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The Impact of Liner Shipping Trade and Competition Regulations on The Market Structure, Maritime Transport Costs and Seaborne Trade Flows

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Contents

List of Tables and Figures

Abbreviations

ALADI	Asociación Latino-Americana de Integración
ANTAQ	Agencia Nacional de Transportes Aquaviários
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
AvW	Anderson and van Wincoop
BIMCO	Baltic and International Maritime Council
BMA	Bilateral Maritime Agreement
BoP	Balance of Payment
BOT	Built-Operate-Transfer
CAFTA	Central America Free Trade Agreement
CER	Closer Economic Relations
CI	Containerization International
CIF	Cost Insurance and Freight
CSA	Cargo Sharing Agreements
DWT	Deadweight Tonnage
EBoPS	Extended Balance of Payments Services Classification
EC	European Commission
E-IAP	Electronic-Individual Action Plan
EU	European Union
FATS	Foreign Affiliates Trade in Services
FDI	Foreign Direct Investment
FEFC	Far East Freight Conference
FOB	Free On Board
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GNI	Growth National Income
HHI	Herfindahl-Hirschman Index

HS	Harmonized System
ICS	International Chamber of Shipping
ICT	Information and Communication Technologies
IMF	International Monetary Fund
IMO	International Maritime Organization
ISF	International Shipping Federation
IV	Instrument Variable
KG	Kommanditgesellschaft
LAIA	Latin American Integration Association
LCI	Liner Connectivity Index
LNG	Liquefied Natural Gas
MFN	Most Favoured Nations
MTC	Maritime Transport Cost
NAFTA	North American Free Trade Agreement
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
OSRA	Ocean Shipping Reform Act
PCA	Principal Component Analysis
PTA	Preferential Trade Agreement
RCA	Revealed Comparative Advantage
Ro-Ro	Roll-on Roll-off vessels
SFL	Squared Factors Loadings
STRI	Service Trade Restrictiveness Index
TEU	Twenty-feet Equivalent Unit
2SLS	Two-Stage Least Squares
UN	United Nations
UNCTAD	United Nations Conference for Trade And Development
US	United States
USSR	Union of Soviet Socialist Republics
WITS	World Integrated Trade Solution
WTO	World Trade Organization

General Introduction

Motivations

This dissertation deals with trade in international shipping services with a focus on the impact of trade and competition regulations on the sector's efficiency. International shipping is a crucial service sector. For certain countries, it represents a substantial source of revenues. It is also of utmost importance for consumers and producers worldwide as around 80% of international trade in volume transits by sea. More precisely, this dissertation deals with the international liner shipping sector which is defined as the service of transporting goods by means of vessels that transit on regular routes on fixed schedules. Liner shipping is a key intermediate service essential to transport finished goods. It is also essential to transport inputs which are at the heart of the current international division of the production process. Importantly, around 40% of seaborne trade in volume (e.g. manufactured and semi-manufactured goods and some raw materials) is transported by liner vessels.

Liner shipping trade and competition regulations are a key issue. Indeed, trade- and competition-restricting regulations are likely to affect the sector's efficiency, and notably Maritime Transport Costs (MTCs).[1] Therefore, these restrictive regulations are likely to lead to additional trade costs affecting the countries' competitiveness, their integration to international trade, and finally their welfare.

However, despite its importance for global economy the liner shipping sector is neglected at the GATS (General Agreements on Trade in Services). Indeed, GATS commitments of countries are weak and negotiations have been at a standstill since 1997. This dissertation aims at providing clear and robust quantitative impact assessments of these trade- and competition-restricting regulations, which could act as a trigger and relaunch negotiations at the GATS.

[1] In the literature, MTCs is the usual term for maritime transport prices -- also called freight rates. As a rule, I keep using the term MTCs.

Main research questions

This dissertation aims at assessing the impact of liner shipping trade and competition regulations on competition, prices, and seaborne trade flows. Beyond the importance of the liner shipping sector for economies and the potential impact of regulations on MTCs, countries' competitiveness and their integration to trade globalization, another motivation of this dissertation is to fill some gaps that exist in the literature.

In the literature I found only two articles measuring the restrictiveness of barriers to trade in the liner shipping sector (McGuire *et al.*, 2000 and Li and Cheng, 2007). For three main reasons, both attempts are imperfect. First, the index developed by McGuire *et al.* (2000) is biased since it misinterprets the impact of certain restrictions. Second, McGuire *et al.* (2000) and Li and Cheng (2007) do not use the state of the art methodologies developed recently. Third, both papers do not use consistent regulatory information. Thus, McGuire *et al.* (2000) use information on regulatory regimes bound at the GATS (i.e. GATS commitments) while huge gaps exist between bound and applied regimes of countries (Gootiiz and Mattoo, 2009). And, Li and Cheng (2007) use obsolete information dating from the early 2000's. This dissertation therefore focuses first on the construction of an extensive index measuring the restrictiveness of barriers to trade in the liner shipping sector.

Another key question which has not been fully investigated in the literature deals with the impact of barriers to trade on MTCs. Indeed, various articles measure the determinants of MTCs. Interestingly, each article focuses on a different issue. Limao and Venables (2001) are interested in the impact of the quality of transport and communication infrastructures on MTCs. Sanchez *et al.* (2003) and Clark *et al.* (2004) focus on port efficiency, Wilmsmeier *et al.* (2006) on port characteristics and Wilmsmeier and Hoffmann (2008) on port infrastructures. Marquez-Ramos *et al.* (2006) and Wilmsmeier and Hoffmann (2008) put emphasize on the countries' connection with international liner shipping networks. Marquez-Ramos *et al.* (2006) centre their attention on the impact of the services' quality. Wilmsmeier and Martinez-Zarzoso (2010) focus on the impact of being an open registry country. And, only one article focuses on the impact of barriers to trade on MTCs (Fink *et al.*, 2002). One motivation of this dissertation is to provide a more detailed and extensive analysis on this crucial issue.

Then, while liner shipping-specific competition regulations are likely to limit new entry by favouring strategic entry deterrence and/or predatory pricing behaviour (Fusillo,

2003 ; Scott Morton, 1997), I did not find any article assessing the impact of these regulations on the market structure. Most of the existing literature focuses on the impact of liner shipping-specific competition regulations on other economic outcomes such as prices (Clydes and Reitzes, 1998 ; Fink *et al.*, 2002), prices stability (Haralambides *et al.*, 2004) or carriers' revenues (Von Hinten-Reed *et al.*, 2004). Filling this gap by measuring the determinants of the liner shipping market structure with a focus on regulations is therefore the third key objective of this dissertation.

Finally, my dissertation hinges on the three main research issues mentioned above. In the next section, I detail the organization and content of the dissertation. I also present the contributions of each chapter to the literature.

Structure and main contributions

The first chapter aims at presenting ins and outs of the liner shipping sector. It provides a minimum knowledge helpful to understand the next chapters. In this chapter, I explain when trade in liner shipping occurs and how articulate the various modes of supply. I describe barriers to trade and competition regulations affecting the sector, and I explain how these regulations are likely to impact competition, prices, and seaborne trade flows. This chapter contributes to the literature by applying the economics of services to the international shipping sector.

The second chapter aims at studying the degree of preference granted in the maritime transport sector in the pre- and post-GATS (General Agreement on Trade in Services) schemes. In this chapter, I describe the preferences granted and their evolution, I determine which preferences are still alive and which ones are outdated, and I assess the degree of preference really granted between partners through Preferential Trade Agreements (PTAs). The main contribution of this chapter is to provide a sectoral analysis for a topic usually investigated horizontally.

The third chapter aims at assessing the impact of barriers to trade on MTCs and seaborne trade flows. It comprises two parts: the construction of an index measuring the restrictiveness of barriers to trade in liner shipping, and an econometric analysis. The

econometric analysis is, in turn, organized in two stages. Since barriers to trade are likely to influence seaborne trade through transport costs, in a first stage, I assess the impact of trade restrictions on MTCs. And, in a second stage I assess the impact of MTCs on seaborne trade flows.

One of the main contributions of this chapter is the construction of an original index measuring the overall intensity of restrictions to trade existing in the liner shipping sector (hereafter, Service Trade Restrictiveness Index -- STRI). Constructing an STRI consists in quantifying qualitative information on the restrictiveness of barriers to trade. The construction of such index is of particular interest since it can easily be included in quantitative impact assessments. Importantly, my STRI is based on discussions and exchanges with experts and professionals in order to avoid misinterpretations and bias. In contrast to the two previous attempts by McGuire *et al.* (2000) and Li and Cheng (2007), it is constructed using state of the art methodologies developed by the OECD (OECD, 2008). Furthermore, as mentioned in the next section, I use high quality information on the regulatory regime effectively applied by countries (World Bank, 2008).

Other contributions of this chapter are methodological and technical. First, an endogeneity issue arises when I measure the determinants of MTCs because of the reverse causality between MTCs and the total amount of bilateral imports (which is a proxy variable for economies of scale). Indeed, MTCs affect the choice of the mode of transport, therefore total seaborne imports. Following the existing literature, I use a Two-Stage Least Squared (2SLS) methodology. However, to address this issue the literature used imperfect Instrument Variables (IVs) as they do not vary across the same dimensions as the endogenous variable (Clark *et al.*, 2004 and Marquez-Ramos *et al.*, 2006). In this dissertation, I use an index of tariff protection as IV for total bilateral imports. It varies across country-pairs. Moreover, it is correlated with the endogenous variable (total bilateral imports) and influences only the dependant variable (MTCs) through the endogenous variable. In other words, my IV satisfies the exclusion conditions and it is more relevant than instruments used previously in the literature. Furthermore, assessing the impact of MTCs on seaborne trade flows raises another endogeneity issue because some variables such as distance are likely to affect both MTCs and seaborne trade flows. In the literature most papers address this issue by running 2SLS regressions (Martinez-Zarzoso and Suarez-Burguet, 2005 ; Marquez-Ramos *et al.*, 2006 and Korinek and Sourdin, 2009). As an IV for MTCs, they use the unitary value of goods transported. However, since the unitary value of goods corresponds to the products' price, it influences trade directly (and not only through the endogenous variable), and therefore does

not satisfy the exclusion conditions. To address this issue and because it is very difficult to find an instrument, I use the two-stage approach developed by Limao and Venables (2001). This two-stage framework also allows disentangling direct and indirect effects of distance and trade restrictions on seaborne trade flows, which is an important contribution of my dissertation. Finally, I assess the impact of MTCs on seaborne trade flows in a gravity framework as in the existing literature. However, in contrast to most of the literature, with the exception of Korinek and Sourdin (2009), I use the state of the art gravity framework developed by Anderson and van Wincoop (2003) which allows to control for the key multilateral resistance terms.

The fourth chapter provides an impact assessment of trade and competition regulations (acting as entry barriers) on the market structure and MTCs. It is also organized in two stages. The first stage assesses the impact of trade and competition regulations on the number of carriers deploying services on routes. The second stage evaluates the impact of the number of carriers on prices.

Chapter 4 contains two main contributions, a theoretical and an empirical one. First, from a theoretical point of view, I contribute to the literature by following an original approach to test whether liner shipping carriers exercise a market power. Since the liner shipping market is likely to be imperfectly competitive, many papers investigate whether liner shipping carriers exercise a market power. Importantly, most of them follow a price discrimination approach (Clydes and Reitzes, 1998 and Hummels *et al.*, 2007). In this dissertation I follow an approach based on a Cournot model of oligopoly. Precisely, I test whether the markets structure (i.e. the number of carriers on routes) affects MTCs. If the market structure affects the MTCs, it means that carriers charge prices above marginal costs and therefore, exercise a market power. Second, from an empirical point of view, I solve the endogeneity problem arising when I assess the impact of the number of carriers on MTCs. Indeed, the number of carriers is endogenous because most variables determining the number of carriers on routes also affect MTCs. And, because most variables determining the number of carriers on routes also affect MTCs, it is difficult to find an IV satisfying the exclusion conditions. Indeed, variables correlated with the endogenous variable (i.e. the number of carriers) also influence the dependant variable (i.e. MTCs) directly and not only through the endogenous variable. To address this particular form of endogeneity, I use a non-conventional methodology. Precisely, I use a two-stage approach that consists in re-injecting in the MTC equation, residuals of previous estimations measuring the determinants of the number of

carriers deploying a service on routes. The two-stage structure also allows to disentangle the impact of trade restrictions on MTCs through marginal costs and through the market structure.

Finally, beyond the chapter-specific contributions presented above, my dissertation contributes to the literature by providing a necessary sectoral study and by using original data. These contributions are detailed in the next section.

Contributions

A fundamental characteristic of services sector is its heterogeneity. Since each service sector has its own specificities in terms of functioning, regulations, etc., sectoral studies are of particular interest. Broadly speaking, one contribution of this dissertation is to provide a sectoral analysis of a key sector for global economy. After accumulating knowledge on the sector characteristics and particularities, I am able to provide a sharp analysis on the impact of liner shipping regulations on various economic outcomes.

Another contribution of this dissertation is to use data which has never been used in previous research. In general, studying the services' regulation is a challenging issue because the regulatory information is scarce and difficult to collect. In this dissertation I have had access to high quality information on the international shipping regulatory regime effectively applied in countries. This data comes from a World Bank survey realized between 2006 and 2008 (World Bank, 2008). I used this data in order to construct my index of restrictiveness (Chapter 3). I also use data from the Containerization International (CI) Online database. This database provides accurate data on the fleet deployed by each carrier on each bilateral route. This data allows me to test the applicability of bilateral cargo reservations (Chapter 2), and to compute carriers' market shares and some indexes of competitiveness on maritime routes (Chapters 1 and 4). The CI Online database also provides extensive information on the active price-fixing agreements -- i.e. conferences and discussion agreements. It details the carriers involved in each agreement and the routes covered (Chapter 4).

Finally, by including the STRI in econometric analysis, I am able to assess the impact of barriers to trade on various outcomes. My dissertation contributes to the literature by going further than the only article on this topic (Fink *et al.*, 2002). Thus, while Fink *et al.* (2002) focus on the impact of barriers to trade on MTCs, in my dissertation I assess their impact on MTCs (Chapter 3 and 4), seaborne trade flows (Chapter 3) and the liner shipping market

structure (Chapter 4). Then, Fink *et al.* (2002) focus on cross-border restrictions (mode 1 of supply). However, since almost all cross-border restrictions to trade disappeared (e.g. cargo reservations), I focus on restrictions on establishment of firms (mode 3 of supply). Then, Fink *et al.* (2002) include simple dummies as policy variables. My STRI is more accurate because it measures precisely the intensity of restrictiveness. Finally, I succeed in disentangling direct and indirect effects of distance on seaborne trade flows (Chapter 3) and disentangling the impact of trade restrictions on prices through the market structure and marginal costs (Chapter 4). To my knowledge, this has never been done in the literature.

