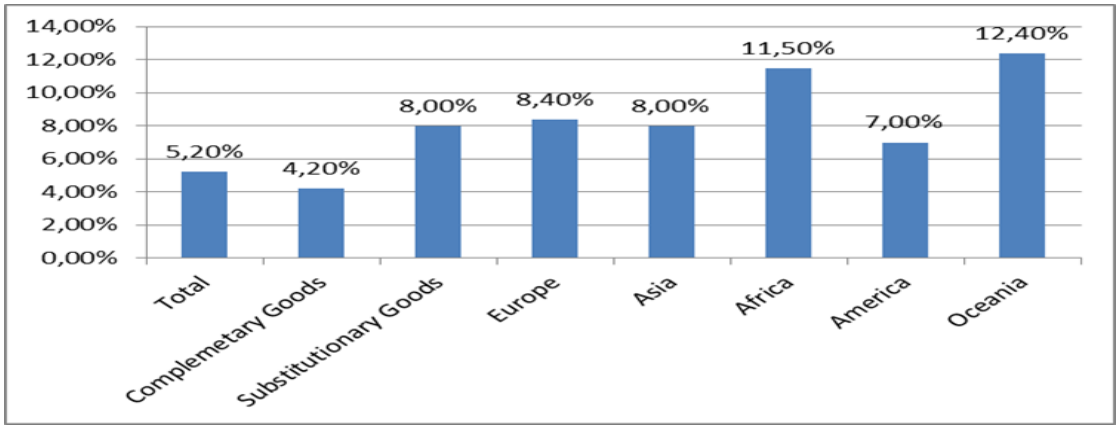
MTC: Maritime Transportation Costs

RTC: Road Transportation Costs

TDC: Transaction and Distribution Costs

It is obvious that the transportation costs don't take the same values in every single country. The table provided below offers some estimates of the overall transport costs in various areas of the world. However, the author believes that these estimates could have changed due to the rapid technological progress.

Figure 6: 1998 Transport Costs as a percentage of Import FOB prices



Source: Micco and Perez (2001)

Maritime transport costs are the first components to be examined in the current analysis. Apart from the factors mentioned above to define maritime transport costs, Clark et al. (2002) believe that distance, value/weight, level of containerization, port efficiency, total linear volume and the policy applied are the determinants for maritime transport costs. The equation generated by Clark et al. (2002) offers us a theoretical framework for the calculation of maritime transport costs, although it appears two disadvantages; the OLS linear regression model was based on 1999 data and emphasis was given on data from the United States' ports. However, it could be considered as a good starting point of discussion in the significant issue of maritime transport costs' estimation:

$$(4.6.2)\ \boldsymbol{MTC = 0.25 * D + 0.53 * WV - 0.07 * PFRA + 0.01 * CA + 0.003 * LC - 0.057 * LPE}$$

Where:

MTC: Maritime Transport Costs

D: Distance from the port of origin to the port of destination

WV: Weight Value of the Cargo transported and handled in the ports of destination

PFRA: Dummy Variable which examines whether a price fixing rate agreement exists (1) or not (0)

CA: Dummy Variable which examines whether a cooperative agreement exists (1) or not (0)

LC: Level of containerization

LPE: Level of Port Efficiency in the ports of destination

Apart from the maritime transport costs, land transport costs are also an important component of the overall transportation costs. Unfortunately, short-sea shipping mode might not be a suitable choice for logistics service providers in Greece due to the nature of the geographical characteristics in Greece. For example, the author assumes that road and rail transport costs can be evaluated as more efficient transportation modes in the case of Greece than short-sea shipping. As a matter of fact, the logistics service providers (LSP) maintain the option to choose between two modes of transport; rail and road. The table provided below indicates us the allocation of volumes on the basis of the transportation mode used in Greece today.

Table 23: Modes of Transport chosen to carry goods in Greece

Modes of Transport	Road	Rail
Transportation Volumes (%)	98.00%	2.00%

Source: Compiled by the author, Data collected by Van Elswijk (2012)

Due to the short period of time between the scenarios examined in this paper, the author believes that this trend will also be the same in the following years. However, the manufacturing of the motorways mentioned in the Priority Plan 7 will affect the cargo volumes of all the Greek ports. In any case, the author believes that the distances from the selected ports to the final customer are not larger than 500 km. The table provided below show us the road and rail transportation costs per ton carried by truck or train.

Table 24: Road and Rail Transportation Costs/TEU in Greece for a distance of 500 km

Modes of Transport	Truck	Train
Transportation Costs	US$ 418.92	US$ 707.92

Source: Compiled by the author, Data collected by Van Elswijk (2012)

Additionally, the cost of storage, transaction and distribution of the goods will be calculated on the basis of the approach proposed by Anderson and Van Wincoop (2004). As the overall process of supply chain optimization is conducted on the same country (Greece), the author believes there are no significant border-related costs. According to Anderson and Van Wincoop (2004) the equivalent to the logistics costs mentioned above is equal to 55% of an ad valorem tax equivalent. However, the land transportation costs and the storage-distribution costs will maintain the same tariff-equivalents. As a consequence, the storage and distribution costs' tariff equivalents are equal to 0.55*0.25=0.1375 or 13.75%

Last but not least, since road transportation costs/container reach an amount of US$ 418.92 for a distance of 500km; the author can subsequently infer that carrying 1 ton of cargo costs US$ 17.46. The distance from the production points to the port is 100km, so the road transportation of carrying 1 ton of cargo is US$ 3.42. Like the maritime transport costs, this value must be assigned as a percentage of freight costs. Calculating the overall sum of barriers in Excel and following an aggregation approach of the tariff-equivalents of transport, storage and distribution costs offer us

the possibility to estimate the overall transport costs as tariffs. The tables provided below provide a sum of the tariff-equivalents of transport costs.

Table 25: Tariff equivalents of Transport Costs in Containers

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,211143	0,236125	0,166165	0,161	0,188229
Thessaloniki	0,20704	0,230068	0,165839	0,161414	0,186753
Patras	0,210356	0,236507	0,165907	0,161803	0,188495
Heraklion	0,209687	0,233375	0,165984	0,160811	0,187334
Volos	0,208333	0,229027	0,16573	0,161494	0,187184
Igoumenitsa	0,210393	0,234656	0,166265	0,161751	0,187986
Kavala	0,208923	0,235049	0,165683	0,161733	0,188186
Alexandroupoli	0,21026	0,234354	0,166171	0,161663	0,187832
Elefsina	0,210795	0,235543	0,166123	0,161674	0,188102
Agioi Theodoroi	0,211244	0,236267	0,166176	0,161716	0,18826
ROGP	0,209792	0,234048	0,166004	0,161506	0,187831
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,209874	0,234834	0,165772	0,16063	0,187578
Thessaloniki	0,205855	0,228864	0,165454	0,161051	0,186125
Patras	0,209091	0,23522	0,165513	0,161432	0,187846
Heraklion	0,208444	0,232111	0,165593	0,160442	0,186691
Volos	0,207122	0,227796	0,165342	0,161128	0,186549
Igoumenitsa	0,20915	0,233392	0,165873	0,161382	0,187342
Kavala	0,20768	0,233785	0,165292	0,161364	0,187542
Alexandroupoli	0,209017	0,233089	0,16578	0,161294	0,187189
Elefsina	0,209532	0,234258	0,16573	0,161304	0,187453
Agioi Theodoroi	0,209973	0,234973	0,165782	0,161345	0,187609
ROGP	0,208548	0,232783	0,165612	0,161137	0,187187

Source: Compiled by the author

Table 26: Tariff-equivalents of Transport Costs in Dry Bulk

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,257634	0,206211	0,207585	0,223927	0,203686
Thessaloniki	0,251644	0,205911	0,207088	0,22573	0,203449
Patras	0,261896	0,205878	0,207173	0,226203	0,203428
Heraklion	0,257503	0,206545	0,207584	0,237012	0,203977
Volos	0,252372	0,203906	0,206645	0,226143	0,203559
Igoumenitsa	0,251787	0,205929	0,207099	0,225857	0,203471
Kavala	0,267539	0,205765	0,208028	0,225945	0,203308
Alexandroupoli	0,252172	0,206051	0,207237	0,226249	0,20359
Elefsina	0,257621	0,2061	0,207582	0,22666	0,203687
Agioi Theodoroi	0,257679	0,206208	0,207578	0,226694	0,203704
ROGP	0,256558	0,205849	0,207357	0,2269	0,203585
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,255465	0,205279	0,206586	0,222504	0,202808
Thessaloniki	0,249607	0,204989	0,206107	0,224334	0,202579
Patras	0,259632	0,204958	0,206171	0,224794	0,202559
Heraklion	0,255337	0,205602	0,206585	0,23537	0,203088
Volos	0,250314	0,20298	0,205659	0,224736	0,202686
Igoumenitsa	0,249746	0,205007	0,206117	0,224458	0,202601
Kavala	0,265166	0,204848	0,207011	0,224544	0,202444
Alexandroupoli	0,25012	0,205124	0,20625	0,224838	0,202715
Elefsina	0,255451	0,205169	0,206583	0,225236	0,202809
Agioi Theodoroi	0,255508	0,205276	0,206579	0,22527	0,202825
ROGP	0,254413	0,204921	0,206362	0,225469	0,20271

Source: Compiled by the author

Table 27: Tariff-equivalents of Transport Costs in Liquid Bulk

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,258127	0,206422	0,207812	0,22425	0,203886
Thessaloniki	0,252106	0,20612	0,207311	0,226047	0,203647
Patras	0,262411	0,206088	0,207401	0,226523	0,203625
Heraklion	0,257995	0,206759	0,207811	0,237385	0,204179
Volos	0,252839	0,204117	0,206869	0,226463	0,203758
Igoumenitsa	0,252251	0,206139	0,207322	0,226175	0,203669
Kavala	0,268078	0,205973	0,208258	0,226263	0,203505
Alexandroupoli	0,252639	0,206262	0,207462	0,226569	0,203789
Elefsina	0,258114	0,206312	0,207809	0,226983	0,203887
Agioi Theodoroi	0,258172	0,20642	0,207805	0,227017	0,203903
ROGP	0,257046	0,206059	0,207583	0,227225	0,203783
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,255957	0,205491	0,206813	0,222827	0,203007
Thessaloniki	0,250069	0,205199	0,20633	0,224651	0,202777
Patras	0,260146	0,205167	0,206399	0,225114	0,202756
Heraklion	0,255829	0,205816	0,206812	0,235743	0,20329
Volos	0,250782	0,20319	0,205883	0,225055	0,202884
Igoumenitsa	0,250209	0,205217	0,20634	0,224776	0,202799
Kavala	0,265705	0,205057	0,207242	0,224862	0,20264
Alexandroupoli	0,250586	0,205335	0,206474	0,225159	0,202914
Elefsina	0,255944	0,20538	0,20681	0,22556	0,203008
Agioi Theodoroi	0,256001	0,205488	0,206806	0,225593	0,203024
ROGP	0,2549	0,205132	0,206588	0,225794	0,202909

Source: Compiled by the author

Table 28: Tariff-equivalents of Transport Costs in Ro-Ro

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,235559	0,266891	0,175195	0,16863	0,203989
Thessaloniki	0,230032	0,258908	0,174747	0,169112	0,202036
Patras	0,234557	0,26735	0,17487	0,169631	0,204317
Heraklion	0,233617	0,263328	0,174956	0,168383	0,202838
Volos	0,231772	0,257736	0,174623	0,169222	0,20261
Igoumenitsa	0,234499	0,264928	0,175307	0,169558	0,203653
Kavala	0,232662	0,265419	0,17458	0,169535	0,203903
Alexandroupoli	0,234333	0,26455	0,17519	0,169447	0,203461
Elefsina	0,235097	0,266135	0,17514	0,16947	0,203824
Agioi Theodoroi	0,235695	0,267078	0,17521	0,169525	0,20403
ROGP	0,233747	0,264168	0,174981	0,169251	0,203459
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,233973	0,265277	0,174703	0,168167	0,203176
Thessaloniki	0,228551	0,257403	0,174265	0,168658	0,201252
Patras	0,232976	0,265741	0,174378	0,169168	0,203506
Heraklion	0,232063	0,261747	0,174467	0,167922	0,202034
Volos	0,230258	0,256197	0,174138	0,168765	0,201816
Igoumenitsa	0,232945	0,263348	0,174818	0,169097	0,202849
Kavala	0,231108	0,263839	0,174091	0,169074	0,203099
Alexandroupoli	0,232779	0,26297	0,174701	0,168987	0,202656
Elefsina	0,233518	0,264529	0,174648	0,169007	0,203013
Agioi Theodoroi	0,234106	0,265462	0,174717	0,169062	0,203217
ROGP	0,232193	0,262587	0,174492	0,16879	0,202655

Source: Compiled by the author

4.7. Estimation of Costs generated by Time Inefficiencies (Time Costs)

As mentioned in chapter 2, the existence of the time costs will be examined at a multiple level. Not only the time costs include the costs generated by the days of a journey a logistics service provider will need to carry the goods from the producers to the consumers but it will also include the costs of congestion due to large waiting lines and the costs of transferring the containers from one terminal to another. Thus, congestion issues are created in front of the customs and the docks. The interpretation of the waiting lines requires the translation of these costs into tariff equivalents.

The estimation of Time Costs includes many simplifications but these are the only factors that can be influenced through investments. During our calculations the time costs can be estimated as an aggregation of the factors mentioned above. It is obvious that the cost reduction can be also achieved from the side of logistics' service providers through optimization of the logistics' supply chain. However a state policy from the side of the Greek government can be primarily achieved on the fields referred above. As a matter of fact, the equation provided below will be used to calculate the overall costs.

$$(\mathbf{4.7.1})\ \boldsymbol{TC = MTTC + CCD + CCC + CTC}$$

Where:

TC: Time Costs

MTTC: Maritime Transport Time Costs

CCD: Costs of Congestion in the Docks

CCC: Cost of Congestion in the Customs

CTC: Cost of Transferring a Container from the port to the Container Terminal

The time costs during have been evolved from the trade-off between air and maritime transport. As shipping trade heavily affects economic life due to low transport costs, maritime transport becomes a matter of crucial importance (Haralambides 2006). It must be also referred that air transport will be preferred if the costs related to the movement of goods and services through trans-Atlantic or ocean shipping don't exceed the premium of air freight (Hummels 2001). In any case the choice of every firm for the most preferable mode of transport will be made on the basis of minimizing the total costs of the firm. In other words, every firm must incorporate the transport costs into the overall cost and choose the mode of transport with the value of freight which will minimize the overall cost. As far as the journey through a ship is concerned, it is obvious that the cost/day must be calculated in order to quantify the impact of time spent on sea to the movement of the goods.

According to Hummels (2001), the interest rate and the depreciation of the value of the good compared to an older one determine the cost per day. The depreciation of the value of the good could be affected by consumer's preferences, as well as by the available consumers' income. In the current analysis, there is a difficulty in calculating the depreciation of many differentiated goods in the consumer's basket. The equations provided below offers us an overview of the maritime transport time costs:

$$(4.7.2)\ \frac{MTTC}{d} = (r + \delta) * P$$

$$(4.7.3)\ P = LAC$$

$$(4.7.4)\ \frac{\frac{MTTC}{d}}{LAC} = r + \delta$$

$$(4.7.5) MTTC = d * \frac{\frac{MTTC}{d}}{LAC}$$

Where:

MTTC: Maritime Transport Time Costs

d: days

LAC: Long-run Average Cost

r: interest rate

δ: depreciation rate by transit trade

p: price of the commodity

Based on the data and the assumptions made in chapter 3, the author can subsequently infer that the overall maritime transport time costs/day will be reduced from 6% to 5%. The table provided below illustrates the maritime transport time costs in US$, as caused by the depreciation and the interest rate.

Table 29: Maritime Transport Time Costs/ton of cargo

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,9648	2,24598	2,09502	1,47078	2,3823
Thessaloniki	1,02756	2,27088	2,13276	1,49898	2,40648
Patras	0,9243	2,27334	2,08974	1,48548	2,4087
Heraklion	0,96654	2,21832	2,09526	1,2747	2,35446
Volos	1,01736	2,25954	2,12226	1,4868	2,3955
Igoumenitsa	1,02528	2,26926	2,13144	1,49604	2,40462
Kavala	0,88206	2,28426	2,05926	1,4934	2,42046
Alexandroupoli	1,01988	2,25792	2,12004	1,4838	2,39274
Elefsina	0,9648	2,24676	2,09502	1,47042	2,38206
Agioi Theodoroi	0,96426	2,24574	2,09502	1,46976	2,38134
ROGP	0,975684	2,2572	2,103582	1,463016	2,392866
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,804	1,87165	1,74585	1,22565	1,98525
Thessaloniki	0,8563	1,8924	1,7773	1,24915	2,0054
Patras	0,77025	1,89445	1,74145	1,2379	2,00725
Heraklion	0,80545	1,8486	1,74605	1,06225	1,96205
Volos	0,8478	1,88295	1,76855	1,239	1,99625
Igoumenitsa	0,8544	1,89105	1,7762	1,2467	2,00385
Kavala	0,73505	1,90355	1,71605	1,2445	2,01705
Alexandroupoli	0,8499	1,8816	1,7667	1,2365	1,99395
Elefsina	0,804	1,8723	1,74585	1,22535	1,98505
Agioi Theodoroi	0,80355	1,87145	1,74585	1,2248	1,98445
ROGP	0,81307	1,881	1,752985	1,21918	1,994055

Source: Compiled by the author

As far as the costs of congestion are concerned, the author distinguishes them into two categories; cost of congestion in docks and costs of congestion in customs. Each 'type' of congestion is caused by similar reasons and the calculation of the congestion costs will follow the same formula presented by Fernandez (2008). As a matter of fact, the author assumes that the quantity of the goods included in a container will suffer significant waiting and transfer costs per hour spent in the port. The facilitation of our analysis required the categorization of the Greek ports into 'big' and 'small' ports. The current analysis believes that a 50% container scanning is a realistic target to be achieved for every Greek port. Given the number of container scanners did every port have (1 or 2), the Greek ports can be distinguished into the categories mentioned above (Fernandez 2008). The current model considers that the ports which have been integrated in the TEN-T strategy belong to the category of big ports (Piraeus, Thessaloniki, Patras, Igoumenitsa), as

there are increased needs for handling the cargo in these ports. On the opposite, the rest of the Greek ports are small ones.

Table 30: Waiting and Transfer costs due to congestion in ports in US$

	Cost/Container		Cost/hour	
	Small port	Big port	Small port	Big Port
Waiting costs	29.98 US$	79.94 US$	2,338.44 US$	16,947.28 US$
Transfer costs	36.83 US$	23.15 US$	2,872.80 US$	4,914.00 US$

Source: Fernandez (2008)

To sum up, the costs of transferring a container or goods handled via other types of goods from the port to the terminal can be ameliorated. This way of thinking can be explained by the assumption of the author that the distribution centers are located at a really close distance from the ports. The aggregated time costs will be translated as a percentage of the freight rates to estimate the tariff-equivalents As a matter of fact, the tables provided below illustrate the tariff-equivalents of the overall time costs for the categories examined (Containers, Dry Bulk, Liquid Bulk, Ro-Ro).

Table 31: Tariff-equivalents in Time Costs for Containers

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,129648	0,155536	0,046581	0,040556	0,079626
Thessaloniki	0,122108	0,145478	0,045784	0,039878	0,077041
Patras	0,128515	0,155552	0,046507	0,040598	0,079741
Heraklion	0,12703	0,151805	0,046283	0,039278	0,078525
Volos	0,124632	0,148548	0,04605	0,04008	0,077834
Igoumenitsa	0,128073	0,152725	0,046485	0,040444	0,078986
Kavala	0,125529	0,152996	0,046082	0,04043	0,079131
Alexandroupoli	0,127977	0,15252	0,046421	0,040379	0,078877
Elefsina	0,129049	0,154821	0,046514	0,0405	0,079431
Agioi Theodoroi	0,129838	0,155777	0,046603	0,040569	0,079676
ROGP	0,127192	0,152507	0,046329	0,04027	0,078878
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,187637	0,210596	0,063513	0,057051	0,107154
Thessaloniki	0,176072	0,196754	0,062316	0,056013	0,103564
Patras	0,186447	0,210355	0,063427	0,057064	0,107183
Heraklion	0,124169	0,145127	0,044331	0,03816	0,074917
Volos	0,121698	0,141924	0,044089	0,038786	0,074213
Igoumenitsa	0,184698	0,20657	0,063274	0,056816	0,106187
Kavala	0,122918	0,146119	0,044164	0,039119	0,075422
Alexandroupoli	0,124958	0,145723	0,044447	0,039077	0,07521
Elefsina	0,126147	0,147946	0,044553	0,039203	0,075751
Agioi Theodoroi	0,12692	0,148862	0,044638	0,039271	0,075985
ROGP	0,124304	0,145712	0,04437	0,038986	0,075211

Source: Compiled by the author

Table 32: Tariff-equivalent in Time Costs for Dry/Liquid Bulk

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,221615	0,112255	0,118189	0,155661	0,107542
Thessaloniki	0,209906	0,111352	0,116627	0,153295	0,106762
Patras	0,230016	0,111264	0,118412	0,154417	0,106691
Heraklion	0,22127	0,113282	0,118179	0,175006	0,108461
Volos	0,211711	0,111761	0,117056	0,154306	0,107115
Igoumenitsa	0,210306	0,11141	0,116681	0,153538	0,106822
Kavala	0,239599	0,110875	0,119722	0,153756	0,106318
Alexandroupoli	0,211262	0,111819	0,117147	0,154558	0,107204
Elefsina	0,221615	0,112226	0,118189	0,155692	0,10755
Agioi Theodoroi	0,221723	0,112264	0,118189	0,155749	0,107574
ROGP	0,219477	0,111846	0,11783	0,156329	0,1072
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,32074	0,151993	0,161149	0,21897	0,144721
Thessaloniki	0,302672	0,150599	0,158739	0,21532	0,143517
Patras	0,333702	0,150463	0,161494	0,21705	0,143408
Heraklion	0,216287	0,108298	0,113196	0,170023	0,103477
Volos	0,206727	0,106777	0,112073	0,149323	0,102131
Igoumenitsa	0,303289	0,150689	0,158822	0,215694	0,143609
Kavala	0,234616	0,105891	0,114739	0,148773	0,101335
Alexandroupoli	0,206278	0,106836	0,112164	0,149574	0,10222
Elefsina	0,216632	0,107243	0,113206	0,150709	0,102567
Agioi Theodoroi	0,216739	0,10728	0,113206	0,150765	0,10259
ROGP	0,214493	0,106862	0,112846	0,151345	0,102216

Source: Compiled by the author

Table 33: Tariff-equivalent in Time Costs for Ro-Ro

Current scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,16206	0,194421	0,058226	0,050695	0,099532
Thessaloniki	0,152634	0,181848	0,05723	0,049847	0,096301
Patras	0,160644	0,19444	0,058133	0,050747	0,099677
Heraklion	0,158787	0,189756	0,057854	0,049098	0,098156
Volos	0,155789	0,185685	0,057562	0,050101	0,097293
Igoumenitsa	0,160091	0,190906	0,058106	0,050555	0,098732
Kavala	0,156912	0,191245	0,057602	0,050537	0,098914
Alexandroupoli	0,159971	0,19065	0,058027	0,050474	0,098596
Elefsina	0,161311	0,193526	0,058143	0,050625	0,099289
Agioi Theodoroi	0,162298	0,194721	0,058254	0,050712	0,099595
ROGP	0,15899	0,190634	0,057912	0,050337	0,098597
Future scenario					
	Europe	Asia	America	Africa	Oceania
Piraeus	0,234546	0,263245	0,079391	0,071314	0,133942
Thessaloniki	0,220089	0,245942	0,077894	0,070016	0,129455
Patras	0,233059	0,262944	0,079284	0,071331	0,133979
Heraklion	0,155211	0,181408	0,055414	0,0477	0,093646
Volos	0,152122	0,177406	0,055112	0,048482	0,092766
Igoumenitsa	0,230872	0,258212	0,079092	0,07102	0,132734
Kavala	0,153648	0,182649	0,055204	0,048899	0,094278
Alexandroupoli	0,156198	0,182153	0,055558	0,048847	0,094012
Elefsina	0,157684	0,184933	0,055691	0,049004	0,094688
Agioi Theodoroi	0,15865	0,186077	0,055798	0,049089	0,094982
ROGP	0,15538	0,18214	0,055462	0,048733	0,094014

Source: Compiled by the author

5. Outcomes of the Research

5.1. Cargo traffic flows, maritime transportation and shipping in Greece

Shipping and Maritime transportation activities in Greece are evaluated as a really significant sector of the Greek economy. It is worth referring that Greek shipping activities are characterized as a pure dynamic and exogenous sector of the Greek economy, which can contribute to the exit of the Greek economy from the current economic crisis. Given the fact that the 2013 Annual IMF Report emphasizes on the need of the Greek economy to improve its competitiveness by creating trade surplus, it is obvious that Greece must develop its comparative advantages from the overall production process to 'follow the path' to the sustainable growth. Due to the long tradition in shipping, Greeks have managed to establish a remarkable know-how process in moving trade and transport flows inside the entire Greek territory, as well as throughout the overall world.