Organization

This dissertation is organized as follows: Chapter 1 is in an introductory chapter providing a minimum knowledge on the liner shipping sector -- e.g. terminologies, concepts, functioning and figures. Chapter 2 aims at assessing the preferences granted in the maritime transport sector. Chapter 3 deals with the impact of barriers to trade on MTCs and seaborne trade flows. It also deals with the direct and indirect (i.e. through MTCs) effects of distance and trade restrictions on seaborne trade flows. Finally, Chapter 4 focuses on the impact of trade and competition regulations (acting as entry barriers) on the market structure and on the market structure on prices. It also assesses the impact of trade restrictions on MTCs through marginal costs and through the market structure.

References

Anderson, James E., and Eric Van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." American Economic Review, 93(1): 170-192.

Clark, Ximena, David Dollar, and Alejandro Micco. 2004. "Port Efficiency, Maritime Transport Costs and Bilateral Trade." Journal of Development Economics, 75: 417-450.

Clydes, Paul C., and James D. Reitzes. 1998. "Market Power and Collusion in the Ocean Shipping Industry: Is a Bigger Cartel a Better Cartel?" Economic Inquiry, 36(2): 292-304.

Fink, Carsten, Aaditya Mattoo, and Ileana C. Neagu. 2002. "Trade in International Maritime Services: How Much Does Policy Matter?" The World Bank Economic Review, 16(1): 81-108.

Fusillo, Mike. 2003. "Excess Capacity and Entry Deterrence: The Case of Ocean Liner Shipping Markets." *Maritime Economics and Logistics*, 5(2): 100-115.

Gootiiz, Batshur, and Aaditya Mattoo. 2009. "Services in Doha: What's on the Table?" World Bank Policy Research Working Paper Series 4903.

Haralambides, Hercules, E., Albert W. Veenstra, Mike Fusillo and William Sjostrom. 2004. "Statistical Analysis on Freight Rate Stability". Final report prepared for the European Commission Competition DG Services/ Transport.

Hummels, David, Volodymyr Lugovskyy and Alexandre Skiba. 2007. "The Trade Reducing Effect of Market Power in International Shipping." National Bureau of Economic Research Working Paper 12914.

Korinek, Jane, and Partricia Sourdin. 2009. "Maritime Transport Costs and Their Impact on Trade."
http://www.etsg.org/ETSG2009/papers/korinek.pdf

Li, Kevin X., and Jin Cheng. 2007. "The Determinants of Maritime Policy." Maritime Policy and Management, 34(6): 521-533.

Limao, Nuno, and Anthony J. Venables. 2001. "Infrastructure, Geographical Disadvantages, Transport Costs and Trade." The World Bank Economic Review, 15(3): 451-479.

Márquez-Ramos, Laura, Inmaculada Martínez-Zarzoso, Eva Pérez-García, and Gordon Wilmsmeier. 2006. "Determinants of Maritime Transport Costs: Importance of Connectivity Measures".
http://www.univ-lehavre.fr/actu/itlcsge/ramos.pdf

Martinez-Zarzoso, Inmaculada, and Celestino Suarez-Burguet. 2005. "Transport Costs and Trade: Empirical Evidence for Latin American Imports from the European Union." *Journal of International Trade and Economic Development*, 14(3): 353-371.

Martinez-Zarzoso, Inmaculada, Eva Maria Perez-Garcia, and Celestino Suarez-Burguet. 2008. "Do Transport Costs Have a Differential effect on Trade at the Sectoral Level?" *Applied Economics*, 40: 3145-3157.

McGuire, Greg, Michael Schuele and Tina Smith, "Restrictiveness of International Trade in Maritime Services," in Christopher Findlay and Tony Warren, eds, Impediments to Trade in Services: Measurement and Policy Implications, London: Routledge, 2000, pp. 189-200.

OECD. 2008. "Handbook on Construction Composite Indicators: Methodology and User Guide." Paris: OECD Publications.

Sanchez, Ricardo J., Jan Hoffmann, Alejandro Micco, Georgina V. Pizzolitto, Martin Sgut, and Gordon Wilmsmeier. 2003. "Port Efficiency and International Trade, Maritime: Port Efficiency as a Determinant of Maritime Transport Costs." Maritime Economics and Logistics, 5: 199-218

Scott Morton, Fiona. 1997. "Entry and Predation: British Shipping Cartels 1879-1929." Journal of Economics & Management Strategy, 6(4): 679-724.

Von Hinten-Reed, Nils, Chipty Tasneem and Fiona Scott Morton. 2004. "Shipping Conferences: A Study of the Impact of FEFC Activity on Prices in the North Europe-Asia Trade." Charles River Associates.
http://ec.europa.eu/competition/consultations/2004_6_reg_4056_86/fefc_study_redacted_en.pdf

Wilmsmeier, Gordon and, Jan Hoffmann. 2008. "Liner Shipping Connectivity and Port Infrastructure as Determinants of Freight Rates in the Caribbean." Maritime Economics and Logistics, 10: 130-151.

Wilmsmeier, Gordon, Jan Hoffmann and, Ricardo J. Sanchez. 2006. "The Impact of Port Characteristics on International Maritime Transport Costs", Port Economics, 16: 117-140.

Wilmsmeier, Gordon, and Inmaculada Martinez-Zarzoso. 2010, "Determinants of Maritime Transport Costs -- A Panel Data Analysis for Latin American Trade." Transportation Planning and Technology, 33(1): 105-121.

World Bank. 2008. "Maritime Transport Services." World Bank Survey on Impediment to Trade Integration. Unpublished.

Chapter I

An Overview of the Liner Shipping Sector

What is at Stake?

Abstract

This chapter is an introductory chapter providing a minimum knowledge on the liner shipping sector that will be useful to fully understand the next chapters.

Liner shipping vessels mainly transport general cargoes such as manufactured and semi-manufactured goods and some raw materials. Around 80% of international trade in volume transits by sea. And, around 40% of seaborne trade in volume is transported in liner vessels. Hence, this dissertation deals with a substantial share of international trade. Then, air and surface transport are substitutes to international liner shipping. The characteristics of goods, their unitary values and geographical factors are crucial determinants in the choice of the transport mode. With regards to the intensity of competition, the liner shipping sector is a concentrated market. And, by taking each bilateral maritime route as a different market, liner shipping markets are likely to be oligopolies.

Since vessels have to cross borders to provide international shipping services, mode 1 is the key mode of supply. However, mode 3 (i.e. the implementation of agencies abroad) is crucial to provide certain sub-services such as the administration and organization of vessels' calls, the management of cargoes in ports and the administration and organization of intermodality.

Since restrictions to trade in mode 1 have almost disappeared over the last decades, the liner shipping sector is considered liberalized by some economists and experts. However, substantial trade restrictions remain in mode 3. Importantly, restrictions in mode 3 are likely to affect operations as well as the establishment of firms. Therefore, they are likely to affect MTCs through marginal costs and the market structure.

Finally, the liner shipping sector enjoys particular competition policies. Indeed, on some maritime routes, shipping lines are allowed to collaborate on prices, capacity or schedules. Practically, these collaborations take the shape of various types of agreements. In this dissertation, I focus on price-fixing agreements (i.e. conferences and discussion agreements) because they are likely to have the strongest anticompetitive effects. Even tough price-fixing agreements are loosing ground consequently to the reform of the system in some countries, they are likely to still affect MTCs through various channels. Indeed, agreements members are likely to act as cartels, exercise a market power (because of a favourable environment) or affect the structure of markets by practicing strategic entry deterrence and/or predatory pricing.

JEL Codes: L92, F13, F14

Keywords: International shipping, Services trade, Services regulations

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1. Introduction

This chapter is an introductory chapter providing an overview of the liner shipping sector. Since each services sector has its own specificities in terms of terminology, concepts, functioning or regulations, the study of a service industry requires a minimum knowledge of this industry. This first chapter aims at providing such minimum knowledge. It is organized as follows: the first section is the introduction. In the second section, I present the international shipping sector with a focus on the liner shipping segment and I provide some key figures. The third section deals with trade in international liner shipping services. In this section, I explain when trade in international shipping occurs, I discuss the complementarity between modes of supply and, provide again some key figures. In the fourth section, I present liner shipping trade and competition regulations which are the core of my dissertation. The fifth section regards Maritime Transport Costs (MTC) data which is critical to this dissertation since an important part of it deals with the impact of regulations on MTCs.

2. The tramp and liner shipping markets

Liner shipping is defined as the service of transporting goods by means of vessels that transit on regular routes on fixed schedules. In one journey, liner shipping vessels transport many small cargo parcels for thousands of customers. In contrast, in tramp shipping, vessels do not operate on definite routes and fixed schedules. Usually, in this market, vessels are hired as a whole for a defined period.

2.1. Products, cargoes, vessels and shipping markets

It is crucial to differentiate products from cargoes. The latter term describes the products' mode of transport. According to their shape, their volume (also called the stowage factor) and their form of packaging, transported products are classified into four categories of

cargoes: dry bulk, liquid bulk, general and special cargoes. Freight transportation vessels are designed to transport these various types of cargoes.

First, dry bulk products are themselves divided into two sub-categories: major and minor dry bulk (Table 1). On the one hand, major dry bulk products (also called "the five major bulks") are homogeneous and transported unpacked. This category comprises the following products: grain, iron ore, coal, bauxite and alumina, phosphate rock. They are transported as bulk cargoes in dry bulk ships. On the other hand, minor bulk products are usually packed and transported as general cargoes -- e.g. non transformed agricultural, metals and minerals products. An increasing share of minor dry bulk products is containerized. Second, liquid bulk products are essentially composed of petroleum and its derivatives. They are transported as liquid bulk cargoes in tankers -- also called tank ships. Third, manufactured and semi-manufactured goods are transported as general cargoes in general cargo vessels. Nowadays, an important share of general cargoes is containerized and this share keeps on increasing. Finally, as its name suggests, special cargo is an heterogeneous category comprising various types of products. It includes bulky, dangerous and/or fragile products that have to be transported in specially-designed vessels. Some special cargoes are dry bulk products (e.g. wood), others are liquid bulk products (e.g. chemicals and Liquefied Natural Gas -- LNG), and others are manufactured goods (e.g. vehicles and reefer goods). For many special cargoes, containerships compete with special vessels (e.g. car-carriers and reefer ships).

Table 1: Products, cargoes, vessels and shipping markets

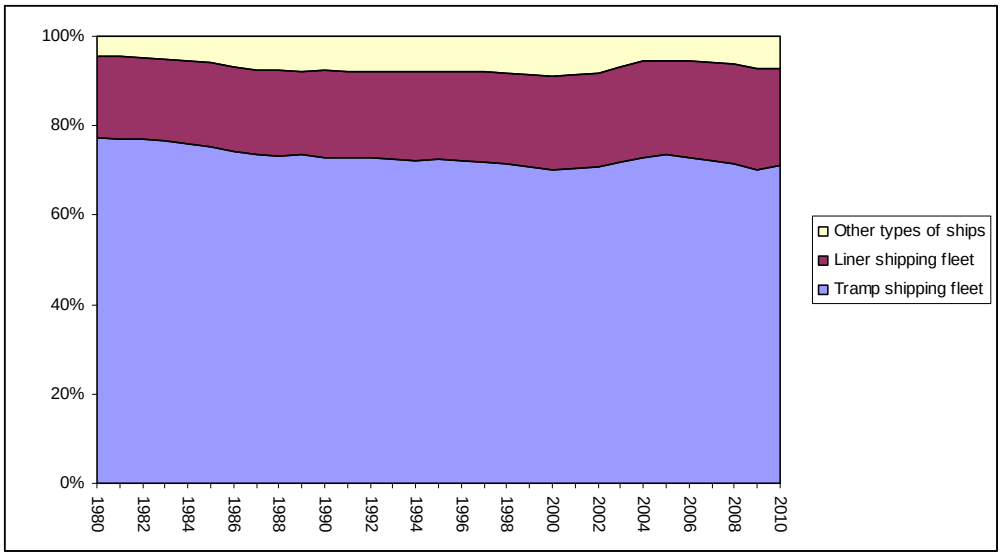
Type of product		Type of cargo	Example	Dedicated ship [a]	Shipping market
Dry bulk product	Major bulk	Dry bulk cargo	Iron ore, coal, grain, bauxite and alumina, phosphate rock	Bulk ships	Tramp
	Minor bulk	General cargo	Agribulk, metals and minerals	General cargo ships or containerships	Liner
Liquid bulk product		Liquid bulk cargo	Oil and its derivatives	Tankers	Tramp
Manufactured and semi-manufactured goods		General cargo	Garments	General cargo ships or containerships	Liner
Other product [b]		Special cargo	Wood, cement, etc…	Woodship, cement carriers, etc… [c]	Either tramp or liner
			Fresh fruits and vegetables	Specialized "reefer" ships [c]	
			Chemicals, LNG and other gases, etc…	Chemical tankers	
			Vehicles	Car carriers [c]	

Source: Adapted from Stopford (2009). Notes: General cargoes can be containerized or not. Here I provide some generalities, however, some exceptions exist, for instance: [a] combined carriers transport dry and liquid bulk cargoes, multipurpose vessels transport dry bulk and general cargoes -- of which containers. [b] Special cargoes can be dry bulk, liquid bulk commodities, semi-manufactured or manufactured goods. [c] For these products, containerships compete directly with special vessels.

Importantly, most of the time, general cargo ships and containerships operate as liner services while dry bulk ships and tankers operate on a tramp basis. In other words, liner shipping vessels mainly transport general cargoes such as manufactured and semi-manufactured goods and some raw materials.

Since 1980, the relative importance of the liner shipping fleet has increased slightly with respect to tramp shipping (Figure 1). In 1980, the latter represented 77.3% of the world fleet volume while the former represented 18.3%. In 2010, these shares were of 71% and 21.7%, respectively. The figure does not reveal the increasing importance of manufactured goods in value in global trade.