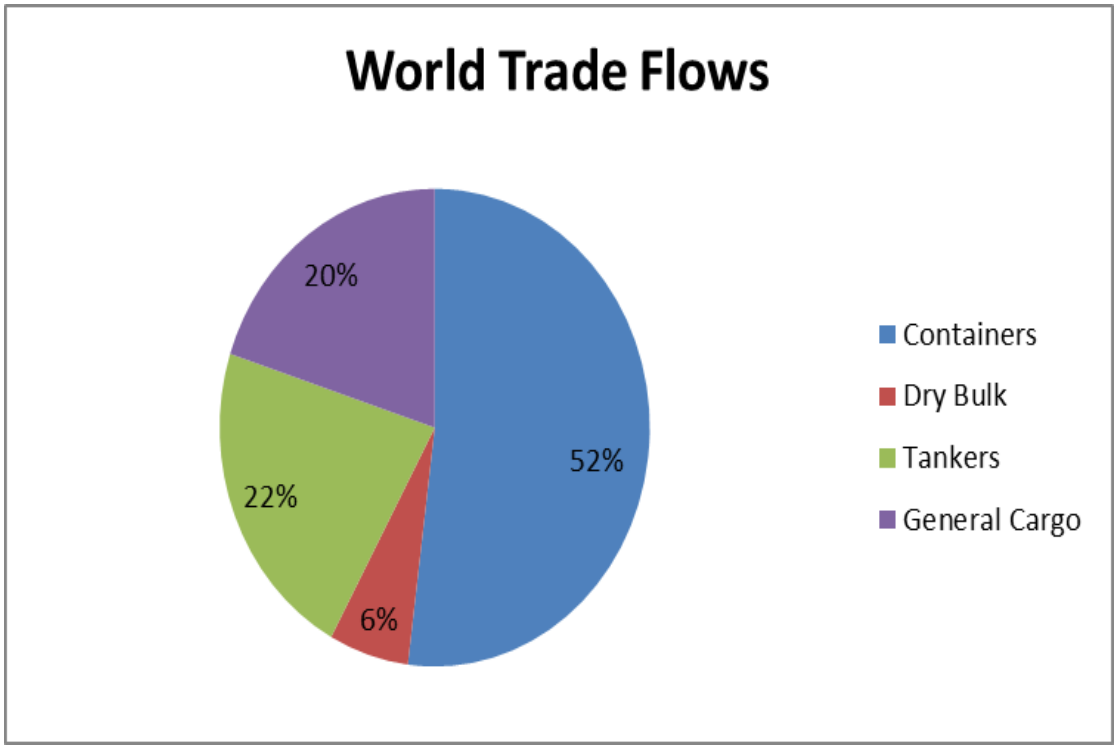
Shipping and Maritime transportation is associated with two human needs; the movement of goods and the transportation of passengers. In general, passenger transportation is affected by tourism, and the movement of passengers to their final 'tourist' destination seems to be a quite profitable activity. Being a popular tourist destination, the Aegean and the Ionian Islands, as well as parts of the Greek hinterland must incorporate and manage the huge passengers' flows. For instance, Piraeus is the busiest port among the European Union in terms of passengers' transportation volumes (Eurostat 2012).

In addition to this, sea transportation of passengers also becomes a necessity for another reason; Greek geomorphology and the existence of more than 2,000 inhabited and non-inhabited islands in booth the Aegean and Ionian Sea require the creation and development of a well-structured network of sea connections between the different islands, as well as between the Greek peninsula and the various islands. However, one basic disadvantage of sea passenger transportation inside Greece is that it doesn't generate value added to be exported in other countries. One out of the few exceptions-deviations from that rule is the cruise industry and the linear shipping connections between the western Greek ports (especially ports of Patras and Igoumenitsa) and the Italian ones.

On the contrary, the movement of cargo volumes from Greece to foreign countries and vice versa is an exogenous economic and business activity which creates value added for the domestic market. The increasing trade flows in the traditional 'silk route' from Asia to Europe and the geographical positions of the Greek ports located close to the three continents (Asia, Europe and Africa) generate identical conditions for the growth of the value added. Approximately the 90% of the currency coming from maritime transportation originates from cross-trading activities (Spathi et al. 2010) In theory, this growth could be accompanied with an increase in maritime employment and in investments, creating a positive 'shock' and diffusing the growth in maritime transportation into the entire economy. For instance, Greek shippers are associated with oil transportation from Middle East to Europe through bulk carriers.

Despite the global economic crisis and the reduction of consumption in the developed world, the author believes that the maritime sector is expected to keep up growing in the forthcoming year, as the significance of the developing world for the worldwide seaborne trade is emerging. Due to this trend, Spathi et al. (2010) are expecting a 6% average growth per year in the value of cargo imported in Greece for the period 2011-14. Transit trade could contribute to this growth, mainly due to the fact that Greece is one of the very few countries located at a close geographical distance from the emerging Asian markets and Russia. Through indicating us the allocated value of international trade flows handled in world ports per type of cargo, the graphs provided below aim at explaining us the trends in world seaborne trade.

Figure 7: Allocation of world seaborne trade per value of cargo type



Source: Gatera (2012)

However, the containerization level of the Greek seaborne trade flows in terms of value is estimated to be approximately 11% at the current research. Instead of container flows, transportation of dry bulk and liquid bulk is much more significant for Greek shippers. This number is definitely low, given the fact that some of the largest container ports in terms of TEU throughput in both Asia and Europe (Shanghai, Singapore, Marseille etc.) could be connected with Greek ports like Piraeus and Heraklion. According to the author's point of view, the harmonization of the Greek seaborne trade to the world trend could upgrade the importance of Greece as a part of traditional route Asia-Europe, as high-value goods will be transported through the Greek ports.

To some extent, it must be referred that the importance of Greek ports as transit hubs is rather limited. Although they are located in a strategic position near the Suez Canal and the Black Sea, large ships tend to use the ports of Northern Europe (Rotterdam, Antwerp and Hamburg) as transit hubs or ports of destination. Thus, it is doubtful whether the Greek governments of the past years have realized the strengths, weaknesses, opportunities and threats coming from the implementation of a structured maritime policy.

5.2. Reduction of NTB's and container exports

According to the initial hypothesis of the current research, the reduction of the non-tariff barriers, as expressed for every one of the destinations used in the current analysis, causes positive effects in the dependent variables of the GSIM; the output changes of the Greek ports' trade flows and the welfare effect in the overall Greek economy. This way of methodological approach is not only valid in the value of container throughput in the Greek ports, but in the other types of cargo examined in this survey as well. Although General Cargo is not analytically examined in this modeling due to the lack of relevant data, the rest of the categories offer us enough evidence to quantify the impacts of this removal on the way they affect the Greek economy.

Containers are divided into three categories; the 20' ft. (1 TEU), the 40' ft. (2 TEU) and the 45' ft. high-cube (2.5 TEU). They are used for the carriage of final merchandise goods, especially the valuable ones. However, the current research doesn't use the TEU as a means of calculating the container throughput in the Greek ports, preferring the ton as a simpler way to quantify the gross tonnage of the products. The ton has been selected for two reasons; to harmonize the standards used for all the cargo categories and types and to reduce the inefficiencies caused by some container moves, as well as by the fact that calculating the gross tonnage in terms of TEUs doesn't take the possibility of the existence of empty containers loaded/unloaded into consideration.

Instead of removing the overall NTB's in Greek ports, their reduction follows the general pattern described in the chapter 4 of the paper. This approach is more realistic, as the capability of every state to incorporate radical reforms in a relatively small period of time is definitely questioned by the author. The difference between the two scenarios (the current ones and the future simulation) can be explained by the impacts generated by the differences in the quantification on tariff equivalents and on subsidies.

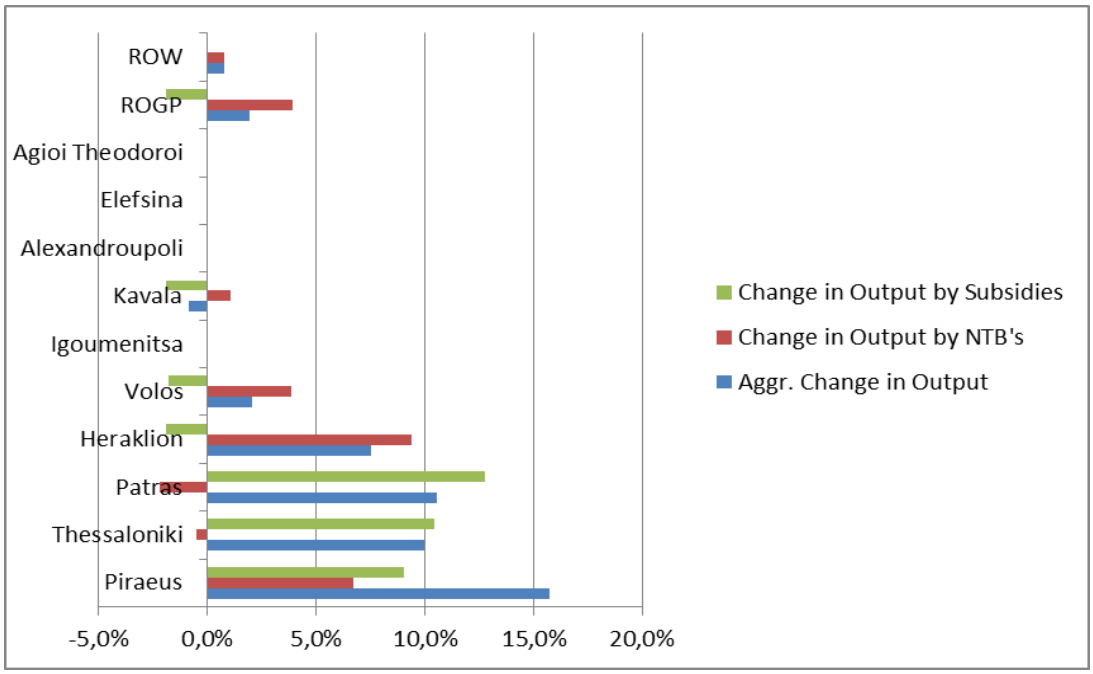
After following the GSIM methodology and calculating the value of container cargo handled in the Greek ports, the graph provided below offer us a realistic overview of the changes in export growth, as expressed in US$ value. According to the table provided in the next page, the outcome of the values calibrated by the existing model strongly confirms our initial hypothesis, as the reduction of NTB's and the forthcoming proposal of subsidies caused significant rates of growth in all the Greek ports. It must be also referred that the indication "ROGP" is used to describe the existence of a number of container terminal like the Astakos container terminal and the investments of COSCO in the port of Piraeus. In addition to this, it is worth referring that the ports of Igoumenitsa, Alexandroupoli, Elefsina and Agioi Theodoroi don't have the capability of handling container cargo.

Table 34: Growth rates of container cargo export values in Greek ports

	Aggr. Change in Output	Change in Output by NTB's	Change in Output by Subsidies
Piraeus	15,7%	6,7%	9,1%
Thessaloniki	10,0%	-0,5%	10,5%
Patras	10,6%	-2,2%	12,7%
Heraklion	7,5%	9,4%	-1,9%
Volos	2,1%	3,9%	-1,8%
Igoumenitsa	0,0%	0,0%	0,0%
Kavala	-0,8%	1,1%	-1,9%
Alexandroupoli	0,0%	0,0%	0,0%
Elefsina	0,0%	0,0%	0,0%
Agioi Theodoroi	0,0%	0,0%	0,0%
ROGP	2,0%	3,9%	-1,9%
ROW	0,8%	0,8%	0,0%

Source: Compiled by the author

Figure 8: Growth rates of container cargo exports of Greek ports after the reduction of NTB's



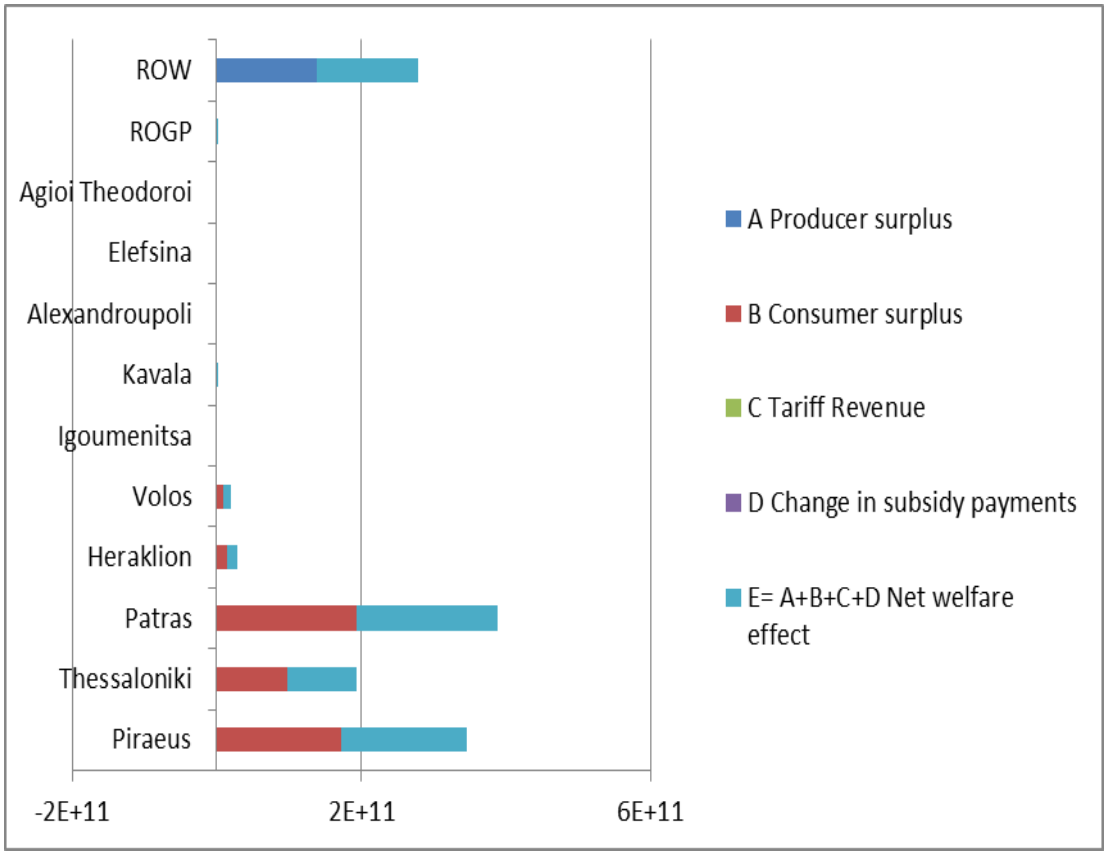
Source: Compiled by the author

In accordance to the outcomes provided by the GSIM calibration, the author observes that the removal of the non-tariff barriers, as defined in the current way of modeling causes impressive effects in the value of container throughput growth of the larger Greek ports. In other worlds, the Greek ports of Piraeus, Thessaloniki, Patras and Heraklion are going to achieve a growth rate in export value larger than

7%. As a matter of fact, the general average of estimated 6% growth rate in value of cargo traffic flows is surpassed on these ports. On the opposite, the smaller ports achieve less significant growths of export value (smaller than 2%). The only exception in this general rule refers to the port of Kavala, which achieve slightly negative growth rates of export value.

As a matter of fact, the larger public ports, as well as the private ones, have a comparative advantage in managing container cargo flows. This comparative advantage could be explained by the fact that these Greek ports are much more specialized in handling containers, as well as by the consolidation of the container cargo. However, a careful examination of the outcomes makes the author to conclude that the removal of NTB's causes negative effects on the ports of Patras and Thessaloniki. Since the subsidies provided to these ports support their income, it is obvious that they have to take advantage of them to renovate their infrastructure and to restructure their activities. On the opposite, the ports of Piraeus, Heraklion and Volos can achieve positive effects in export value even if they don't make use of the subsidies provided to them. The graph provided below offers an overview of the welfare effect caused by the reduction of NTB's.

Figure 9: Welfare effect of NTB's and subsidies in container cargo flows



Source: Compiled by the author

In the introductory paragraph, the reduction of the NTB's had been characterized by the author as a pro-competition reform. The Greek port and maritime industry is also characterized by the lack of reforms, which would help them to compete with the European and Asian ports on equal terms. As a result, major shipping companies don't consider the Greek ports as an important cargo destination. The Greek ports' structural problems (which are associated with the existence of the NTB's incorporated in this analysis) have created a situation which is no longer sustainable.

To sum up, the reduction of NTB's will create positive impacts in the final consumer's (and user's) surplus and almost neutral impacts to the shippers and the logistic service providers. Based on the diagram provided above, the author concludes that the shippers and the logistics service providers will lose their capability to charge high prices for moving the containers at the route Asia-Europe. Furthermore, the upgrading of the services provided in the Greek ports and the high growth rates will increase competition by foreign shippers, which will be tempted to enter the Greek ports' industry in the long-run. Thus, the prices will remain rather stable or they are going to fluctuate with non-significant percentages of growth or reduction. On the other side, the expected reduction of freight rates will reduce the transportation costs of the products carried in containers, thus putting a pressure for the reduction of the final prices of the goods offered to the customers.

5.3. Reduction of NTB's and dry/liquid bulk cargo exports

In contrast to container shipping, the carriage of dry bulk and liquid bulk products can be considered as an important source of revenues for both the Greek ports and the Greek taxation authorities. Greek shippers and logistic service providers are specialized on carrying dry and liquid bulk cargo from the places of origin like Middle East to the places of destination like the Western developed countries. It is worth referring that approximately the 20% of the tanker fleet is controlled by Greek owners (Spathi et al., 2010). Although Greek shippers are not only operating in the traditional routes Asia-Europe affecting the Greek ports' trade flows, it is obvious that part of the Greek-owned fleet is transferring bulk cargo to the Greek customers.

Bulk commodities are subdivided into two categories; liquid bulk and dry bulk. Dry Bulk commodities include products like steel, iron ore, coal, grain and other agricultural products. On the other side, liquid bulk is a really significant sector for the development of every economy as it is highly interconnected with fuels and derivatives of energy resources. Oil, petroleum, gasoline, liquefied natural gas and chemical industry derivatives are some of the most characteristic liquid commodities to be transported through the bulk carriers. Alongside with the existing target of turning the Greek ports into transit hubs, carrying adequate quantities of these dry and liquid commodities in a rapid and an efficient way allows the industry sector to manufacture a wide range of goods.

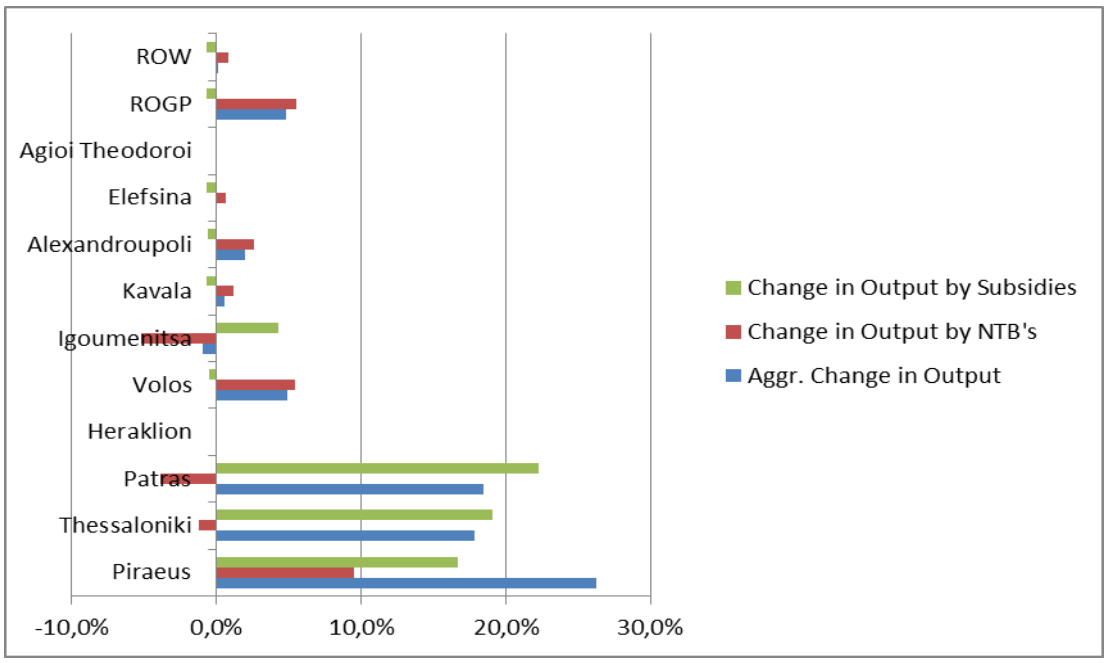
However, it must be referred that there is a particular limitation in the current research. Bulk commodities like oil and iron ore are being negotiated in the world stock markets, being also indicators for the global economic growth. Given the fact that it is rather difficult to predict the cyclicality trends of these commodities' supply and demand, the fluctuations in their daily, weekly and yearly prices is expected to affect the freight rates, the transport costs and the commodity prices. The current analysis considers the commodities' prices to remain constant at the long-term; although it is worth referring that an increase in prices is probable to reduce both production and supply of manufactured goods. That's why the estimations of the micro-economic effects coming from the reduction of NTB's may be subject to commodity prices' changes. The graphs provided below indicate us the growth rates achieved in the Greek ports after the reduction of NTB's. It must be however referred that this analysis believes that the ports of Agioi Theodoroi and Piraeus don't accept dry and liquid bulk cargo flows, respectively, whereas the exporting character of the port of Heraklion in liquid bulk is rather limited. These are the restrictions of this part of the research.