Figure 1: Evolution of the world merchant fleet -- By type of ship (2009)



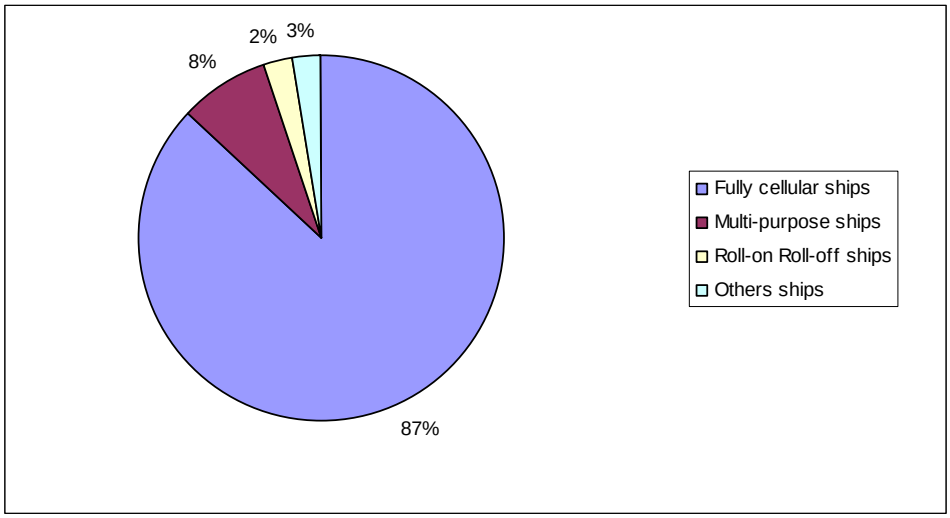
Source: UNCTADStat database (2010). Notes: In % of the Dead-Weight Tonnage (DWT). DWT corresponds to the weight of a full-load vessel -- including the weights of cargo, fuel, fresh water, ballast water, provisions, passengers, and crew. The liner shipping fleet is considered to be mainly composed of general cargo vessels and containerships. The tramp shipping fleet is considered to be mainly composed of dry bulk vessels and tankers.

Concerning the composition of the fleet, over the period the share of containerships has increased at the expense of the general cargo one. This evolution reveals the containerization of international shipping and international transport. In February 2011, the liner shipping fleet capacity was 16 millions of Twenty-foot Equivalent Units (TEUs).[1] Most of the liner shipping fleet comprises vessels fully dedicated to the transport of containers -- also called fully cellular container ships (Figure 2). The second category comprises

[1] Twenty-foot Equivalent Units (TEUs) is a measure of capacity. It corresponds to the volume of a standardized twenty-foot-long container.

multipurpose ships which are general cargo ships partially dedicated to the transport of containers. Finally, Roll-on Roll-off vessels (Ro-Ro) are considered to be special vessels but they operate in the liner shipping market.[2]

Figure 2: The liner shipping fleet (February 2011)



Source: Containerization International Online -- CI Online (2011). Notes: In % of total TEU. Fully-cellular ships are entirely dedicated to the transport of containers.

It is important to notice that accurate data on the share of the general cargo market in the world seaborne trade does not exist. However, this share can be estimated by using available data. In 2008 around 16% of the international seaborne trade was containerized. By adding the category "minor bulk" cargoes which are usually transported as general cargoes, the share of general cargo in the international seaborne trade reaches 39.5% (Table 2). It is important to be aware that this data is expressed in volume. Thus, since dry and liquid bulk cargoes are very heavy, this data underestimates the importance of general cargo in value.

Table 2: International seaborne trade (2008)

Shipment	Cargo loaded	Share (%)
Crude oil and products	2600	34.2
The five major bulk	2000	26.3
Minor bulk	1800	23.7
Container	1200	15.8
Total	**7600**	**100.0**

Source: UNCTAD (2010). Notes: Cargo loaded in millions of tons. The five major bulk corresponds to iron ore, grain, bauxite and alumina and phosphate rock. There is no double-counting between minor bulk and container categories.

[2] Roll-on Roll-off vessels (Ro-Ro) are designed to carry wheeled cargo such as automobiles, trucks, semi-trailer trucks, etc…

Interestingly, the United States (US) reports detailed data on seaborne containerized trade in volume and in value. For this country, in 2008, 15,4% of the volume of the seaborne imports was containerized while, in value, it represented 50,4% of seaborne imports. With regards to exports, shares in volume and in value are respectively 20.8% and 46.6% (US Census Bureau, 2008).

2.2. Functioning of the international shipping markets

In this sub-section, I focus on the functioning of the chartering and the freight markets. I present stakeholders involved in these markets which are at the heart of the international shipping activity.[3]

In the chartering market, owners of vessels supply them for hire to charterers.[4] In the freight market, carriers supply maritime transport services to shippers. Various stakeholders are involved in these markets. First, some owners of vessels hire their vessels on the chartering market while others operate them directly and provide a transport service supplied on the freight market. Second, the shipper is the consumer of the transport service. It could be the producer or the consumer of the merchandise transported or it could be a trade intermediary. The shipper could provide the transport service itself by hiring a vessel on the chartering market or it could purchase it on the freight market. Third, the carrier provides a transport service by operating vessels that could be owned or chartered. Fourth, the charterer designates the agent (i.e. a person or a company) who hires the vessel from a vessel owner and who operates it. The charterer could be an intermediary (who supplies a transport service on the freight market) or directly the shipper. Various types of charter contracts exist -- e.g. time charter, voyage charter or contract of affreightment. These contracts have various characteristics in terms of period of hiring, employment, responsibilities, costs paid, etc… Finally, the chartering shipbroker is an intermediary between the agent having a vessel for hire and the party looking for a vessel to hire. According to the type of charter contract signed the chartering shipbroker arranges employment and collects revenues. Its role is also to

[3] Shipbuilding markets (new building, second hand and demolition) which are not of first interest for the topic also interact with these markets.

[4] Importantly, the term "shipowner" has to be used carefully. Nowadays, it is often use as a synonymous for company (or carrier) which does not necessarily own vessels that they operate.

provide information and other services. Some owners or shippers carry out these tasks themselves (Stopford, 2009).

The functioning of the liner and tramp shipping segments differs according to the type of goods transported. As mentioned in the previous sub-section, in general, agents who want to transport bulk cargo hire vessels as a whole and the cargo fills it. This characteristic of the bulk market is key. It can be summarized in the following expression: the bulk market consists in "ship for cargo and cargo for ship". In contrast, general cargoes are transported through small cargo parcels. As a consequence, in the tramp segment, transport contracts relate to vessels' chartering while, in the liner shipping segment, transport contracts relate to cargoes (Cariou, 2000). Thus, the biggest charter market is in the transport of dry and liquid bulk cargoes -- i.e. the tramp segment.

Table 3: Owned and chartered capacities operated by major shipping lines (2009)

	Rank	Owned fleet	Chartered fleet	Total fleet	Percentage chartered
Maersk Line	1	1 004 484	727 175	1 731 659	42.0
MSC	2	746 399	754 178	1 500 577	50.3
CMA CGM	3	332 950	586 070	919 020	63.8
Evergreen Line	4	367 558	241 622	609 180	39.7
APL	5	152 409	379 995	532 404	71.4
Cosco Container Line	6	267 736	227 776	495 512	46.0
Hapag-Lloyd	7	303 310	178 981	482 291	37.1
CSCL	8	274 762	180 591	455 353	39.7
Hanjin Shipping	9	157 518	231 308	388 826	59.5
NYK Line	10	267 349	93 111	360 460	25.8
Top 10		**3 874 475**	**3 600 807**	**7 475 282**	48.2

Source: CI Online (2009). Note: Capacity in TEU.

Historically, shipping lines used to operate their own vessels while they chartered only a small share of their fleet. However, nowadays, an increasing share of liner shipping vessels operated is chartered by carriers (Stopford, 2009).[5] In 2009, between 26% and 71% of the fleet operated by the top-ten shipping lines was chartered (Table 3). On average, 48% of the fleet operated by these companies was chartered. Previously, chartering was used sparingly by shipping lines in order to replace vessels being repaired or to face a temporary increase of demand. Today, chartering is a common method of management of lines' fleet and risk. Shipping lines use this method to manage the trade-off between capital costs (to own vessels) and demand fluctuations.

[5] The German KommanditGesellschaft (KG) is a good demonstration of this new behaviour. According to this investment scheme, German citizens put money in funds which buy and own vessels. Then, the German KG hires owned vessels to shipping lines through time charter contracts.

2.3. The "modal splits" and the modal split

International institutions do not agree on the share of international trade carried by sea. For instance, according to the International Maritime Organization (IMO), the United Nations (UN) and the International Chamber of Shipping (ICS), 90% of the international trade is carried by sea. However, according to the European Commission (EC) and the United Nations Conference for Trade and Development (UNCTAD), only 80% is. Moreover, when these institutions assert such figures, none of them specifies whether they refer to the volume or to the value of trade -- even though, considering the existing estimations, it can be assumed that they refer to the volume (Table 3). Finally, according to a study realized by the Lloyd's Marine Intelligence Unit in 2006, 75% of world trade was carried by sea in volume and 59% in value (Wally Mandryk, 2009). These gaps and over-estimations are due to the difficulties in establishing such statistics -- notably, to probable "double reporting" of trade flows because of the multimodality (and intermodality) of international transport. Indeed, to transport a product from one point to another, various modes of transport are needed (for instance maritime and road transport), in this case the trade flow could be reported twice in both sea and surface transport statistics.

Table 4: Disagreement over the share of international trade transported by sea

Insitution	Year	Share	Volume/value	Source
IMO	2009	More than 90% of global trade	?	International Shipping and World Trade
UNCTAD	2010	More than 80% of international trade in goods	?	Review of Maritime Transport website
EC	2010	80% of international freight	?	Website of the Acquis Communautaire
ICS	2007	About 90% of all world trade	?	Statement

Sources: Various reports and websites (various years).

Because systematic data is not available, the share of international trade carried by sea have to be approximated. However, some countries report trade by modes of transport in value. It is the case of Brazil, Chile, the European Union (EU), New Zealand and the US. In Brazil, 73.5% of imports and 82.1% of exports are transported by sea. In Chile, 66.4% of imports and 83.1% of exports are transported by sea (ALADI, 2009). In the EU, 55.4% of

extra-imports and 48.3% of extra-exports are transported by sea (Eurostat, 2009).[6] In New Zealand, 84.5% of imports and 71.8% of exports are transported by sea (New Zealand Statistics, 2009). In the US, 51% of imports and 34.8% of the exports are transported by sea (US Census Bureau, 2009). These figures reveal that the share of traded goods transported by sea is likely to vary across countries. This share is likely to depend on countries' characteristics such as the level of development, trade specializations or geography.

Broadly speaking, other modes of transport are substitutable to international shipping. Since I focus on international transport of general cargo, the most serious rival competitor to the maritime transport is air transport. Additionally, rail and road transports, which are related to the domestic and regional trade, are also potential rivals for maritime transport.

Table 5: The US modal split (2009)

Trade partner	Trade flow	Sea	Air	Surface [a]
World		51.0	23.5	25.5
Canada	Imports	6.7	3.8	89.5
Mexico		16.0	4.4	79.6
World		34.8	31.7	33.6
Canada	Exports	2.1	7.9	90.0
Mexico		8.8	5.6	85.6

Source: US Census Bureau (2009). Notes: In % of the total value of trade. [a] Surface transport relates to road and rail transport and pipelines.

The unitary value of goods is one of the main determinants of the modal's choice -- notably concerning the competition between maritime and air transport. The higher the unitary value of a product is, the more likely this product is to be transported by plane. The characteristics and nature of goods are also crucial determinants in the choice of the transport mode. High-quality and time-sensitive products are more likely to be transported by air. It is the case for inputs that have to be delivered just in time, for consumption goods that benefit from a fashion effect as clothes and for consumption goods with a short life cycle such as technological products. Fresh products (e.g. fruits and vegetables), which are difficult to preserve as are also classified in this category.

[6] Extra-EU trade measures trade by excluding intra-EU trade.

Table 6 : The EU modal split (2009)

Trade partner	Trade flow	Sea	Air	Surface [a]	Unknow
World [b]		55.4	20.0	15.2	9.4
Belarus		29.9	0.4	68.4	1.2
Russia	Imports	76.7	2.2	11.2	9.9
Turkey		46.1	3.2	46.9	3.8
Ukraine		42.9	1.5	53.8	1.8
World [b]		48.3	27.2	23.8	0.7
Belarus		3.9	3.5	92.7	0.0
Russia	Exports	15.4	8.0	76.5	0.1
Turkey		39.2	9.0	51.7	0.1
Ukraine		6.5	5.6	87.8	0.0

Source: Eurostat (2009). Notes: In % of the total value of trade. [a] Road and rail transport. [b] Extra EU27 trade.

Intuitively, Tables 5 and 6 confirm that high value goods are more likely to be transported by air. Indeed, the share of US and EU world exports (which are expected to be more sophisticated and more costly than their imports) transported by air is higher than the imports' share.

With regards to the competition between maritime and surface transports (i.e. rail, road and pipelines), determinants are rather geographical. As shown by Hummels (2007), around 90% of the US trade towards neighbour countries is realized by surface transports and this percentage is similar for Latin American countries (Table 5). Even if it is less obvious concerning the EU, this phenomenon is confirmed by Table 5 and 6. Globally, the distance is a determinant of the modal's choice.

2.4. The market structure of the international shipping sector

By comparing the tramp and the liner shipping market structure, we observe that the latter is much more concentrated. Indeed, in liner shipping, more than 37% of the world's fleet capacity is operated by the five biggest shipping lines while the capacity of the top-five bulk carriers represent 16% of the world's fleet. Similarly, in liner shipping more than 53% of the world's fleet capacity is operated by the ten biggest shipping lines. In comparison, the capacity of the top-ten oil carriers represent 27% of the world's fleet (Tables 7 and 8). Additionally, the dry bulk and the tramp's shipping segments are dominated by small carriers. Thus, 90% of the smaller bulk carriers (less than ten vessels) own 26% of the fleet and 47.5% of firms own only one vessel. (Clarkson Research Studies, 2004).