Table 35: Growth rates of bulk commodities' export values in Greek ports

Dry Bulk	Aggr. Change in Output	Change in Output by NTB's	Change in Output by Subsidies
Piraeus	26,2%	9,5%	16,7%
Thessaloniki	17,8%	-1,2%	19,1%
Patras	18,4%	-3,9%	22,3%
Heraklion	0,0%	0,0%	0,0%
Volos	4,9%	5,4%	-0,5%
Igoumenitsa	-1,0%	-5,2%	4,3%
Kavala	0,5%	1,2%	-0,7%
Alexandroupoli	2,0%	2,6%	-0,6%
Elefsina	0,0%	0,7%	-0,7%
Agioi Theodoroi	0,0%	0,0%	0,0%
ROGP	4,8%	5,5%	-0,7%
ROW	0,1%	0,8%	-0,7%
Liquid Bulk	**Aggr. Change in Output**	**Change in Output by NTB's**	**Change in Output by Subsidies**
Piraeus	0,0%	0,0%	0,0%
Thessaloniki	17,8%	-1,2%	19,1%
Patras	18,4%	-3,9%	22,3%
Heraklion	13,4%	14,1%	-0,6%
Volos	4,9%	5,4%	-0,5%
Igoumenitsa	-1,0%	-5,2%	4,3%
Kavala	0,5%	1,2%	-0,7%
Alexandroupoli	1,9%	2,6%	-0,6%
Elefsina	0,0%	0,7%	-0,7%
Agioi Theodoroi	4,8%	5,5%	-0,7%
ROGP	4,8%	5,5%	-0,7%
ROW	0,1%	0,8%	-0,7%

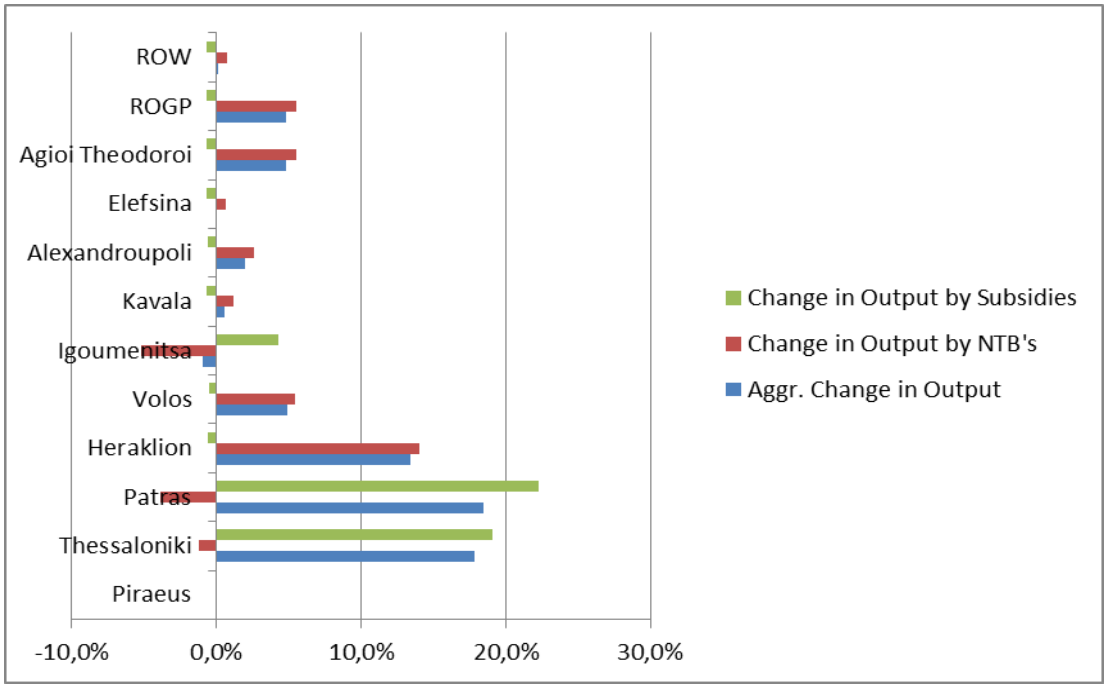
Source: Compiled by the author

Figure 10: Growth rates in dry bulk cargo exports of Greek ports after the reduction of NTB's



Source: Compiled by the author

Figure 11: Growth rates in liquid bulk cargo exports of Greek ports after the reduction of NTB's



Source: Compiled by the author

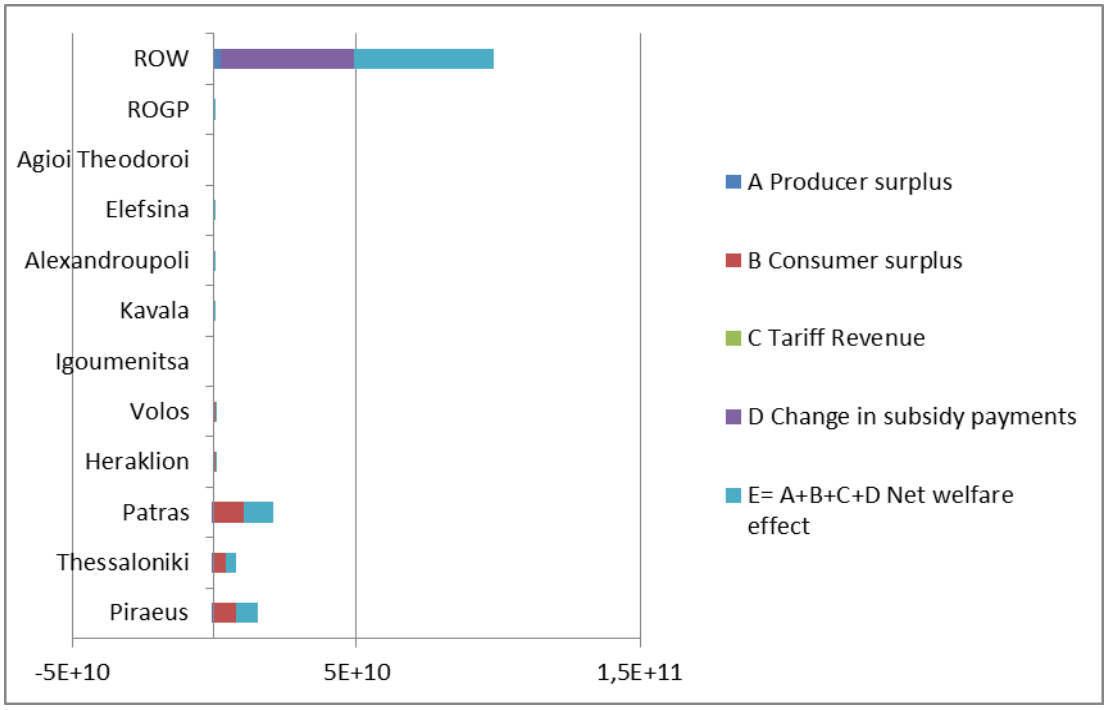
An important detail that needs to be taken into account refers to the variable under the name 'ROGP'. This variable expresses the dry and liquid bulk terminal existing in the overall Greek periphery and don't belong to the ownership of anyone of the 10 ports. Characteristic examples of ports belonging to this category are the dry bulk terminal in Astakos, the refineries in Skaramagas and Aspropyrgos and the platforms of oil exploitation in Prinos. The graphs provided above show us a rather similar picture in the exchange of trade flows of dry bulk and liquid bulk commodities in the Greek ports (imports and exports). This observation can be partially explained by the methodological assumption the author has made; no matter the type of dry/liquid bulk commodity the ship can carry, the charter spots remain the same.

It must be referred that the majority of the trade flows of dry bulk and liquid bulk commodities handled in Greek ports are transported in the axis Asia-Europe. According to the GSIM calibration, it seems that the ports of Heraklion, Agioi Theodoroi, Piraeus and Volos are specialized in attracting and managing bulk cargo flows, partially because of their location in the eastern coast of Greece. Some ports like Aspropyrgos could be also included in this category, as expressed with the ROGP variable. Their advantageous geographical location can make us to consider that shippers can develop connections between the Greek ports and the Asian-Middle East ports. On the contrary, the ports of Patras and Thessaloniki appear negative rates of export value growth, as they have mainly developed connections with the western world rather than the Asian market. Like the container cargo analysis, these ports tend to use subsidies as a source of income.

It is true that the rates of growth incurred by some of the largest Greek ports are really impressive. For example, the ports of Piraeus, Thessaloniki and Patras can incur rates of export growth from 15% to 27%. However, the author believes that the enthusiasm coming from this finding must be moderated, because these number are highly dependent on subsidies provided to the ports and exporters. Getting subsidies outside of this analysis, the port of Heraklion seems to appear rates of growth almost reaching 15% for dry bulk, whereas the ports of Piraeus and Volos are also performing really well. On the other side, the ports of Patras and Igoumenitsa form negative rates of growth in exports. In that case the ambitious target of 6% growth is achieved (and surpassed) by the ports of Piraeus and Heraklion, following by the port of Volos.

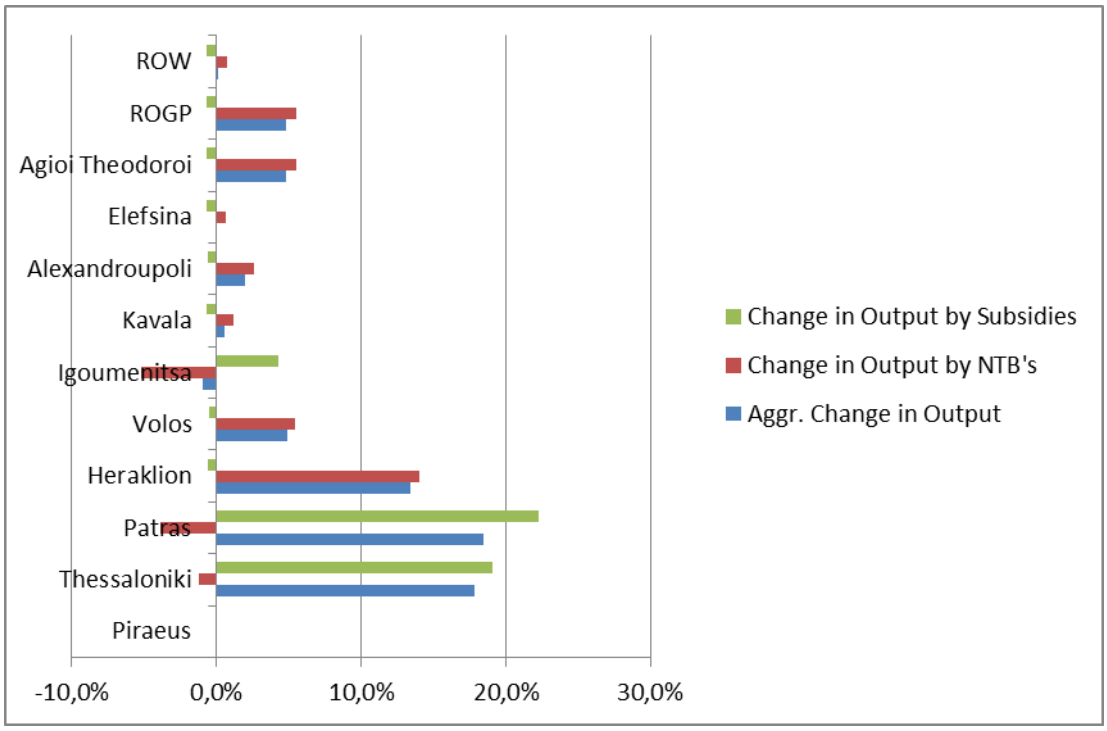
In general, it is obvious that the Greek ports should accept and develop trade flows from the developing markets like BRICS and the remaining Asian countries. A well-established trade policy could include the following; exports of high-quality agricultural products from Greece to Asia, imports of iron ore from China, as well as imports of oil and LNG from Russia etc. In addition to this, the Greek shippers and logistics service providers could be motivated to take part in this transport industry from Asia to Europe so as to generate value added, given the fact that they maintain a comparative advantage by making use of the economies of scope (know-how). A trade approach like this will probably cause the following effects in the Greek economy welfare, as extracted from the GSIM modeling.