Table 7: The market structure of the liner shipping fleet (February 2011)

	Operator	Share	Cumulative share		Operator	Share	Cumulative share
1	MSC	11.84	11.84	**11**	OOCL	2.40	55.87
2	Maersk	11.74	23.58	**12**	MOL	2.34	58.20
3	CMA CGM	6.70	30.28	**13**	K Line	2.29	60.49
4	Evergreen Line	3.72	34.00	**14**	NYK	2.27	62.76
5	APL	3.69	37.69	**15**	Hamburg Sud	2.09	64.85
6	COSCON	3.65	41.34	**16**	YML	2.06	66.92
7	Hapag-Lloyd	3.62	44.96	**17**	HMM	1.94	68.86
8	Hanjin	3.06	48.02	**18**	Zim	1.82	70.68
9	CSCL	2.96	50.98	**19**	PIL	1.50	72.18
10	CSAV	2.49	53.47	**20**	UASC	1.18	73.36

Source: CI Online (2011). Notes: In % of the world liner shipping fleet capacity -- in TEU. The remaining share comprises around 360 companies. Operators of 7% of the world liner fleet is unknown. Multipurpose and fully container ships operated by companies.

Table 8: The market structure of the oil and dry bulk carrier fleets (January 2007)

	Carrier	Oil carriers			Carrier	Dry bulk	
		Share	Cumulative share			Share	Cumulative share
1	Frontline	5.01	5.01	1	COSCO	5.25	5.25
2	Teekay Shipping	3.71	8.72	2	NYK	3.51	8.76
3	MOL	2.87	11.59	3	MOL	3.21	11.97
4	NYK	2.58	14.17	4	K Line	2.72	14.69
5	OSG	2.48	16.65	5	Zodiac	1.63	16.32
6	NITC	2.32	18.97				
7	Euronev	2.30	21.27				
8	MISC	2.29	23.56				
9	Vela International Marine	1.76	25.32				
10	HMM	1.72	27.04				

Source: Le Marin (2008) and UNCTAD (2008). Notes: In % of the world oil and dry bulk shipping fleet capacity -- in DWT. It includes the operated and/or the chartered fleet.

Furthermore, by studying the capacity deployed by shipping lines on 122 bilateral maritime routes (the sample includes four importers and thirty-two exporters), I focus on the level of competition in the liner shipping market. Among the sample, a monopoly exists on six routes and a duopoly exists on eight routes (CI Online, 2010).[7] The average number of carriers deploying vessels on route is 4.3 and the average Herfindahl-Hirschman Index (HHI) is 0.343.[8] Therefore, by assuming that each bilateral route is a different liner shipping market, routes of my sample can be considered as oligopoly markets.

[7] A direct service is not available on 48 routes -- i.e. on these routes, a transhipment is needed to connect the two countries.

[8] HHI is computed as the squared sum of market shares of companies. The HHI is equal to 1 when the market is a monopoly. The more a market is competitive, the more the HHI tends towards 0.

Table 9: Average number of shipping lines and HHI on routes (2010)

	ISO Code	Carriers	HHI	No direct service [a]
Importer	USA	7.8	0.256	6
	BRA	4.8	0.310	13
	NZL	1.8	0.432	18
	CHL	2.5	0.438	16
Exporter	HKG	12.0	0.167	0
	THA	1.5	0.174	3
	CHN	12.3	0.184	0
	SGP	7.8	0.185	1
	KOR	9.8	0.186	0
	AUS	5.3	0.194	2
	EGY	2.0	0.196	3
	DEU	6.0	0.213	1
	MEX	7.3	0.262	0
	BEL	4.5	0.275	1
	COL	7.0	0.280	0
	CAN	4.8	0.303	2
	GBR	6.8	0.320	0
	ESP	5.0	0.333	1
	ITA	4.3	0.356	1
	JPN	6.5	0.378	0
	MYS	4.3	0.481	0
	ZAF	5.0	0.516	1
	FRA	5.3	0.526	0
	IND	2.0	0.613	2
	MAR	1.5	0.676	2
	IDN	0.5	0.740	3
	TUR	0.3	1.000	3
	DZA	-	-	4
	NGA	-	-	4
	RUS	-	-	4
	SAU	-	-	3
	SEN	-	-	4
	TUN	-	-	4

Source: CI Online (2010). Notes: HHI is computed as the squared sum of market shares of companies. [a] 32 observations by country concerning reporter countries and 4 observations concerning partner countries. Because only one direct service calls at Thai and Egyptian ports, the HHI is not representative for these countries.

Bilateral maritime routes to South-East Asian countries are the most competitive ones, followed by routes to OECD countries and finally routes to developing countries (Table 9). This allows to draw some assumptions about the determinants of the market structure on maritime routes. Considering the rank of China, Honk Kong, Korea and Germany, it can be inferred that the trade power of countries is likely to affect the market structure of routes. Considering that routes between the US and China and the US and Honk-Kong are the most competitive (respectively twenty and eighteen carriers deploying vessels and HHIs of 0.065 and 0.072) the trade intensity between two partners is likely to affect the market structure of routes as well. Moreover, considering the rank of Singapore (which is one of the biggest maritime Hub -- if not the biggest) and Colombia, the role of the country in the world liner

shipping network also potentially affects the market structure of shipping routes. Again, level of development and geography are potential determinants.

Finally, other factors can affect the market structure of maritime routes and notably policy factors. Trade regulations are likely to affect the entry of carriers on routes. And, above all, sector-specific regulations are likely to have a strong impact on the competition level on routes. Indeed, historically, in many countries, shipping lines are exempted from competition rules. Therefore, they are allowed to agree on prices, capacity or schedules. In other words they are allowed to broke the most elementary competition rules. In the fourth chapter, I will test, through an econometric analysis, assumptions made above about the market structure determinants with a focus on the competition policy.

3. Trade in international shipping services

In order to provide international shipping services, vessels cross borders. Therefore, international shipping is the tradable service *par excellence*. First, I explain how international shipping services are traded by relying on the key concept of mode of supply. Then, I present a broad picture of trade in international shipping.

3.1. What is trade in international shipping?

The key concept of mode of supply has been developed in order to facilitate the comprehension of what is trade in services and when it occurs. It is used by the WTO in order to facilitate negotiations on trade liberalization at the GATS (General Agreement on Trade in Services).[9] The mode of supply of services depends on providers' nationality and consumers' territory of residence. It also depends on the nature of the firm providing the service.[10]

[9] The GATS framework was developed in order to facilitate trade negotiations. Considering the complexity of concepts around trade in service (when trade occurs, what are barriers to trade, etc…), this framework is a very useful tool. For these reasons and, in a concern to be clear and precise, I decided to follow the GATS conceptual framework. However, because it is not always adapted to the economic analysis, I sometimes take some liberty with it.

[10] According to Article XXVIII of the GATS, in maritime transport, the provider's nationality depends on the country of registration of the vessel or the nationality of the agent which supplies the service through the operation of a vessel. Actually, because of complex arrangements involving ownership, mode of operation and chartering and because of the flag of convenience system (i.e. the country of registry differs from the operator's or the owner's country of residence), it is often difficult to determine the residence of the operating company. Hence, following the Manual on Statistics of International Trade in Services (United Nations, 2002), I consider that the shipping activity is attributed to the country of residence of the operating enterprise.

Mode 1 is cross-border trade. A service of international shipping is traded in mode 1 when a maritime transport company from country A provides a service to a consumer resident in country B. Mode 1 represents the physical access to the market which is needed to provide the service. According to the GATS, a full commitment in mode 1 means that countries allow all vessels to call at their ports in order to load and unload all types of cargoes. In international shipping, mode 1 has two aspects. The first cross-border aspect is reflected by the fact that vessels cross borders physically in order to provide the service. Importantly, this makes mode 1 the key mode of supply. The second mode 1 aspect is reflected by the fact that (contrary to other services) a direct contact between the producer and the consumers is not required. Indeed, technically, international shipping services can easily be booked by phone or by internet.

Mode 2 is consumption abroad. It occurs when an agent from country A consumes a service abroad. It is very difficult to find straightforward examples of this in international shipping. Therefore, I excluded this mode from the scope of my research.

Box 1: The Modes 3a and 3b in the GATS Maritime Model Schedule

The Draft Schedule on Maritime Transport Services designed to help negotiations at the GATS splits mode 3 into two modes: 3a) and 3b). Mode 3a) corresponds to the establishment of a registered company for the purpose of operating a fleet under the national flag. Mode 3b) is defined as "the ability for international maritime transport service suppliers to undertake all activities which are necessary for the supply of a partially or fully integrated transport service, within which the maritime transport constitutes a substantial element". Nowadays, mode 3a) is less and less relevant. Indeed, since the 1970s, international shipping has experienced two linked important changes. First, with the development of the freedom of seas, most international trade can be transported no matter the colour of the vessel's flag. Second, with the deflagging process, most of international shipping is realized by the owned fleet and not by the flagged-fleet -- i.e. vessels are owned by companies established in a country but flagged in another country with an open or an international registry.[11] In this dissertation, mode 3 always relates to mode 3b) according to the GATS definition.

[11] For more details on the freedom of seas and the deflagging process, please, sea the box 3 "flying the flag" of the next section.

Mode 3 of supply is commercial presence abroad. Services of international shipping are traded in mode 3 when a foreign affiliate of a maritime transport company from country A provides a service to a consumer resident in country B. Importantly, in maritime transport mode 3 is in turn split into two categories (Box 1).

Finally, mode 4 corresponds to the temporary movement of individual service suppliers. In international shipping, a service is provided in mode 4 in two ways. When a seafarer from country A works on a vessel operated by a company from country B. And, when a worker from country A is employed by a foreign affiliate resident in country B. This dissertation focuses on mode 1 and mode 3, and to some extent, on mode 4.

3.2. Are modes 1 and 3 of supply complementary or substituable?

The degree of complementarity/substituability between modes (notably between mode 1 and 3) depends on services' characteristics. More specifically, it depends on the service differentiation, the countries' technology level (the development of ICT -- Information and Communication Technologies), the preference of consumers for a direct relation with the service's provider and regulation (Copeland and Mattoo, 2008). In this sub-section, I draw some conclusions on the complementarity and substituability between mode 1 and 3 in international shipping by adapting the theory developed by Copeland and Mattoo (2008) to the sector's specificities.

As stated above, mode 1 is the crucial mode of supply in international shipping. And, if vessels operated by foreign companies or flying foreign flags are not allowed to call at a country's ports to load and unload cargoes, mode 3 is of no interest. Therefore, mode 1 and 3 are not substituable. However, to some extent, mode 3 can be an important complement to mode 1. First, establishing a commercial presence abroad could be important from the demand's point of view. It is a mean for firms to be closer to consumers and their tastes. As stated by Copeland and Mattoo (2008), it is important when consumers have a preference for a direct relation with the provider. More specifically to the maritime transport service, it is important for carriers (at least for a minimum volume of production) in order to develop a network of offices to recruit freight all over the world (and not only in ports) and to fill its vessels with more ease. Second, establishing a commercial presence abroad could be

important from the supply's point of view. Indeed, it is important for carriers to establish a commercial presence in order to manage vessels and cargoes within ports abroad -- in other words, to handle all steps of the supply chain. Finally, nowadays, international transport is more and more "door to door" and multimodal. Hence, it is important for maritime companies to establish a commercial presence abroad in order to develop partnerships with local transportation firms and then facilitate the surface-leg of the journey from the port to the final delivery point of the cargo (Box 2).

Box 2: Maritime agent and agency -- establishing or not a commercial presence abroad?

Maritime agents represent the business interests of one or more shipping lines in ports abroad. Their activities consist in selling maritime transport services and organizing port calls. The Draft Schedule on Maritime Transport Services describes the maritime agencies activities as follows: "the marketing and sales of maritime transport and related services, from quotation to invoicing, and issuance of bills of lading on behalf of the companies, acquisition and resale of the necessary related services, preparation of documentation and provision of business information; acting on behalf of the companies organising the call of the ship or taking over cargoes when required."

All ports request the physical presence of an agent. Some firms have as only purpose to provide such services, but classical carrier operating their own fleet can also provide them. Thus, foreign carriers calling at ports abroad have two choices. They can either contract a firm established in the port or (if regulation allows it) establish their own commercial presence. Both choices can be efficient, and this choice often depends on the economical importance of the port for the carrier.

Interestingly, according to experts and professionals, the mix of mode 1 and 3 in the provision of international shipping service varies according to the market segment (liner or tramp shipping), the nature of cargo also influences the mean to provide the service. In tramp shipping, tankers or dry bulk carriers are chartered by a single customer. Therefore, the transaction could easily be arranged by phone or by internet. In contrast, with liner shipping a company needs hundreds and even thousands of customers to fill a containership -- or a general cargo vessel. Hence, in liner shipping the development of an agencies' network is

crucial. An equivalent comment can be done about the management of cargoes in ports. It is much more difficult to manage ten thousand boxes pertaining to ten thousand customers than 100,000 tonnes of crude oil pertaining to one customer. Consequently, mode 3 is likely to be more important in liner than in tramp shipping. Finally, *ceteris paribus*, mode 1 and 3 are not substitute but rather complement each other to some extent. Mode 1 is the key mode of supply and could also be useful in order to book a transport service or to send documents. Mode 3 is useful to find customers in isolated places, to administrate and organize vessels' calls and land transport all over the world. Data on trade in international shipping in mode 1 and 3 is available, unfortunately it does not split the sector into liner and tramp shipping. Therefore, it is very difficult to validate assumptions made above.

To conclude, it is important to note that the mode 4 of supply is undoubtedly complementary and not substituable with mode 1 and 3. Indeed, with the simultaneous development of the freedom of seas and the deflagging process, trade in mode 4 has become crucial. Today, the nationality of seafarers is different from the colour of the flag, the country of ownership of the vessel or the nationality of the operating company.

3.3. Trade in international shipping services -- a broad picture

In this sub-section I describe trade flows of maritime transport services with a focus on mode 1 and 3. First, I compare the importance of both modes of supply. Then, I look at the importance of trade for various countries. More specifically, I look at their dependence to imports and exports of sea freight transport service and their revealed comparative advantage. Importantly, due to the scarcity of data, the samples of countries presented in this sub-section are heterogeneous.

Concerning trade in mode 1, I use Balance of Payment (BoP) data -- credit are exports while debit are imports. Concerning trade in mode 3, I present Foreign Affiliates Trade in Services (FATS) data that describes the foreign affiliates activity. Inward FATS describes the activity of foreign affiliates resident in the economy while outward FATS describes the activity of foreign affiliates abroad controlled by the economy. Due to the scarcity FATS data, I also used FDI (Foreign Direct Investment) data as a proxy for trade in mode 3.

Important traders of goods like Germany and the US are also the biggest traders of sea freight transport services. As exporter of hydrocarbons, Norway also imports and exports a lot of sea freight transport services (Table 10). Following are the United Kingdom, France and Belgium. As expected, the amount of transaction is more important in BoP data than in FATS data. At the country level a few exceptions exist. In Hungary, Norway and Sweden the amount of inward turnover is greater than imports in mode 1. Similarly, for the US, the amount of outward turnover is greater than exports in mode 1. Germany, the United Kingdom, Norway and Belgium show a substantial surplus while the US shows a huge deficit. This tends to suggest that some countries are specialized in the sector while others are importers of water transport services provided by these countries. This underlines the importance of the "third traffic" in maritime transport -- i.e. transport services which are provided neither by companies from the importing nor by companies from the exporting country but by companies from a third country. Finally, because this data is not disaggregated enough it is very difficult to draw other conclusions.

Table 10: Trade of water transport services: mode 1 vs. mode 3 (various years)

Reporter	Exports in mode 1 [a]	Imports in mode 1 [b]	Difference [a] - [b]	Outward turnover [c]	Inward turnover [d]	Difference [c] - [d]
Belgium	11 340	7 672	3 668	306 [e]	1 886 [e]	-1 580
Finland	1 798	3 826	-2 028	386 [e]	1 088	-702
France	13 630	13 930	-300	n.a.	457	n.a.
Germany	28 530	18 150	10 380	3 388 [e]	2 110 [e]	1 278
Hungary	33	111	-78	n.a.	4 287 [e]	n.a.
Norway	14 650	9 204	5 446	n.a.	21 638	n.a.
Portugal	752	1 527	-775	n.a.	126 [e]	n.a.
Spain	2 864	4 692	-1 828	n.a.	253 [e]	n.a.
Sweden	4 997	4 130	867	n.a.	10 699	n.a.
United Kingdom	17 920	11 870	6 050	n.a.	2 871 [e]	n.a.
USA	4 673	33 640	-28 967	14 374 [e]	6 388 [f]	7 986
Total	**101 188**	**108 752**	**-**	**18 454**	**51 803**	**-**

Source: OECD (various years) and UN Service Trade Statistics Database (2007). Notes: Trade in value -- in millions of US dollars. Trade in mode 1 corresponds to EBoPS data -- Sea transport (206). Trade in mode 3 corresponds to FATS data -- Water transport (61). [a] 2006. [b] 2005. Sea transport and water transport correspond to sea and coastal transport and inland water transport.

Among the top-twenty countries that are the most dependant to their sea-freight transport imports, only developing countries are present (Table 11). Additionally, among developing countries West African countries are over-represented. And, among African countries, oil exporters as Liberia and Angola are the most dependant. Logically, many insular (and even micro-insular) countries such as the Seychelles, Vanuatu, Fiji, Jamaica and East Timor are present in this ranking.

Table 11: Top-twenty traders of sea freight transport services (2007)

		Imports in percentage of GDP		Exports in percentage of GDP
1	Liberia	18.12	Denmark	17.30
2	Seychelles	13.83	Norway	5.54
3	Congo	12.88	Estonia	4.07
4	Guyana	10.30	China, Hong Kong SAR	3.75
5	Angola	10.26	Cyprus	3.55
6	Guinea-Bissau	9.64	Seychelles	3.39
7	Togo	9.23	Belgium	3.14
8	Vanuatu	9.20	Gambia	2.09
9	Fiji	8.68	Chile	1.94
10	Côte d'Ivoire	8.67	Latvia	1.90
11	Gambia	7.54	United Rep. of Tanzania	1.72
12	Jamaica	7.50	Croatia	1.67
13	Senegal	7.11	Netherlands	1.57
14	Ghana	7.03	Sweden	1.51
15	Benin	6.93	Ghana	1.41
16	Malaysia	6.64	EU27	1.37
17	Lesotho	6.57	Malaysia	1.31
18	Mali	6.21	Germany	1.28
19	Cambodia	5.92	Iran	1.24
20	Timor-Leste	5.88	Ecuador	1.20

Source: UN Service Trade Statistics Database (2007). Notes: In % of GDP. Sea transport of freight (EBoPs 206) -- Sea and coastal water transport of freight.

Concerning exports, the most dependent countries are large maritime transport producers (and ship-owners countries) such as Denmark, Norway and Cyprus. Interestingly, these countries control a substantial share of the world's fleet -- also called countries of ownership. Indeed, at the beginning of 2010, Norway, Denmark and Cyprus controlled 3.5%, 2.9% and 0.76% of the total world's fleet capacity, respectively. The good exports performance can be explained by the chartering and/or the operation of owned vessels. Undoubtedly, Danish exports are pushed up by the firm Maersk which is the market leader for liner shipping. The surprising rank of Estonia can be explained by two facts. First, the country has a dynamic transport ferry industry in the Baltic Sea. Second, it is the country of arrival of a few Russian pipelines. The transport of Russian oil and gas can explain the important share of sea and coastal water transport of freight in Estonia's total GDP.

Table 12 confirms the dominance of Denmark and Norway as exporters of water transport services in mode 1. In contrast, (and surprisingly) large traders of goods such as the United Kingdom, Brazil, Italy, Russia, Turkey, Canada and the US show a comparative disadvantage. It is important to mention that Tables 11 and 12 provide only a view of the broad picture since they include only figures concerning trade in mode 1.

Table 12: Revealed Comparative Advantage (RCA) in sea transport of freight (2007)

Rank	Country	RCA seafreight	Rank	Country	RCA seafreight
1	Denmark	6.74	24	United Kingdom	0.71
2	Iran	3.64	28	Brazil	0.65
3	Norway	3.62	37	Italy	0.45
4	Ecuador	3.00	39	Egypt	0.39
5	Chile	2.93	40	Russian Federation	0.35
6	El Salvador	2.43	41	Turkey	0.34
7	China	2.17	45	Canada	0.25
8	United Rep. of Tanzania	2.01	55	USA	0.12
9	Venezuela	1.77	63	Tunisia	0.03
10	Germany	1.56	68	Luxembourg	0.01
11	Belgium	1.50	69	Montenegro	0.01
12	China, Hong Kong SAR	1.40	70	Hungary	0.01
13	Estonia	1.25	71	TFYR of Macedonia	0.01
14	Gambia	1.24	72	Cambodia	0.00
15	EU27	1.11	73	Kazakhstan	0.00
16	France	1.04	74	Bermuda	0.00

Source: UN Service Trade Statistics Database (2007). Notes: Sea transport of freight (EBoPs 206) -- Sea and coastal water transport of freight. The RCA index is computed as $[(X_{ik}/ X_{Tk})/(X_{iW}/ X_{TW})]$. Where X corresponds to exports, i to the country i, k to sea fright transport, T to total trade and W to world. RCA>1 shows a comparative advantage.

Table 13: Inward and outward FDI positions in water transport services (2008)

	FDI inward in % of total industry	FDI outward in % of total industry
Norway	6.44	7.55
Denmark	4.37	7.23
Greece	1.36	0.02
Korea	1.26	0.80
Sweden	0.55	1.11
France	0.34	0.16
Netherlands	0.34	0.12
Germany	0.28	0.11
United Kingdom	0.19	-
Slovenia	0.14	2.88
Estonia	0.11	9.76
Turkey	0.10	-
United States	0.08	0.27
Hungary	0.03	0.00
Austria	0.01	0.00

Source: OECD (2008). Notes: Inward position describes the activity of foreign affiliates resident in the economy. Outward position describes the activity of foreign affiliates abroad controlled by the economy.

Additionally, the share of FDI outward in water transport in percentage of total industry suggests that Denmark and Norway also dominate trade in mode 3 (Table 13). This confirms that mode 1 and 3 complements each others. All these figures support the widespread maritime transport concept of shipper and ship-owner countries. Shipper countries

have a small (owned and flagged) fleet with respect to their amount of seaborne trade flows. The United States and Australia are good examples for this category. In contrast, shipowners countries have a huge fleet with respect to their amount of seaborne trade flows (e.g. Denmark, Norway or Greece). Some countries like China, Germany and to a lesser extent France have both characteristics.

Table 14: Global seafarer supply by broad geographical area

Area	Officers		Ratings	
	in thousand	in %	in thousand	in %
OECD countries	184	29.49	143	19.14
Eastern Europe	127	20.35	109	14.59
Africa and Latin America	50	8.01	112	14.99
Far East	184	29.49	275	36.81
Indian Sub-Continent	80	12.82	108	14.46
All National Groups	624	100.00	747	100.00

Source: The Baltic and International Maritime Council (BIMCO) and the International Shipping Federation (ISF) (2010).

Finally, Table 14 confirms the importance of mode 4 for international shipping for on-board workers. Indeed, considering countries of ownership and registration, some areas like the Far-East or Eastern Europe are over-represented among seafarers.

4. Regulations in the international liner shipping sector

This section deals with the liner shipping regulatory framework. It describes the various regulations and policies applied and it explains to what extent they affect the efficiency of the sector -- through the cost to provide the service (i.e. the marginal cost) and the level of competition. The first sub-section focuses on trade regulations and the second sub-section on competition regulations.

4.1. Trade regulations

This sub-section aims at identifying all regulations which are likely to affect trade in services of international liner shipping. I first introduce trade restrictions. They are classified into three categories. The first category regards the mode of supply which is affected by restrictions with a focus on restrictions to cross-border trade (mode 1) and commercial presence (mode 3). Then, restrictions are split into discriminatory or non-discriminatory

barriers -- the former affects foreign providers only while the latter affects both domestic and foreign providers. Finally, barriers to trade are categorized depending on whether they affect the entry or the operations of providers. A summary of restrictions following this classification is provided in Table 17. Second, I use this classification in order to explain the theoretical impacts of restrictions on the sector's efficiency.

Description of barriers to trade

Regarding cross-border trade (mode 1), the main restrictions are called cargo reservations -- or cargo preferences. Cargo reservations are very specific to transport sectors. This restriction specifies that some types of cargo (e.g. government-generated cargo or strategic cargo) can only be transported by some types of vessels -- in general by vessels flying the country's flag or by vessels operated by national or domestic shipping lines. Cargo reservations are unilateral discriminatory restrictions to market access and they are restrictions to firms' operations. Generally, the objective of this measure is to protect the national-flagged fleet involved in international shipping for security and strategic objectives -- they allow to maintain certain skills and qualifications domestically. During the 1980s and the 1990s, most cargo reservations disappeared (Fink *et al.*, 2002). Indeed, nowadays among a sample of 47 countries only eight apply this restriction. As shown in Table 15, cargo reservations are mainly applied in developing countries and the United States is the only OECD country applying such a restriction. Moreover, most reservations are put on imports of government cargoes.[12] As a consequence, they represent a tiny share of seaborne trade flows. For instance, in the US, between 2005 and 2007, the volume of cargo transported under preference schemes represented around 1.5% of the total seaborne trade (Bertho, 2011). In Brazil, in 2009, 0.18% of the total seaborne import tonnage was reserved to Brazilian flagged-vessels (E-mail communication with the Agência Nacional de Transportes Aquaviários -- ANTAQ, 2010). In other words, cargo reservations are likely to represent a negligible part of world seaborne trade flows. However, the revenue generated can be sizeable. For instance, in the US, between 2005 and 2007 it represented more than 1.3 billion of dollars. Thus, it potentially represents an important share of the total revenues of carriers transporting reserved cargo. Importantly, Fink *et al.* (2002) show that cargo reservations do not influence MTCs anymore.

[12] According to the US Maritime Administration, a government cargo is cargo that is moving either as a direct result of Government involvement, through financial sponsorship of a Government program or, in connection with a guarantee provided by the Government.

Table 15: Cargo reservation schemes in international liner shipping

Country	Type of cargo	Type of vessel
Bangladesh	Government cargo	Operated by a national shipping line
Brazil	Government-generated cargo, and cargo financed by government programs	Flying the national flag
Indonesia	Government cargo	Flying the national flag
India	Government cargo	Flying the national flag
Lebanon	All cargo	Operated by a national shipping line [a]
Philippines	Government-generated cargo, and cargo financed by government programs	Operated by a national shipping line
Thailand	Government or state enterprise imports	Flying the national flag
United States	Government-generated cargo, and cargo financed by government programs	Flying the national flag

Source: World Bank (2008). Note: [a] Priority is given to Lebanese shipping lines.

Additionally, some countries do not apply cargo reservations but rather the principle of reciprocity to cross-border trade, this is the case in Latin-American countries like Chile, Colombia and Mexico. For instance, Bolivia, Brazil, Paraguay and Ecuador applies cargo reservations to Chile which in turn apply itself such restrictions to Bolivia, Brazil, Paraguay and Ecuador (E-mail communication, Chilean Ministry of Transport, 2010).

Another impediment to trade in mode 1 deals with maritime agents.[13] Some countries require that maritime companies be represented by a particular type of agent in their ports. The degree of restrictiveness of this measure depends on the type of agent that must be appointed. For instance, in Syria companies must appoint a government agency, in Chile and Indonesia companies must appoint a national agent and in Australia companies must appoint a resident. Logically, requiring a government agency is more restrictive than requiring a national agent and requiring a resident is even less restrictive. Therefore, this restriction is not discriminatory.

The last restriction in mode 1 relates to domestic shipping -- also called cabotage. *Stricto sensus*, cabotage consists in providing a transport service between two ports of the same country. However, because some countries apply a restrictive definition of cabotage, related restrictions can affect international shipping. Indeed, to differentiate international shipping from cabotage some countries look at the journey covered rather than cargoes' origin. Therefore, these countries regard domestic parts of international shipping journeys (as international relay) to be cabotage even if the cargo is originating from abroad.[14] Importantly,

[13] For more details on maritime agents, please see Box 2 of the previous section "Maritime agent or maritime agency -- establish or not a commercial presence abroad?"

[14] International relay consists for company in using two vessels to transport a container. A vessel coming from a country A unloads a cargo in the port of a country B which is not the final destination of the cargo. Then, a

cabotage is much more regulated than international shipping and most countries reserve cabotage for national-flag vessels. Hence, vessels that want to perform such international transport services must comply with cabotage requirements. These restrictions prevent carriers from operating their fleets on the most efficient way and they lead to complexities and additional costs related to port passage.