Figure 12: Welfare effect of NTB's and subsidies in dry bulk cargo flows



Source: Compiled by the author

Figure 13: Welfare effect of NTB's and subsidies in liquid bulk cargo flows



Source: Compiled by the author

According to the GSIM modeling and the diagrams provided above, the author reaches the conclusion that the removal or reduction of NTB's causes about the similar effects to the dry bulk and the liquid bulk sector of the port industry with the ones extracted in the container industry of the Greek ports. Despite the advanced services provided by the Greek ports, the liberalization of the Greek port industry and the removal of NTB's will facilitate the entrance of competitive foreign shippers in the domestic market, resulting to the reduction of spot rates. However, the shippers will reduce their shipping and voyage costs due to increased efficiency in the port and transport sector, and the results from the second effect will exceed the ones generated from the first one. On the other side, the final users such as the households and the companies will be benefitted from the reduction of both spot rates and voyage costs, as these products will become available at more competitive prices. As a matter of fact, these effects are expected to create a 'positive shock' throughout the entire Greek economy.

5.4. Reduction of NTB's and Ro-Ro cargo throughput

The carriage of relevant cargo through the use of Ro-Ro ships remains an issue of particular interest for the Greek ports. Although the Ro-Ro volumes transported through the Greek ports are considered to be small compared to the cargo volumes of the other categories examined (Container, Dry Bulk and Liquid Bulk), their significance for the Greek ports must not be ameliorated. These products to be transported to/from Greece are high-valued per average item (according to the hypothesis the author has made). Until now, based on the data retrieved from the ESPO Annual Reports, the ports of Patras, Igoumenitsa and Elefsina are currently managing the largest Ro-Ro cargo flows in terms of gross tonnage.

Ro-Ro cargo freight consists of autos, trucks, buses, tractors or other vehicles. Apart from being measured in tons, the carriage of cars and other vehicles throughput is also counted on items. This way of measuring Ro-Ro cargo could facilitate the procedures in car terminals of the ports. However, due to the different size of vehicles, the author has measured the quantity of the Ro-Ro in tons. These vehicles are 'rolled on' and 'rolled off' from platforms specially designed for loading and unloading this particular type of cargo. The current analysis examines the impacts of Ro-Ro trade flows on selected Greek ports.

Generally speaking, the Ro-Ro cargo trade flows existing among the Greek ports and the other countries include car or vehicle imports from other countries to Greece or the possibility of having the vehicles transit traded through the Greek ports. As a matter of fact, the Greek ports are used in the overall transportation process for two reasons. First of all, vehicles are being imported from foreign producers to serve the needs of the domestic Greek market. In addition to this, the Greek ports can be considered as intermediary points during the process of vehicles' carriage from the point of origin to some other point in the hinterland of the Greek ports.

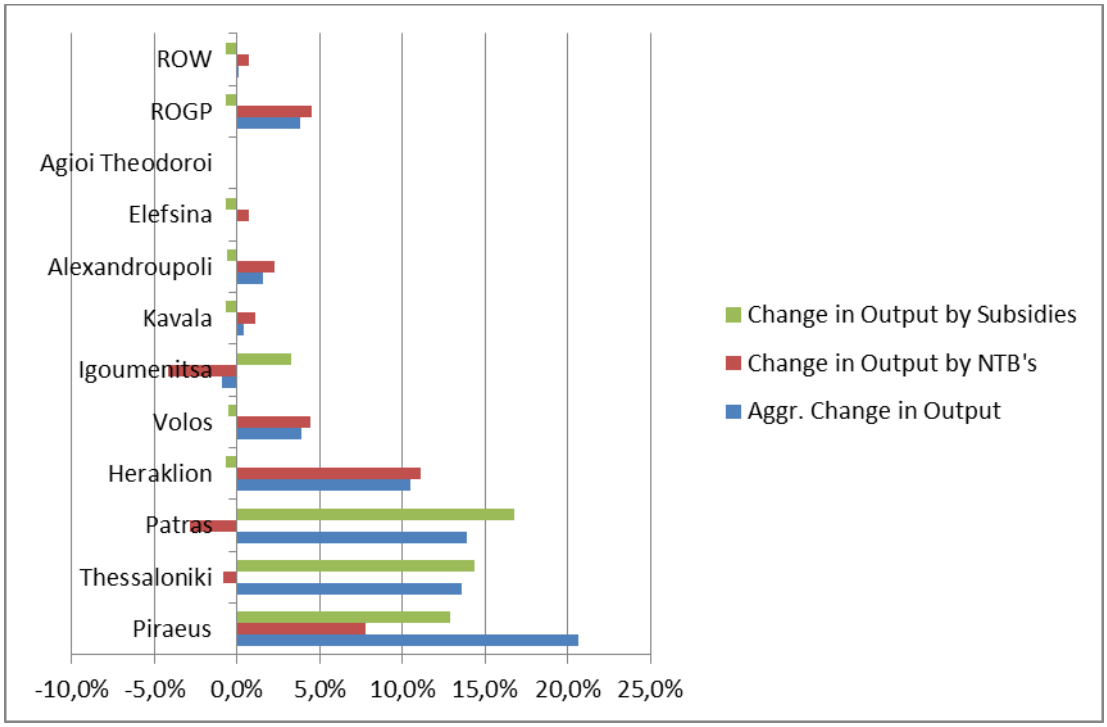
Since the Greek ports have not been integrated as parts of the global supply chain, the author believes that their significance as transit hubs of vehicles is rather limited. As a consequence, vehicles are mostly carried from foreign factories and warehouses to become available in the Greek domestic market. Under the assumption that the NTB's will be reduced under the existing methodology, the graphs provided below offer us the outcomes extracted from the calibration of the GSIM model.

Table 36: Growth rates of Ro-Ro commodities' export values in Greek ports

	Aggr. Change in Output	Change in Output by NTB's	Change in Output by Subsidies
Piraeus	20,6%	7,8%	12,8%
Thessaloniki	13,5%	-0,8%	14,4%
Patras	13,9%	-2,8%	16,7%
Heraklion	10,5%	11,1%	-0,7%
Volos	3,9%	4,4%	-0,5%
Igoumenitsa	-1,0%	-4,2%	3,2%
Kavala	0,4%	1,1%	-0,7%
Alexandroupoli	1,6%	2,2%	-0,6%
Elefsina	0,0%	0,7%	-0,7%
Agioi Theodoroi	0,0%	0,0%	0,0%
ROGP	3,8%	4,5%	-0,7%
ROW	0,1%	0,7%	-0,7%

Source: Compiled by the author

Figure 14: Growth rates of Ro-Ro cargo exports in Greek ports after the reduction of NTB's

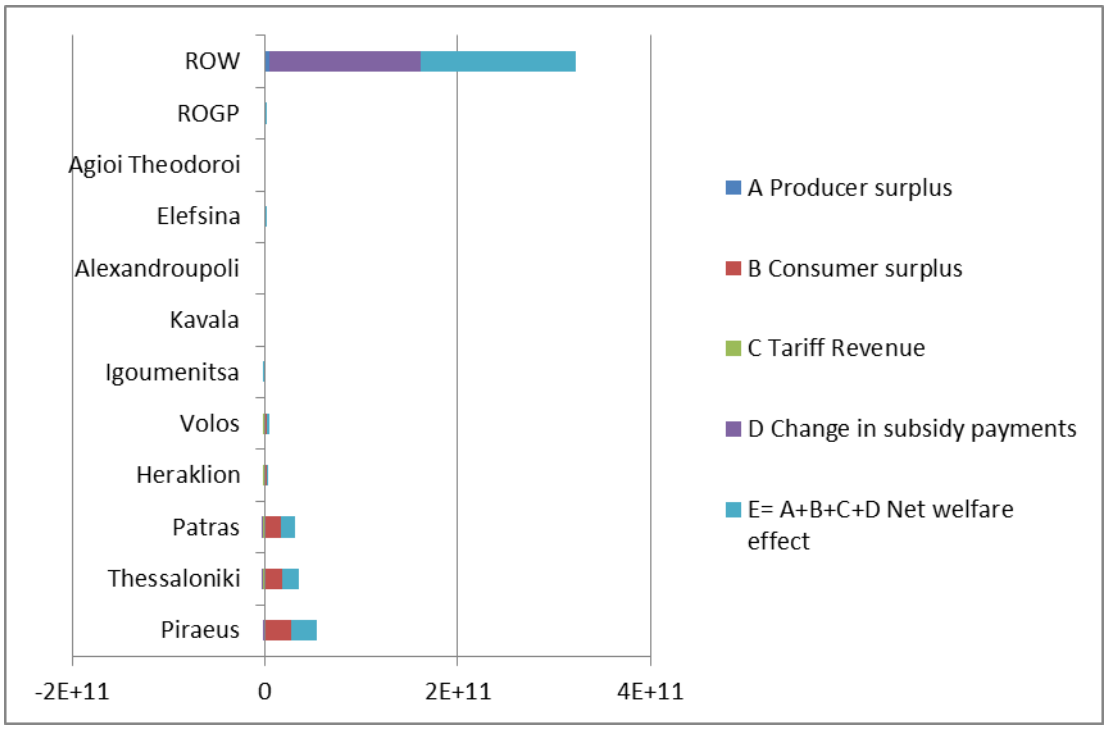


Source: Compiled by the author

Based on the research conducted by the author, it must be referred that the GSIM model showed some quite interesting outcomes. The ports of Patras and Igoumenitsa, will not increase their export value significantly despite the existence of

subsidies. On the contrary, the 4 largest Greek ports appear similar outcomes with the other categories of cargo examined from the process of removing NTB's, as well as under the impact of subsidies. Specifically the ports of Heraklion, Piraeus and Volos are the ones that manage to catch, or at least try to catch the target of 6% export growth. This paradox could be explained by the fact that vehicles are produced in many different countries and not only in the European ones. More specifically parts of the vehicles are also manufactured in Asian countries. In addition to this, the European cars' manufacturers have moved their production lines in Eastern Europe countries and in Turkey. This strategy has also caused the following effects to the welfare of the Greek economy, as extracted by the graph provided below.

Figure 15: Welfare effect of non-tariff barriers in Ro-Ro cargo flows



Source: Compiled by the author

Last but not least, the welfare effects caused by the reduction of NTB's are similar to the welfare effects generated in the other cargo categories handled in Greek ports. The consumer surplus increases as the prices of the vehicles are reduced due to smaller transport costs. Increased efficiency in Greek ports also reduces time costs and the delivery time of the vehicles to their final buyer. On the other side, NTB's reduction in maritime transportation doesn't seem to affect industrial production of manufacturing vehicles. The production of manufactures in the foreign countries is affected by the special and endogenous characteristics of the foreign economies. Since these products are mostly imported in or transported through Greece, the reduction of NTB's in the Greek economy affects the domestic consumer rather than the foreign producer.

5.5. Proposals for the inauguration of port and maritime strategy

Since the author has emphasized on the reduction of NTB's by defining the measures to be taken in order to achieve this reduction, a particular policy needs to be established aiming at growing and developing the maritime industry in Greece. Although Greece is located at a strategic position in the Mediterranean Sea, he has not still benefitted from the growing importance of seaborne trade, as well as by the increase of the cargo flows traded at an international level. It is obvious that reforms need to be made to improve port efficiency.

To begin with, port governance is an extremely critical issue for the survival and the growth of the Greek port industry. Although the port authorities have been granted autonomy as administrative bodies, the public sector intervenes in the Greek port industry. Apart from the ports of Piraeus and Astakos, which have been privatized and the port of Agioi Theodoroi, which serves the needs of the local refinery, the Greek government and public sector is the major shareholder of the remaining ports (ELIME 2012). However, the Greek government debt crisis and the financial needs incurred by the stabilization program have revitalized the interest for the privatization of these ports.

The main notion behind this approach is concentrated on taking decisions about financing the infrastructure of the ports. The Greek government doesn't have unlimited resources and other parties must contribute to the overall process of financing the ports' infrastructure. The author 'votes' in favor of a 'hybrid model', which will combine government control on the shares' portfolio of the port with public and private financing to develop the infrastructure, as well as rail, road and short-sea connections with major shipping lines and other ports to increase the cargo flows. Public-Private Partnerships (PPP's) could be also developed between linear shipping companies and port authorities to manufacture the port infrastructure, container terminals and other connections. Ports can also sign concession agreements with the private sector to exploit particular areas of interest and to establish industrialized units of production.

In addition to this, the port labor force could be also reformed. It is true that investments on port industry can also have positive effects in labor efficiency, as funding provided to the ports by different sources will be used to increase the quality and the quantity of the machinery of the ports. In this way, newly built quay cranes, efficient processes in stacking, automation technology and adequate storage places can increase the number, the speed and the reliability of handling moves. However, emphasis must be also given on hiring qualified, experienced and well-trained personnel, which will be able of making use of the advanced machinery at an efficient level. On the opposite, the full abolition of restrictive practices in shipping, although right in theory, still remains a controversial issue. Firstly, such a policy can face the reactions of different pressure groups, leading to conflicts and strikes. Furthermore, these liberalized strategies must be applied after careful planning, so as to take the differentiated characteristics and nature of the Greek economy into consideration.

Except from efficiency, ports' authorities must also strive to solve congestion issues. Managing cargo flows is a really critical issue, being dependent on the allocation of cargo at the given area length and width. According to the calibrations provided at

the GSIM model, the Container, Dry bulk, Liquid Bulk and Ro-Ro cargo flows are expected to increase after the reduction of NTB's. Specifically, the ports of Patras, Volos and Igoumenitsa will be heavily affected by this reduction, as they will accept significantly increased larger volumes. As a matter of fact, congestion issues need to be resolved in order to reduce time costs in front of the docks, locks or customs. Thus, it is worth referring that the customs' authorities need to be modernized and registration, container scanning and documentation process must be simplified and electronically conducted.

Acting at a macro-economic policy, the Greek governments must fully understand the significance of the Greek ports as parts of the global and the European supply chain. As emphasized on the current paper, the Greek location is located exactly on all the routes connecting the Eastern with the Western countries. Based on the simulation conducted on the current research, the ports of Heraklion and Piraeus do have the largest estimated growth in the value of cargo. As a result, these ports can be turned into transit hubs. The port of Piraeus can serve the needs of the overall Balkan Peninsula by attracting cargo flows from Europe and Asia, whereas the port of Heraklion can increase its throughput value from 8% to 10% by taking advantage of its location near the continents of Asia, Africa and Europe. The highest growth is observed at the liquid/dry bulk category of cargo, which includes the transportation of oil, petroleum, iron ore etc. from Asia to Europe.

As far as the exchange of cargo flows with Europe is concerned, the manufacturing of the major railway and road axis is really important. The capability of the Greek government to absorb all the relevant funding from the NSRF needs to be improved. Railway axis among the Greek ports must be established and manufactured, and the Greek railway network must shift itself from the passenger transportation to the transportation of goods. For example, the Priority Plan 22 of TEN-T must be executed as soon as possible so as to propose an alternative solution other than road transportation in terms of land transport. It must be currently referred that there is no rail connection between the central market of Athens and the international port of Patras, as well as rail connection connecting Greece with Central Europe. It is obvious that establishing adequate rail and road connections is a necessary preposition for developing multimodal transport and transit trade in the Greek ports.

The author also believes that a strategy must be implemented in terms of dry and liquid bulk carriage of the relevant goods. Studies and scientific researchers must be financed to ensure the existence of oil, petroleum and LNG fields in the Aegean or the Ionian Sea. Given the fact that some of these fields which can be exploited are located near the island of Crete, the port of Heraklion can become both a port of origin for LNG and petroleum and a transit hub. The exploitation of these fields is provided to the private sector through a concession agreement, whereas particular areas in the port of Heraklion can be also hired by the LNG operator. The operator can also participate on the funding of infrastructure in this port, as the development of a modern port is a matter of shared interest for all the participating parties. This policy aims at increasing the energy independence of Greece, as the country will be less dependent on the pipelines transferring oil and gas from the Middle East and the Caspian Sea to Europe. In addition to this, carrying LNG and oil from the place of origin to the place of destination by sea will support the domestic maritime industry.

To sum up, the Greek shipping in the future can become a crucial factor leading the Greek economy to the growth path. It is obvious that these high rates of throughput value growth can create a positive shock in the Greek economy. However, the author thinks that port and maritime industry policy must be designed, planned and executed by the administrative bodies of the Greek government such as the Ministry of Shipping, although the private sector will dominate shipping in a market-based, internationalized approach.

6. Additional Conclusions

6.1. Final Remarks

The investigation procedure of the current research has revealed us some interesting points in the important issue of the way the non-tariff barriers of the Greek port and maritime industry affect the entire Greek economy. Although this research has used a really simplified analysis to calculate the NTB's by making a lot of heroic and non-realistic assumptions, interesting remarks about the development and the growth of Greek seaborne trade and maritime industry have been pointed out. These remarks could be considered as a good starting point for discussion so as to enhance a port and maritime policy which can support the Greek economy by reducing the negative effects of the existing recession.

Starting with, government intervention in seaborne trade and distribution costs cannot be easily reduced. The current monetarist program carried out by the Greek authorities under the consultancy of the International Monetary Fund and the European Central Bank doesn't allow the Greek government to incur significant changes on the taxation system and the subsidization policy. On the other hand positive changes in maritime transport costs, time costs, the standardization of technical barriers to trade and the increase of port efficiency can increase the throughput value of the cargo traffic of all the Greek ports.

As far as the cargo categories are concerned, it must be referred that dry and liquid bulk cargoes appear higher rates of growth in the majority of ports rather than containers and Ro-Ro. This observation could be explained by the specialization of the Greek shippers in oil and petroleum carriage (Spathi et al. 2010). On the other hand, the port of Piraeus is the only port which has already achieved rates of containerization close to 50%. The containerization rates in the other ports are much lower.

Based on the current analysis, the ports of Heraklion and Piraeus appears a significant dynamism and potential in terms of the reduction of NTB's. In contrast to this port, the ports of Patras, Thessaloniki and Igoumenitsa appear the following paradox; although they appear significant rates of growth of cargo quantity, the value of their throughput is slightly increased compared to the growth rates of other ports. This paradox can be explained by the fact that the ports appear higher documentation and regulation requirements, which are translated into time and congestion costs, due to their integration in the TEN-T network. In addition to this, the ports of Kavala and Alexandroupoli appear small fluctuations of the exports' value.

6.2. Proposals for further research

As far as the existence of NTB's and their impact on trade flows are concerned, this research leaves several crucial matters and fields for further research open. The nature of the research forces the author to make a lot of assumptions, which can prove out to be unrealistic. The interpretation and the calculation of the given existing barriers to trade were conducted on the basis of past data, which may not fit to the current data. That's why the author offers some more topics for research, aiming at calculating the equivalents of NTB's at a more accurate way.

To begin with, a sensitivity analysis must be carried out to define the particular characteristics of both international supply and demand of every demand. In this way, the effects of a possible removal of NTB's can be predicted much more easily, as the elasticities and the substitution effects would be already known. This approach will also help the author to predict the cyclicality of the market. It is worth referring that cyclicality trends help us to find out which are the most suitable methods to smoothen the effects of a deep recession like the one we are surviving to.

In addition to this, the calculation of the port efficiency in Greek ports and the ratings they are given is a quite interesting topic. Not only it helps us to calculate the maritime transport costs but it also gives us a feedback for the estimation of important variables like the maritime employment efficiency and the competitiveness of Greek ports. These variables could also be used to define the pricing strategy of every port on its own, as well as their capability to become port clusters by generating value added. This is a really important topic as it defines their evaluation of their possibilities of growth and development.

Another interesting topic could be the estimation of the time needed to get out of the current recession. Since ports are acting in a very liberalized and internationalized environment, it is obvious that every positive or negative shock incurred at a global level is 'transmitted' through the port industry. Given the fact that this trend effects seaborne trade at first, the future researcher could be able to calculate the cyclicality of the shipping market and compare it with past periods of crisis. This study will be a really useful tool for future researchers aiming at conducting surveys for the possibilities, the threats, the opportunities and the weakness of a particular part of the shipping industry or of the shipping industry in general.

Last but definitely not least, the survey the author has conducted on the NTB's of Greek ports for these four types of cargo could be made for some benchmark strategic types of products. For instance, emphasis could be given on fuels like LNG, gas, petroleum or on products used on heavy industry such as iron ore. The prices, the production and the trade flows could be considered as an indicator for the trends of these products in heavy industry, as well as for both producer's and consumer's needs. If the researcher finds out a strong positive relationship between the removal of NTB's and the growth of these products, it can be easily referred that there will be a comparative advantage in trading these types of goods.

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Appendices

Calculation of labor handling costs

The calculation of labor handling costs will be achieved on the basis of a number of following equations. The equations provided below are based on simple labor economic theory and they are extracted from Bitros et al. (2001). After calculating the basic labor microeconomic variables, they are presented in the tables provided after the equations.

$$ACH = \frac{\sum_{i=1}^{n} CH}{n}$$

$$OCH = CCH + RRCH + DBCH + LBCH + GCH$$

$$APE = \frac{ACH}{L}$$

$$LHC = \frac{ASE}{APE}$$

Where

CH: Cargo handled

ACH: Average Cargo handled

CI: Cargo Imported

CE: Cargo Exported

n: Number of years

OCH: Overall Cargo handled

CCH: Container Cargo handled

RRCH: Ro-Ro Cargo handled

DBCH: Dry Bulk Cargo handled

LBCH: Liquid Bulk Cargo handled

GCH: General Cargo handled

APE: Average Productivity of employees

L: Number of employees (labor force)

ASE: Average Salary of employees

Table 37: Economic indicators and costs for the Port of Piraeus, 2008-2011

Port of Piraeus	
Average Container Cargo handled	4,937,933.85 tons
Average Ro-Ro Cargo handled	740,422.75 tons
Average Dry Bulk Cargo handled	2,577.25 tons
Average Liquid Bulk Cargo handled	515,151.75 tons
Average General Cargo handled	5,420,023.07 tons
Average Overall Cargo handled	11,676,839.82 tons
Number of employees	1,846.00 employees
Average productivity of employees	6,325.29 tons/employee
Average salary of port employees	52,629.64 US$/year
Labor handling cost	8.32 US$/ton handled

Source: Compiled by the author, Data collected from Piraeus Port Authority (2013)

Table 38: Economic indicators and costs for the Port of Thessaloniki, 2008-2011

Port of Thessaloniki	
Average Container Cargo handled	2,781,715.00 tons
Average Ro-Ro Cargo handled	82,711.00 tons
Average Dry Bulk Cargo handled	3,843,118.00 tons
Average Liquid Bulk Cargo handled	7,632,108.00 tons
Average General Cargo handled	870,498.00 tons
Average Overall Cargo handled	15,210,148.00 tons
Number of employees	646.00 employees
Average productivity of employees	23,545.12 tons/employee
Average salary of port employees	57,162.34 US$/year
Labor handling cost	2.43 US$/ton handled

Source: Compiled by the author, Data collected from Thessaloniki Port Authority (2013)

Table 39: Economic indicators and costs for the Port of Patras, 2009-2011

Port of Patras	
Average Container Cargo handled	303,056.73 tons (estimated)
Average Ro-Ro Cargo handled	2,758,000.00 tons
Average Dry Bulk Cargo handled	271,205.00 tons (estimated)
Average Liquid Bulk Cargo handled	109,785.00 tons (estimated)
Average General Cargo handled	92,333.33 tons
Average Overall Cargo handled	3,534,380.06 tons (estimated)
Number of employees	72.00 employees
Average productivity of employees	49,088.61 tons/employee
Average salary of port employees	56,477.15 US$/year
Labor handling cost	1.15 US$/ton handled