Box 3: Flying the flag

Register a vessel in a country (which is, in most countries, equivalent to fly the flag of this country) gives rights and duties. A vessel flying the flag of a country is under the security and the legal protection of this one. In return, a company that wants to operate a fleet under the national flag has to comply with some requirements. In general, it has to establish a commercial presence in the country, and pay taxes, a minimum share of the ownership must be national, a minimum share of the crew (including the captain and mates) must be citizens of the country, vessels operated have to comply with security, environmental and social requirements.[15]

Contrary to many articles on this field I do not consider requirements to fly the flag as a direct impediment to trade. First, ships are only tools to provide international shipping services. Second, nowadays, most of international trade can be (and is) transported no matter the colour of the flag. Indeed, most of international shipping is realized by vessels owned by the agent of one country, registered in a second country (generally an open or international registry country) and often operated by a company established in a third country. Thus, in 2010, 68% of the world fleet capacity was foreign-flagged (UNCTAD, 2010).

Therefore, despite their restrictive nature, requirements to fly the flag are not restrictions themselves. They are coupled with some restrictions (as cargo reservations) and they express the degree of restrictiveness of these ones. One peculiarity of international shipping is to discriminate by the vessels' flag instead of the providers' nationality. I consider these restrictions as discriminatory measures since in most countries, requirements to fly the flag are discriminatory.

vessel operated by the same company take over the first vessel to transport the cargo to its final destination -- that could be a port of the same country.

[15] It is not the case in open registry countries where these requirements are very low.

Regarding mode 3 of supply, most restrictions are common to all services sector. The most obvious barriers to the establishment of a commercial presence are the limitations to foreign ownership that prevent foreigners from entirely controlling liner shipping companies. Some restrictions also exist on the form of the commercial presence. In some countries, the creation of new affiliates has to take the form of a subsidiary and the establishment of branches is prohibited. Furthermore, some countries require the commercial presence of being a joint venture. The limitations on foreign ownership or the joint venture requirement can affect distinctly greenfield projects and the acquisition of existing (public or private) domestic entities by foreigners.

In some countries, foreign investors must obtain an authorization before being allowed to invest in a sector. This restriction is also called screening and approval process. It is common in strategic and sensitive sectors as maritime transport. The authorization can be automatic or subject to some requirements and evaluations by the related Ministry or a governmental agency. All these measures are discriminatory barriers to entry on the market.

Licence requirements are also considered barriers to trade in mode 3. This type of restriction varies a lot across countries. In certain countries a licence is required in order to establish a business and operate vessels -- which is different from the security, safety and environmental licence required to fly the flag of a country (Box 3). In this case the restriction is non-discriminatory. In other countries a licence is required to establish a commercial presence only. In this case, only foreigners have to obtain it and the restriction is discriminatory. Regardless of its form, obtaining a licence implies more or less burdensome and costly administrative formalities. Licence criteria may or may not be publicly available. If criteria are fulfilled, licensing may or may not be automatic. This information gives clues on the degree of restrictiveness for market entrance.

Turning to restrictions on employment and on the board of Directors' members, restrictions on employment are impediments to trade in mode 4.[16] Nevertheless, I classify them as barriers to trade in mode 3 because they indirectly affect the decision of foreigners to invest abroad. Restrictions on the board of Directors' members are impediments on the control of investments. Such restrictions rely on the people's nationality or residency. They consist in a minimum number or a minimum share.

[16] Here, I refer to restrictions on the temporary movement of managers, executives and specialists -- in contrast with restrictions related to vessels' crews required to fly the national flag.

Box 4: Barriers to trade -- protectionism or response to a market failure?

Because of their nature, services sector are prone to market failures -- e.g. economies of scale, imperfect information, externalities. Therefore, they are highly regulated (Copeland and Mattoo, 2008). Regulations have two main objectives, protect domestic providers from the foreign competition and/or respond to market failures. Often, the entanglement of both purposes makes the analysis of barriers to trade difficult. In this box, I present regulations that could be seen as protectionist at a first sight but which, in fact, respond to a market failure.

Requirements such as the appointment of particular maritime agents are barriers to trade in the sense of the GATS. However, the main objective of the residency requirement is not a protectionist but rather a fiscal and legal matter. It establishes practical jurisdiction over maritime incidents in territorial waters and ensures that ships do not leave port without paying their bills. The national and governmental agency requirements are protectionist. Similarly, the prohibition of creating branches is a restriction on the form of the commercial presence. However, again, this measure aims at establishing a practical jurisdiction over foreign companies. Finally, screening and approval processes and licensing are required in order to make sure of carriers' honesty and solvency. Concerning these regulations the issue of the boundary between protectionism and response to a market failure is even more difficult to define. Answering this question consists in understanding if the regulation is more restrictive than necessary to pursue the objective.

Interestingly, all regulations presented above aim at dealing with information asymmetries in order to protect consumers and workers, to protect the environment, and globally to avoid negative spillovers for society as a whole.

In the same way, restrictions on repatriation of earnings potentially affect the decision to invest in countries. Hence, I classify them as restrictions in mode 3. Usually, they are horizontal restrictions -- i.e. restrictions affecting all sectors without distinctions. They prevent foreigners from using, conversing and/or transferring the money earned freely. They are discriminatory restrictions on foreign firms' operations.

Moreover, certain regulations are likely to affect trade even though they are neither barriers to trade in mode 1 or in mode 3. First, a variety of support schemes aim at protecting the domestic maritime industry to the expense of foreign providers. These schemes can take the form of subsidies, credit guarantees or tax deferrals. They can be alternatively dedicated to support vessels' owners, vessels' operators (international or domestic trade vessels) or shipyards. Importantly, direct subsidies have become scarce, they are progressively substituted by non-discriminatory fiscal instruments such as tonnage tax (WTO, 2010). Second, some countries discriminate vessels with regards to the access and the use of ports and related services. These discriminations can be either included or not in the legislation. When they are included in the legislation, national-flagged vessels or vessels operated by national companies have preferential access to port infrastructures or services. These discriminations can be of various natures. They can affect the entering (departing) into (from) ports, they can be put on the use of infrastructures for the loading and unloading of cargoes, they can relate to the collection of port duties and taxes -- different amount or payable in hard currency. Discriminations in the access and the use of ports and related services can also be "silent". This is frequent in developing countries where port authorities have large discretionary powers. Third, because of potential conflict of interest or risk of discriminations, government ownership in maritime companies can be considered as an impediment to trade. And, considering the strategic nature of the liner shipping sector, government ownership is a common practice (Table 16).

Table 16: Nationally-owned shipping lines

Country	Company	Governement stake	Fleet capacity [a]	Comments
Algeria	CNAM Group Spa	100%	1 020	-
China	COSCO Container Lines Ltd	100%	495 512	-
China	China Shipping Container Lines Ltd	100%	455 353	Shipping arm of the state-owned China Shipping Group
Egypt	Egyptian Navigation Co	100%	-	-
Gulf countries	United Arab Shipping Co	100%	165 572	Owned by the governements of Saudi Arabia, Kuwait, Bahrain, Qatar, UAE and Iraq
India	Shipping Corp of India Ltd	100%	31 573	-
Malaysia	MISC Berhad	100%	95 016	Subsidiary of the Malaysian oil group Petronas wholly-owned by the government
Saudi Arabia	National Shipping Co of Saudi Arabia	28%	-	Held by the Public Investment Fund of the Saudi government
Singapore	APL Co Pte Ltd	100%	532 404	Wholly owned by Neptune Orient Line, a subsidiary of Temasek Holdings (governement Sovereign Wealth Fund)
Tunisia	Compagnie Tunisienne de Navigation	100%	-	-

Source: CI Online (2010) and various sources. Note: [a] in TEU.

Finally, in services sector, the regulatory environment and notably the quality of the regulator (generally the related Ministry) is critical. In general, the mission of the regulator is

to ensure competition and contestability in the market. In international shipping, the regulator is responsible for the issuance of licences. When a regulator exists, its quality can be estimated thanks to various information, such as the ability to appeal regulatory decisions or the prior notification of regulatory changes.

Table 17: A typology of barriers to trade in services

	Mode 1	Mode 3	Other	Horiz.	Ope.	Estab.	Discr.
Cross border trade							
Cargo reservation	X				X		X [d]
Restriction on the maritime agent	X				X		
Restriction on national parts of international journeys	X				X		X [d]
Commercial presence							
Foreign ownership limitation		X				X [c]	X
Restriction on the form of the commercial presence		X				X [c]	X
Joint venture requirement		X				X [c]	
Screening and approval		X		X		X	X
Licencing requirement		X				X	[e]
Limitation on employees		X [a]		X	X [b]		X
Limitation on the Board of Directors		X		X		X [c]	X
Restriction on the repatriation of earnings				X	X [b]		X
Other restrictions							
Subsidies and other supports			X		X		X [d]
Government ownership			X		X		X
Discrimination in access to and use of ports and related services			X		X		X [d]
Quality of the regulator			X			X	

Source: Author's calculation. Notes: Horiz. is for horizontal restriction, Ope. is for restriction on operations, Estab. is for restriction on establishment and Discr. is for discriminatory restriction. [a] Restriction in mode 4. [b] Ambiguous, these restrictions are also likely to affect decision to invest and to enter in the market. [c] Ambiguous, these restrictions are likely to affect firms' operation. [d] Discrimination according to the suppliers' nationality or vessels' flag. Hence, requirements to fly the flag could be important. [e] Could be discriminatory or not depending on countries.

Impact of restrictions on the sector's efficiency

The typology established above is used hereafter in order to determine the theoretical impact of barriers to trade on economic variables such as price, trade flows and welfare.

First of all, cargo reservations are restrictions on the quantity provided. From a trade policy point of view, they work as a zero quota. Cargo reservations provide a protection to eligible companies (usually companies operating nationally flagged vessels) in the form of reserved cargoes by excluding non-eligible providers from the market. Cargo reservations increase the cost to provide the service because it is usually more expensive to transport cargo in nationally-flagged vessels than in vessels registered in open-registry countries. This can be explained by higher labour costs (due to national crew requirements and higher social standards) and higher security and safety requirements. Hence, protection of the domestic fleet leads to an increase in the price of shipping services. It results in an opportunity cost for the reserved cargoes' shippers. As most of reservations are put on government cargoes,

taxpayers pay the bill. Theoretically, cargo preferences are costly to an economy as a whole because the welfare loss to consumers and taxpayers is larger than the gain for producers. Furthermore, in the long run the system does not give proper incentives to carriers operating nationally-flagged vessels. Thus, from a dynamic point of view, quotas drive carriers away from international competitive standards and perpetuate the fleet's inefficiency.

Globally, restrictions to firms' operations increase the cost to provide the service, in other words, the marginal cost. The impact of such restrictions is similar to a tariff in trade in goods. At a given price, providers supply less quantity of the service. Comparatively to trade in goods, in services, barriers are regulatory and therefore purely frictional. Moreover, in contrast to tariffs, regulatory barriers do not generate revenues for governments. It implies that the deadweight loss of protection (and the gain resulting from the liberalization) is higher.

From a static point of view, restrictions on establishment have the same impact as restrictions on operations but through a different channel. As their name suggests, restrictions on establishment have an impact on the entry of new firms in the market -- by prohibiting it (e.g. foreign ownership is banned in the sector) or by imposing additional fixed costs (e.g. burdensome licensing processes) or by discouraging investment (e.g. by limiting foreign ownership or by requiring the establishment of joint venture). These restrictions reduce the number of providers in the market. As a consequence, domestic prices increase and the quantity provided decreases. This leads to a decrease of the economy's total welfare.

Basically, barriers to trade in mode 3 are restrictions on establishment. However, the boundaries between restrictions in mode 3, restrictions on operations and restrictions on establishment are fuzzy. Thus, some restrictions in mode 3 are pure restrictions on establishment such as screening and approval processes and licensing requirements. Some restrictions in mode 3 are restrictions on establishment which are likely to affect marginal costs -- e.g. providing a service through a joint venture could lead to additional costs and inefficiencies. Furthermore, some restrictions in mode 3 are restrictions on operations which affect establishment by discouraging investments -- e.g. limitations on employees, restrictions on the repatriation of earnings. Moreover, restrictions in mode 3, which are basically restrictions on FDI, are harmful from a dynamic point of view. Beyond their positive impact on the sector's level of competition, FDIs increase the economies' possibility of financing, they facilitate the transfer of technology between countries, and induce positive spillovers in

terms of knowledge, skills, experience and organisation. Thus, for countries, restricting FDI is to foregoing all these dynamic benefits.

Concerning production subsidies, the welfare static outcome is different. Logically, because it is subsidised, domestic production increases. In contrast to barriers on operations and establishment, production subsidies do not affect the supply of foreign providers. Because subsidies increase the production of eligible providers without raising the cost for consumers, in comparison to restrictions mentioned above, the production subsidy leads to lesser distortions (since only the production side is distorted but not the consumption one). They also lead to a smaller welfare loss. To some extent, for a similar objective (i.e. increase the production of domestic producers) the implementation of such a subsidy can be more efficient. However, the subvention comes at great expenses for governments.

An important issue deals with the interaction between modes of supply. Indeed, if modes of supply are complementary, the implementation of restrictions in one mode may prevent providers from using the most efficient mode. In this case, barriers to trade introduce distortions in the mean to provide the services. This may increase the cost to provide the service and affect the quality of the service provided (Copeland and Mattoo, 2008). Thus, as explained in the previous section, even though mode 1 is crucial in the provision of international shipping services, mode 3 is likely to be more efficient to carry out some activities needed to provide the final service. In such way, there is an opportunity cost in providing some parts of an international shipping service in mode 1 rather than in mode 3. Therefore, restrictions in mode 3 are likely to have an impact on the overall efficiency of the sector.

To conclude this sub-section on barriers to trade in the liner shipping sector, some comments have to be made. First, in liner shipping (as in most services sector), barriers to trade are essentially regulatory. They are qualitative information which are difficult to include in quantitative impact assessments. Furthermore, several heterogeneous restrictions affect trade in international liner shipping services. Therefore, in order to assess and quantify the overall level of restriction in the sector, I will construct a composite index of restriction (also called Service Trade Restrictiveness Index -- STRI) (Chapter 3). Since the most significant barriers to trade in mode 1 disappeared and are not likely to affect MTCs anymore (Fink *et al.*, 2002), I will focus on barriers to trade in mode 3. Considering the difficulty to collect

regulatory information (due to source limitation), it is not possible to include in the index all trade restricting regulations presented above. However, the most important restrictions will be included. Then, the original liner shipping STRI in mode 3 will be included in econometric analysis in order to assess the impact of restrictions on various outcomes. I will assess the impact of restrictions in mode 3 on MTCs and seaborne trade flows (Chapter 3). And, since barriers to trade in mode 3 are likely to have an impact on the establishment of firms, I will also test the impact of these restrictions on the liner shipping market structure -- precisely the number of firms deploying vessels on routes (Chapter 4). Finally, as mentioned in this sub-section, barriers to trade in mode 3 are likely to affect MTCs through marginal costs and the market structure. In Chapter 4, I will disentangle the impact of restrictions in mode 3 on MTCs through both channels.

Second, in this sub-section, I presented Most Favoured Nation (MFN) regulations -- i.e. regulations that apply to foreign countries without distinction. Nevertheless, in international shipping, countries can grant preferential treatments to some trading partners through various types of agreements. Thus, some Bilateral Maritime Agreements (BMAs) provide preferential access to transport some types of cargoes. Some Preferential Trade Agreements (PTAs) in services provide preferential access in terms of right of establishment and access and use of ports and related services. In the Chapter 2, I will assess the preferences granted through these various types of agreements. This assessment is important for the next chapters since preferential treatment is likely to affect the MFN regulatory regime of countries.

4.2. Liner shipping competition regulations

Historically and in violation of all competition rules, liner shipping companies are allowed to collaborate on prices, capacity or schedules on some maritime routes. Practically, these collaborations take the shape of various types of agreements: maritime conferences, operational and discussion agreements (Box 5).

Box 5: A typology of liner shipping agreements

Various types of agreement have different aims and different competitive outcomes. I classify these agreements in three categories:

Conferences are route-specific agreements between carriers on conditions for the carriage of cargo. The main characteristics of the conferences are the regulation of capacity and the application of uniform or common freight rates. They can be seen as a kind of entente between carriers that restrict competition.

Operational agreements (or consortiums) allow for cooperation by means of technical, operational or commercial coordination. They take various forms: vessel-sharing agreements, managing port installations, managing marketing activities. They do not affect competition directly and may improve the efficiency of market outcomes.

Discussion agreements are non-biding agreements between conferences or between conference and non-conference members servicing a particular route. They are forum to discuss and share commercial information relevant to a specific route (e.g. forecast, introduction of a new capacity).

In the first sub-section, I describe regulations allowing shipping lines to collaborate into agreements, then, I present economic arguments justifying such regulations and finally, I present their theoretical impact on various economic outcomes.

Competition regulations' content and design[17]

Three types of regulations allow shipping lines to enter into collaborative agreements. First, in countries where competition rules exist, the regulation is an exemption. Generally, competition rules consist in three pillars. The first pillar deals with the cooperation between firms, collusion practices and cartels. The second pillar deals with the abuse of market power and the third pillar regards mergers and acquisitions. Thus, in countries where competition rules exist shipping lines are exempted from the first pillar's rules. Second, in other countries,

[17] A detailed review of liner shipping competition regulations for some countries is available in Annex.

a sector-specific regulation allows lines to cooperate. Third, the UN Liner Code signatories, by recognizing the existence of conferences, implicitly allow companies to enter into collaborative agreements (Box 6 and Table 18).

Box 6: Convention on a Code of Conduct for Liner Shipping

Signed in 1974 and entering in force in 1983, the Convention on a Code of Conduct for Liner Shipping (hereafter, the UN Liner Code) aimed at developing the shipping sector of developing countries which was hindered by anticompetitive practices of the existing maritime conferences. It established a bilateral cargo reservation system (also called cargo sharing) between the member countries applied to trade in liner conferences. The shares were structured as such: 40 % for the member at each end of the route and 20 % for third countries. Chapter 2, will be dedicated to the study of preferential treatment in the liner shipping sector. I will notably investigate the enforceability of cargo sharing agreements.

The main characteristic of the UN Liner Code was to establish a system of cargo sharing agreements in the liner shipping segment. However, because the UN Liner Code makes reference to conferences, its signature can be interpreted as an implicit approval of the conference practice.

86 countries signed the UN Liner Code (UN Treaty Collection Database, 2009), in two waves. The first one involved developing countries, beginning in 1974; the second involved developed countries[18] (mostly Europeans), from 1983 to the entry into force. During the 1990s almost no countries signed the UN Liner Code. In 2007, the EU repealed the regulation which defined the various requirements to be fulfilled by the EU members States when ratifying the Code. From this date on, all EU members were required to denounce the UN Liner Code to comply with the *Acquis Communautaire*.

Usually, the liner shipping-specific competition regulations do not mention the type of agreements covered. Conferences, discussion and operational agreements are covered without any distinctions and there are no special provisions for any agreements. However, some exceptions exist. For example, EU countries allow lines to cooperate into consortiums

[18] According to the World Bank Website ranking of 2009.

(Regulation 823/2000) but by repealing the block exemption for liner shipping conferences (Regulation 4056/86) in 2006, they banned conference and discussion agreements. Then, Canadian and Australian regulations make reference to conferences only. However, in order to ensure that they are covered by the exemption, all types of agreements are registered and adhere to the exemption rules.

In order to enter into agreements, members have to comply with some requirements. All competition regulations require the registration of agreements. Generally, this is a formality as the procedure is simple and automatic. Then, some competition regulations require conferences to be open -- i.e. free entry and withdrawal of members. However, the entry of new carriers in closed conferences is usually not a problem (OECD, 2002). And, in open conferences the rule is ambiguous enough to impose restrictions to new entrants (Sjostrom, 2004). Hence, this requirement is not decisive. Few regulations require that conferences' members enter into negotiation with shippers or with shippers' associations. This requirement is not crucial as it is likely to have a marginal effect on shippers' countervailing power (Productivity Commission, 2005). Finally, the most decisive provisions deal with individual actions of conferences' members. In some regulations the adherence to collective tariffs is mandatory. This provision is often combined with the filing and/or the publication of tariffs. These provisions are crucial since they contribute to the agreements' sustainability. Nevertheless, these provisions have lost ground consequently to the adoption of pro-competitive rules. Indeed, according to certain regulations, confidential contracts between conference members and shippers must be allowed (Table 18). This encourages the agreement's members to deviate from their partners' behaviour. An intermediate provision consists in allowing individual actions of members within conferences. In this case changes must be notified to other members.

In most of the countries allowing shipping lines to cooperate, the regulation admits that carriers agreements (at least conferences) have a tendency to lead to anti-competitive practices. That is why many competition regulations state that agreements must not hurt consumers' interests -- e.g. unduly freight rates' increases or a quality decrease in the service provided. Additionally, competition regulations state that agreements' benefits have to be greater than costs for the economy. As a consequence, regulations include some provisions relative to the oversight and monitoring of agreements. They also make provisions for sanctions. The most widespread mechanism consists in the possibility for the competition

authorities to start investigations (on their own or following complaints by parties) if carriers or agreements do not comply with requirements. The most common sanctions are penalties, immunity removal or agreement deregistration. However, in reality, complaints and investigations are scarce and sanctions even scarcer. This is due to the regulations' vagueness that makes their interpretation difficult. It may also be due to the fact that the burden of proof (of an undue increase of prices for instance) falls on the institution in charge of the monitoring (Fox, 1994).

Table 18: Competition regulations allowing shipping line agreements

Exemption		Sector specific	UN Liner Code
Pro-competitive	Conservative	regulation	signatories
Canada	Australia	China [a]	Algeria
Singapore	Chile [a]	Colombia	Egypt
United States	Japan		India
	Korea [a]		Indonesia
	New Zealand		Malaysia
			Mexico
			Morocco
			Nigeria
			Russia
			Senegal
			Tunisia

Source: Own elaboration. Notes: The regulation 823/2000 allowing shipping lines to enter into operational agreements is still in force. [a] Party to the UN Liner Code.

Finally, competition regulations allowing lines to enter into agreements can be classified in four categories: pro-competitive exemptions (mentioning that individual confidential contracts between conferences members and shippers must be allowed), conservative exemptions (which do not mention requirements vis à vis individual confidential contracts), specific maritime competition rules (mentioning cooperative agreements and related requirements -- registration, monitoring, etc…) and signatories of the UN Liner Code (Table 18).

Economic justifications for allowing shipping lines to cooperate

First of all, it is important to note that there is no consensus among economists, carriers and shippers on the legitimacy of allowing shipping lines to cooperate into agreements (Sjostrom, 2004). Furthermore, there is also a lack of consensus among countries since we observe a divergence of regulations. Indeed, some countries decide to extend the

exemption while others reform or repeal it. Theoretically, two types of justifications are provided for allowing shipping lines to enter into cooperative agreements. The first one is based on the sector's characteristics, the second is more analytical and is called the empty core theory.

According to advocates of exemptions, carriers' cooperation would have a stabilization effect on prices and would prevent destructive competition. It is generally recognized that the cooperation between carriers is beneficial to the sector's efficiency. Cooperation allows carriers to share unusual fixed costs, to take advantage of economies of scale and to rationalize the use of their fleet. Hence, cooperation decreases the cost to provide the service. In addition, cooperation allows carriers to diversify their offer, and therefore to expand the liner shipping network density. It makes investments more secure and indirectly affect positively the quality of the service -- thanks to better vessels and a better technology. Theoretically, it would also stimulate the competition reducing costs of entry. Additionally, most regulations emphasize the services' reliability and stability considering the importance of international shipping for the economy.

Economically, the cooperation between shipping lines could be justified by the sector' characteristics (more precisely the cost and demand structures) that would lead to destructive competition (Sjostrom, 2004). First, liner shipping service suppliers faced unusual fixed costs. Since liner shipping services are regular, providers that want to open a new service have to invest in several vessels. Furthermore, most of operational costs do not depend on the amount of cargo transported. Considering its schedule a vessel has to sail whether it is filled or not. As variable costs are low, prices have to decrease substantially before providers leave the market. In other words, on the short run the supply is inelastic. Second, since liner shipping services are linked to trade flows and pendular, the demand for service is unstable and asymmetrical -- for instance, trade flows from East Asia to developed countries are much more important than trade flows going on the opposite direction. Costs and demand's characteristics make liner shipping prices unstable and the competition unsustainable (Sagers, 2006). These justifications can be challenged in two ways. First, the benefits mentioned are only potential, because they are not automatically passed on to consumers. Second, there is a lack of theoretical and empirical works to validate these assertions.

The empty core theory is a more analytical approach. It has been applied to various sectors of which air and maritime transport. It is based on a game theory framework. The core

is said to be empty when there is no stable solution for the game since each stakeholders can outbid all other stakeholders. Thus, in the liner shipping sector, because of the service's nature (notably its regularity), carriers with excess slots in their vessels are always tempted to decrease prices to fill their vessels. In other words, the empty core theory states the impossibility for carriers to find a cooperative equilibrium, to match supply with demand at any time. This leads, to excess capacities, freight rates volatility and a race to the bottom. Interestingly, Sjostrom (1989) and Pirrong (1992) tested empirically the empty core model adapted to the liner shipping sector. Both authors show that cooperative arrangements exist in the sector to neutralize the core emptiness. Additionally, they show that conferences do not operate as rent-earning cartels (Sjostrom, 2004).

Theoretical impact of price-fixing agreements

In this sub-section, I review the literature dealing with competition in the liner shipping market with a focus on price-fixing agreements -- i.e. conferences and to a lesser extent discussion agreements. Price-fixing agreement are likely to affect the intensity of competition more strongly than other types of agreements such as operational agreements. The ** chapter of this dissertation will focus on the impact of this type of carrier agreements. First, I discuss the most frequently raised questions in the literature. Second, I consider the various approaches used to investigate the role of conferences.

In the literature dealing with competition in the liner shipping segment, the most widespread question is: do carriers exercise a market power? Indeed, because of the sector's characteristics (e.g. high fixed costs, existence of economies of scale and economies of scope), liner shipping markets are imperfectly competitive. And, in such an environment, firms are likely to exercise a market power -- which is defined as the producer's ability to charge and maintain prices above the marginal cost (Haralambides *et al.*, 2004). In order to test if shipping lines exercise a market power, economists investigate whether they practice price discrimination. This approach is based on the following reasoning: the marginal cost of transport is theoretically independent of the price of the good transported. Hence, if the market is competitive, the price of the transport service is independent of the price of the good since the mark-up is zero. In contrast, if the price of the shipping service is positively correlated with the price of the goods shipped, the mark-up is positive and carriers exercise a

market power. Most papers following this approach investigate how an increase in the price of the good transported impact the price of the transport service.[19] However, this methodology has important drawbacks. Indeed, in these papers, the MTC data includes insurance costs that vary across the price of goods transported. Moreover, in general, the marginal cost of transport depends on the good transported. Indeed, the stowage factor affects the marginal cost of transport. Furthermore, some goods have to be refrigerated or required a costlier cargo handling . These factors increase the marginal cost (Clydes and Reitzes, 1998 and Sjostrom, 2004) and (Hummels *et al.*, 2007). In an empirical article, Clydes and Reitzes (1998) investigated if carriers exercise a market power by using the price discrimination approach. They solved the issue mentioned above by adding a product fixed-effect in their freight rates equation -- i.e. by controlling for the various types of goods. On the one hand, they assess the impact of conferences market shares on freight rates and on price discrimination. On the other hand they assess the impact of the market concentration on freight rates and on price discrimination. They found that conferences do not act as effective cartels and that all shipping lines (i.e. conferences and non-conferences members) exercised a market power. Then, Hummels *et al.* (2007) also investigated if shipping lines exercise a market power following the price discrimination methodology. They developed a model where the demand for shipping depends on the goods import demand and that do not suffer from the problem mentioned above. They tested the existence of price discrimination by examining the impact of tariffs and import demand elasticities on MTCs. The Hummels *et al.* (2007) results suggest that carriers charge higher prices when transporting goods with higher product prices, lower import demand elasticities, and higher tariffs and when facing fewer competitors on a trade route. Furthermore, following a simpler theoretical and empirical framework, some papers investigated whether carriers' agreements affect prices or carriers' revenue. Fink *et al.* (2002) included (among other policy variables) simple dummy variables taking into account the existence of price fixing (conferences) and operational agreements on routes in a liner shipping price equation. They showed that price-fixing agreements positively affect prices while cooperative agreements do not. Von Hinten-Reed *et al.* (2004) investigated the impact of the Far East Freight Conference (FEFC) on carriers' revenue. They concluded that the conference members earn higher revenues per TEU than non-conferences members. Von Hinten-Reed *et al.* (2004) suggested that this is due to differences in the quality of services. Finally, Haralambides *et al.* (2004) went further by assessing the impact of conferences on

[19] For a review of this literature see Sjostrom (1992).

freight rates and freight rate stability. Their results suggest that conferences do not have the power to maintain prices above the marginal costs. Results also (weakly) suggest that market concentration promotes freight rates stability.