Source: Compiled by the author, Data collected from ESPO (2012), Ypourgeio Oikonomikon (2012) and Dimas (2008)

Table 40: Economic indicators and costs for the Port of Heraklion, 2008-2011

Port of Heraklion	
Average Container Cargo handled	158,640.00 tons
Average Ro-Ro Cargo handled	97,893.00 tons
Average Dry Bulk Cargo handled	146,481.00 tons
Average Liquid Bulk Cargo handled	20,122.00 tons
Average General Cargo handled	27,363.00 tons
Average Overall Cargo handled	450,500.00 tons
Number of employees	52.00 employees
Average productivity of employees	8,663.46 tons/employee
Average salary of port employees	60,855.26 US$/year
Labor handling cost	7.02 US$/ton handled

Source: Compiled by the author, Data collected from Heraklion Port Authority (2013) and Hellenic Statistical Authority (2010)

Table 41: Economic indicators and costs for the Port of Volos, 2008-2011

Port of Volos	
Average Container Cargo handled	298,616.90 tons
Average Ro-Ro Cargo handled	60,000.00 tons
Average Dry Bulk Cargo handled	543,325.00 tons
Average Liquid Bulk Cargo handled	315,652.35 tons
Average General Cargo	64,535.75 tons
Average Overall Cargo handled	1,282,130.00 tons
Number of employees	64.00 employees
Average productivity of employees	20,033.28 tons/employee
Average salary of port employees	52,186.17 US$/year
Labor handling cost	2.60 US$/ton handled

Source: Compiled by the author, Data collected from Volos Port Authority (2013) and ESPO (2012)

Table 42: Economic indicators and costs for the Port of Igoumenitsa, 2008-2011

Port of Igoumenitsa	
Average Container Cargo handled	0.00 tons
Average Ro-Ro Cargo handled	2,338,250.00 tons
Average Dry Bulk Cargo handled	414,750.00 tons
Average Liquid Bulk Cargo handled	73,600.00 tons
Average General Cargo handled	161,000.00 tons
Average Overall Cargo handled	2,987,600.00 tons
Number of employees	18.00 employees
Average productivity of employees	165,977.78 tons/employee
Average salary of port employees	33,887.70 US$/year
Labor handling cost	0.20 US$/ton handled

Source: Compiled by the author, Data collected from ESPO (2012)

Table 43: Estimates for economic indicators and costs for the Port of Kavala, 2007-2010

Port of Kavala	
Average Container Cargo handled	330,825.60 tons
Average Ro-Ro Cargo handled	11,000.00 tons
Average Dry Bulk Cargo handled	989,666.67 tons
Average Liquid Bulk Cargo handled	11,353.73 tons
Average General Cargo handled	270,750.00 tons
Average Overall Cargo handled	1,613,596.00 tons
Number of employees	15.00 employees
Average productivity of employees	107,573.07 tons/employee
Average salary of port employees	38,486.74 US$/year
Labor handling cost	0.36 US$/ton handled

Source: Compiled by the author, Data collected from Kavala Port Authority (2013) and ESPO (2012)

Table 44: Estimates for economic indicators and costs for the Port of Alexandroupoli, 2007-2010

Port of Alexandroupoli	
Average Container Cargo handled	0.00 tons
Average Ro-Ro Cargo handled	38,031.00 tons
Average Dry Bulk Cargo handled	271,106.00 tons
Average Liquid Bulk Cargo handled	4,600.00 tons
Average General Cargo handled	4,700.00 tons
Average Overall Cargo handled	318,437.00 tons
Number of employees	8.00 employees
Average productivity of employees	39,804.63 tons/employee
Average salary of port employees	36,413.67 US$/year
Labor handling cost	1.09 US$/ton handled

Source: Compiled by the author, Data collected from Alexandroupoli Port Authority (2013) and ESPO (2012)

Table 45: Estimates for economic indicators and costs for the Port of Elefsina, 2008-2011

Port of Elefsina	
Average Container Cargo handled	0.00 tons
Average Ro-Ro Cargo handled	1,359,333.00 tons
Average Dry Bulk Cargo handled	1,969,250.00 tons
Average Liquid Bulk Cargo handled	10,048,750.00 tons
Average General Cargo handled	1,251,750.00 tons
Average Overall Cargo handled	14,629,083.00 tons
Number of employees	18.00 employees
Average productivity of employees	812,726.83 tons/employee
Average salary of port employees	62,422.05 US$/year
Labor handling cost	0.08 US$/ton handled

Source: Compiled by the author, Data collected from ESPO (2012)

Table 46: Estimates for economic indicators and costs for the Port of Agioi Theodoroi, 2008-2011

Port of Agioi Theodoroi	
Average Container Cargo handled	0.00 tons
Average Ro-Ro Cargo handled	0.00 tons
Average Dry Bulk Cargo handled	0.00 tons
Average Liquid Bulk Cargo handled	16,618,500.00 tons
Average General Cargo handled	0.00 tons
Average Overall Cargo handled	16,618,500.00 tons
Number of employees	No data provided
Average productivity of employees	No data provided
Average salary of port employees	No data provided
Labor handling cost	No data provided

Source: Compiled by the author, Data collected from ESPO (2012)

Calculation of subsidies

The tables provided below were used to calculate the aggregated monetary amounts of subsidies provided to the Greek ports by the European Commission authorities. It must be also referred that these tables have been designed to provide information about the exact amount of money each one of the 10 ports examined has been given. These tables have been the basis of identifying the 'tariff-equivalent' of the subsidies provided.

Table 47: Subsidies in Greek ports from EU

	Current scenario	Future scenario
Piraeus	US$ 15,608,692.16	US$ 68,080,465.82
Thessaloniki	US$ 7,306,196.33	US$ 20,590,189.66
Patras	US$ 10,514,594.79	US$ 21,141,789.46
Igoumenitsa	US$ 6,286,175.42	US$ 6,286,175.42

Source: Compiled by the author

Table 48: Subsidies in Greek ports from EU allocated per ton of cargo handled

	Current scenario	Future scenario
Piraeus	US$ 1.34	US$ 5.83
Thessaloniki	US$ 0.48	US$ 3.94
Patras	US$ 2.97	US$ 5.98
Igoumenitsa	US$ 2.10	US$ 2.10

Source: Compiled by the author

Table 49: Subsidies by the Priority Plans of the TEN-T strategy

	Current scenario	Future scenario
Piraeus	US$ 2,32	US$ 2,32
Thessaloniki	US$ 4,98	US$ 4,98
Patras	US$ 8,17	US$ 8,17
Heraklion	US$ 1,03	US$ 1,03
Volos	US$ 6,03	US$ 6,03
Igoumenitsa	US$ 4,97	US$ 4,97
Kavala	US$ 0,29	US$ 0,29
Alexandroupoli	US$ 1,46	US$ 1,46
Elefsina	US$ 0,03	US$ 0,03
Agioi Theodoroi	US$ 0,02	US$ 0,02
ROGP	-	-

Source: Compiled by the author

Average Value of Exports in Greek ports

Last but not least, the GSIM requires the use of exports' value in Greek ports as inputs. The tables provided below offer an average approach of these exports' value to be used in the first matrix of GSIM.

Table 50: 2008-2011 Average Export value of Container cargo in Greek ports (in US$)

	Europe	Asia	America	Africa	Oceania
Piraeus	655766042,62	101355889,63	66851756,99	51381154,04	62257456,72
Thessaloniki	527696250,90	81561287,85	53795743,05	41346517,80	50098700,40
Patras	43032683,20	6651176,80	4386946,40	3371734,40	4085459,20
Heraklion	7152064,40	1105430,60	729113,80	560384,80	679006,40
Volos	77317585,93	11950287,45	7882104,49	6058055,06	7340417,08
Igoumenitsa	0	0	0	0	0
Kavala	27221109,60	4207323,35	2775043,06	2132852,17	2584331,82
Alexandroupoli	0	0	0	0	0
Elefsina	0	0	0	0	0
Ag. Theodoroi	0	0	0	0	0
ROGP	305451822,5	47210955,13	31139140,62	23933028,13	28999143,58
ROW	9,77594E+12	5,49878E+12	1,09924E+13	8,29284E+11	5,54759E+11

Source: Compiled by the author

Table 51: 2008-2011 Average Export value of Dry Bulk cargo in Greek ports (in US$)

	Europe	Asia	America	Africa	Oceania
Piraeus	5677351,52	877497,43	578774,90	444836,81	538999,34
Thessaloniki	130899102,52	20231903,03	13344446,68	10256320,87	12427366,90
Patras	11130489,40	1720340,15	1134692,44	872105,83	1056712,18
Heraklion	0	0	0	0	0
Volos	22298488,31	3446477,82	2273208,77	1747150,64	2116985,45
Igoumenitsa	17021668,48	2630886,99	1735265,89	1333696,64	1616011,99
Kavala	40616703,40	6277760,42	4140650,49	3182435,44	3856089,66
Alexandroupoli	11126405,46	1719708,936	1134276,107	871785,8438	1056324,453
Elefsina	80819579,65	12491559,28	8239113,567	6332446,332	7672891,176
Ag. Theodoroi	0	0	0	0	0
ROGP	695297696,4	107465943,6	70881792,62	54478572,73	66010533,38
ROW	1,12698E+12	6,34318E+11	1,26825E+12	95607100649	63914348085

Source: Compiled by the author

Table 52: 2008-2011 Average Export value of Liquid Bulk cargo in Greek ports (in US$)

	Europe	Asia	America	Africa	Oceania
Piraeus	0	0	0	0	0
Thessaloniki	113305176,13	17510063,67	11549190,93	8876517,02	10739289,75
Patras	7056730,88	1090539,83	719292,23	552836,10	668850,98
Heraklion	2111300,85	326278,23	215204,79	165402,84	200113,29
Volos	10598343,09	1637856,88	1080288,58	830291,93	1004532,02
Igoumenitsa	2471193,60	381895,68	251888,64	193597,44	234224,64
Kavala	16368300,00	2529540,00	1668420,00	1282320,00	1551420,00
Alexandroupoli	146895	22701	14973	11508	13923
Elefsina	124942264,1	19308447,11	12735358,73	9788185,954	11842276,07
Ag. Theodoroi	102490740	15838812	10446876	8029296	9714276
ROGP	561271354,2	86738289,33	57210361,05	43970936,68	53198414,27
ROW	4,13504E+12	2,32626E+12	4,65055E+12	3,50777E+11	2,34617E+11

Source: Compiled by the author

Table 53: 2008-2011 Average Export value of Ro-Ro cargo in Greek ports (in US$)

	Europe	Asia	America	Africa	Oceania
Piraeus	168868505,42	26096762,60	17212758,31	13229441,17	16005692,51
Thessaloniki	17345851,25	2680609,75	1768061,75	1358903,00	1644074,25
Patras	645515038,25	99757220,35	65797315,55	50570727,80	61183198,05
Heraklion	22323227,44	3449808,27	2275405,46	1748838,98	2115839,86
Volos	13990000,00	2162000,00	1426000,00	1096000,00	1326000,00
Igoumenitsa	533207515,25	82401332,95	54349815,35	41772368,60	50538467,85
Kavala	15278479,00	2361120,20	1557334,60	1196941,60	1448124,60
Alexandroupoli	13357652	2064277,6	1361544,8	1046460,8	1266064,8
Elefsina	309978297,7	47903722,63	31596072,37	24284218,32	29380359,02
Ag. Theodoroi	0	0	0	0	0
ROGP	2179008288	336741666,8	222106205,8	170707153,9	206530735,5
ROW	3,75606E+12	2,11431E+12	4,22746E+12	3,18648E+11	2,12998E+11

Source: Compiled by the author