Another part of the literature dealing with competition in the liner shipping sector focuses on strategic entry deterrence practices -- i.e. limit pricing, excess capacity and predatory pricing. According to this literature, considering the sector's characteristics, carriers (or carrier agreements) are likely to limit competition by limiting the number of firms in the market. Thus, Scott Morton (1997), considering the regulatory environment, assumes that the liner shipping segment is prone to predatory pricing. Scott Morton constructed a model of collective predation where cartel members successfully deter entry. Its empirical results show that entrant firms' characteristics are determinants of the launching of a price war or not. Fusillo (2003) then constructs a limit pricing model where incumbents maximize their long term profits rather than their short term profits. His results suggest that entry deterrence strategies are an element of excess capacity that is observed in the sector.

Interestingly, in papers quoted above, the particular competition policies and environment observed in the liner shipping sector is approached in two ways. In some papers, exemptions from competition rules and carriers agreements are not the core subject. They are rather an *ad-hoc* issue that creates a favourable environment for the exercise of a market power by carriers -- see for instance Hummels *et al.* (2007) and Fusillo (2003). In contrast, another part of the literature addresses the competition policy and the carrier agreements issues frontally.[20] From this point of view, Clyde and Reitzes (1998) reconcile both approaches by studying the impact of conferences market shares and the impact of the overall level of competition on prices.

To conclude this sub-section, liner shipping-specific competition regulations (and related price-fixing agreements) are likely to influence MTCs through various channels. Agreement members are likely to act as cartels, to exercise market power and to limit new entry in markets by practicing strategic entry deterrence and/or predatory pricing. In order to fill a gap existing in the literature, I will focus on the impact of price-fixing agreements on MTCs through the market structure (Chapter 4). First, I will measure the determinants of the

[20] This literature is itself split into two approaches. Some papers assume that conferences act as cartels (Scott Morton, 1997 and Fox, 1994) while others investigate whether they really collude.

liner shipping market structure with a focus on regulations. In other words, I will investigate whether the existence of price-fixing agreements on routes acts as barriers to enter markets. And, by studying the impact of the number of carriers on routes on MTCs, I will test whether carriers as a whole (i.e. agreements and non-agreements members) exercise a market power or not.

5. Maritime Transport Costs (MTCs)

Chapters 3 and 4 aim at assessing the impact of trade and competition regulations on various outcomes of which MTCs. Hence, MTCs are at the heart of this dissertation. In this section, I present the debate sparked off by the MTCs data in the literature, I also present the methodology and the data used in the next chapters. Finally, I present descriptive statistics for MTCs, including a comparison between *ad valorem* transport costs and tariffs.

5.1. The data issue

The computation of MTCs is a sensitive issue. For a long time, researchers and international institutions used CIF-FOB (Cost, Insurance and Freight and Free-On-Board, respectively) ratios calculated through mirror data.[21] These ratios were computed and published by the International Monetary Fund (IMF) and they have been reproduced by the United Nations Conference on Trade and Development (UNCTAD) in the Review of Maritime Transport until 2007. Seminal papers on seaborne transport costs such as Radelet and Sachs (1998) and Limao and Venables (2001) also used these ratios. CIF-FOB mirror ratios' data had the benefit to be a substitute to unpublished sensitive commercial information. Moreover, they provided MTCs time series varying across routes and products that would be difficult (even impossible) to collect and very interesting to use in empirical works. However, because of trade data reporting issues, CIF-FOB mirror ratios have been heavily criticized. Indeed, the differences between trading partners in the valuation of goods (due to exchange rate changes during the journey for instance), the classification of goods and more broadly speaking the differences in the quality of data reporting (because importing countries that calculate a tariff revenues on trade flows are likely to report trade better than the exporting

[21] Also called matched partner data. Computed as follows: imports in CIF of the destination country minus exports in FOB in the country of origin.

country) lead to bias that prevent mirror data from being used in empirical works (Hummels and Lugovskyy, 2006).

Other types of data have been used in papers dealing with maritime transport costs. Limao and Venables (2001) used quotes coming form a shipping company transporting containers for the World Bank. Marquez-Ramos *et al.* (2006) and Martinez-Zarzoso and Nowak-Lehmann (2007) used data coming from export declaration forms -- the TradeTrans database compiled by the Valenciaport foundation. Wilmsmeier and Hoffmann (2008) used actual freight rates obtained form a major company. Nevertheless, this data has the drawback to be limited in terms of geographical, product and time coverage.

Then, an interesting methodology was developed by Hummels (1999). Some countries report trade flows data by mode of transport. Additionally, these countries value imports in CIF and in "value for duty" -- also called customs value. Thus, for these countries it is possible to compute the MTCs of imports without the reporting problem. This type of data have been used in various papers. Fink *et al.* (2002), Micco and Pérez (2002), Sanchez *et al.* (2003) and Clark *et al.* (2004) used US data. Wilmsmeier *et al.* (2006) and Wilmsmeier and Martinez-Zarzoso (2010) use data from Latin American countries. Finally, Korinek (2011) used the Hummels' methodology with a new dataset. As part of an OECD project, Korinek created an extensive MTCs database (OECD, 2006). A part of the database comes from actual trade flows and another part is estimated. In this dissertation, I use MTCs coming from actual data only. They represent the transport costs from the point of shipment (i.e. the moment when the good is loaded by a carrier) to the point of entry into the importing country. It includes the price of transport, insurance and cargo handling but not customs' fees.

5.2. Descriptive statistics

In Chapter 3 and 4, I use MTCs data in econometrical analysis. It is computed following the methodology described above. In these chapters, I use different samples. In Chapter 3, I use the New Zealand and US import MTCs for the year 2006 while in Chapter 4, I use the Brazil, Chile, New Zealand and US import MTCs for the year 2009. This part aims at providing descriptive statistics of MTCs data for the four countries of my sample.

In countries of my sample, import freight and insurance costs for containerizable goods reach high values.[22] Thus, in 2009, they represented 18 billions of dollars for the US. For New Zealand, Chile and Brazil, they represented 620 millions, 681 millions and 1.67 billions of dollars, respectively. Then, the share of freight (and insurance) costs in the total import bill was substantial. For instance, in Brazil, in 2009, freight and insurance costs represented 3.8% of the total import bill for containerizable goods. In the US, New Zealand and Chile, freight and insurance costs represented 3.9%, 5% and 5.2% of the total import bill for containerizable goods, respectively.

Table 19: *Ad valorem* Maritime Transport Costs (2006)

	Observation	Average	Stdandard Deviation	Minimum	Maximum
Brazil	2158	6.86	8.72	0.04	91.67
Chile	1509	8.14	8.59	0.24	92.26
New Zealand	2405	7.56	7.88	0.28	91.66
United States	4013	7.11	6.70	0.01	83.33

Sources: OECD (2006) and World Integrated Trade Solution (2006). Notes: Tariffs and *ad valorem* MTCs are simple average. They are expressed in % of imports -- valued in CIF.

Interestingly, in 2006, the average *ad valorem* MTC is of comparable proportion for the four countries of my sample. They were comprised between 6.9% and 8.6% (Table 19). Even though, standard deviations are relatively low, we observe high maximums and tiny minimums for all four importers. Importantly, we observe MTCs peaks. Indeed, in order to transport some products on some maritime routes, MTCs can reach more than 90% of the goods' value.

Brazil is the country with the lowest average *ad valorem* MTCs -- but with the highest standard deviation. New Zealand (which is undoubtedly the country the furthest away from important maritime routes) does not have the highest MTCs. However, as presented in Chapter 3, MTCs are likely to depend on many variables as trading partners, the composition of imports, etc… Since they display, the lowest standard deviation, minimum, maximum and the second lowest average, the US presents the most favourable MTCs profile.

[22] According to the OECD Maritime Transport Costs Database (2006), I assume that, in the Harmonized System (HS) disaggregated at 2-digits, containerizable cargo corresponds to all lines except 10, 15, 25-29, 31, 72, and 99.

Table 20: *Ad valorem* tariffs (2006)

	Observation	Average	Stdandard Deviation	Minimum	Maximum
Brazil	2158	12.95	6.08	0.00	35.00
Chile	1509	3.29	2.84	0.00	6.00
New Zealand	2405	3.65	4.19	0.00	17.00
United States	4010	1.99	3.40	0.00	26.39

Sources: OECD (2006) and World Integrated Trade Solution (2006). Notes: Tariffs and *ad valorem* MTCs are simple average. They are expressed in %.

Because of the decline of tariffs and other trade policy restrictions, the relative importance of MTCs as trade costs have been increasing. In New Zealand, Chile and the US, *ad valorem* MTCs are higher than the average tariff (Table 19 and 20). In the US, the average MTC is more than three times higher than the average tariff. Concerning New Zealand and Chile, the average MTC is more than twice the average tariff. In Brazil, *ad valorem* MTCs are lower in comparison to tariffs. This is due to high tariff rates.

Finally, it is important to note that contrary to tariffs, MTCs at a certain level (and with a constant technical level) become incompressible. The figures presented above suggest that there is some room for progress -- as the existence of MTC peaks for instance. One objective of Chapter 3 and 4 will be to demonstrate that trade and competition policies affect MTCs and therefore, that MTCs are compressible.

6. Conclusion

In this chapter, I draw some conclusions about the liner shipping sector that will be useful to fully understand the next chapters. Liner shipping is defined as the service of transporting goods by means of vessels that transit on regular routes on fixed schedules. Liner shipping vessels mainly transport general cargoes such as manufactured and semi-manufactured goods and some raw materials. Around 80% of international trade in volume transits by sea. And, around 40% of seaborne trade in volume is transported in liner vessels. Hence, this dissertation deals with a substantial share of international trade. Then, air and surface transport are substitutes to international liner shipping. The characteristics of goods, their unitary values and geographical factors are crucial determinants in the choice of the transport mode. Concerning the competition with air transport, the higher the unitary value of

a product is, the more likely this product is to be transported by plane. Concerning the competition with surface modes of transport, if two trading partners share a common border, their bilateral trade is more likely to be transported by rail or road. With regards to the concentration of the liner shipping market, in 2010, 53% of the world liner shipping fleet capacity was operated by the ten biggest lines. After studying the intensity of the competition on a sample of maritime routes, I found that the average number of carriers deploying vessels on these routes was 4.3 and the average Herfindahl-Hirschman Index (HHI) was 0.343. I conclude then that the liner shipping market is concentrated and that routes of the sample studied can be considered as oligopoly markets.

Considering the importance of the "traffic of thirds" (i.e. maritime transport services provided by a carrier which is neither from the importing nor from the exporting country but from a third) and the high degree of specialization existing in the sector, international shipping is a tradable service *par excellence*. Since vessels have to cross borders to provide international shipping services, mode 1 is the key mode of supply. However, mode 3 (i.e. the implementation of agencies abroad) is crucial to provide certain sub-services. Indeed, in order to provide liner shipping services efficiently, carriers have to provide many sub-services necessitating a commercial presence abroad -- e.g. administration and organization of vessels' calls, management of cargoes in ports and administration and organization of intermodality. In other words, mode 1 and 3 are likely to complement each others in the provision of liner shipping services.

Since restrictions to trade in mode 1 have almost disappeared and affect the sector marginally, the liner shipping sector is considered liberalized by some economists and experts. However, substantial trade restrictions remain in mode 3. In order to assess and quantify the overall level of restriction in the sector, I will construct an STRI (Chapter 3). The original liner shipping STRI in mode 3 will be included in econometric analysis in order to assess the impact of restrictions on various outcomes. I will assess the impact of restrictions in mode 3 on MTCs and seaborne trade flows (Chapter 3). And, since barriers to trade in mode 3 are likely to have an impact on the establishment of firms, I will test the impact of these restrictions on liner shipping markets structure (Chapter 4). Finally, as mentioned in this sub-section, barriers to trade in mode 3 are likely to affect MTCs through marginal costs and the market structure. In Chapter 4, I will disentangle the impact of restrictions in mode 3 on MTCs through both channels. In general, barriers to trade apply to all foreign countries and providers in the same way -- i.e. the MFN principle is applied. However, in maritime

transport, countries grant some preferences to certain partners under various schemes. In Chapter 2, I investigate the preferences granted in the maritime transport sector in the pre- and post-GATS (General Agreement on Trade in Services) schemes. This assessment is important for the next chapters since preferential treatment is likely to affect the MFN regulatory regime of countries.

Historically, the liner shipping sector enjoys particular competition policies. Indeed, on some maritime routes, shipping lines are allowed to cooperate into price-fixing agreements. Usually, this peculiarity is justified by the sector's characteristics that, otherwise, would lead to destructive competition and price volatility. Even tough price-fixing agreements are loosing ground consequently to the reform of the system in some countries, they are likely to still affect MTCs through various channels. Indeed, agreements members are likely to act as cartels, exercise a market power (because of a favourable environment) or affect the structure of markets by practicing strategic entry deterrence and/or predatory pricing. In order to fill a gap existing in the literature, I will focus on the impact of liner shipping-specific competition regulations (and associated price-fixing agreements) on MTCs through the market structure (Chapter 4). First, I will measure the determinants of the liner shipping market structure with a focus on regulations. In other words, I will investigate whether the existence of price-fixing agreements on routes acts as barriers to entry. And, by studying the impact of the number of carriers on routes on MTCs, I will test whether carriers as a whole (i.e. agreements and non-agreements members) exercise a market power or not.

Finally, after years of controversy, a consensus appeared on the methodology that has to be used to compute relevant MTCs data. In the next chapters, I will use this methodology. MTCs represent a substantial share of the total import bill on countries of my sample. Furthermore, the figures presented in this chapter suggest that average *ad valorem* MTCs are of comparable proportion for Brazil, Chile, New Zealand and the United States. The existence of MTC peaks suggests that there is some room for progress to reduce MTCs. In Chapter 3 and 4, I will demonstrate that trade policies affect MTCs, and therefore that MTCs are compressible.

7. References

ALADI Statistics Division. 2009. Seaborne Trade Flows Statistics.
http://www.aladi.org/ (received May 12, 2011).

Bertho, Fabien. "Maritime Transport in the United States," in *The Impacts and Benefits of Structural Reforms in the Transport, Energy and Telecommunications Sectors in APEC Economies*, APEC Policy Support Unit Report, Singapore: Asia-Pacific Economic Cooperation Secretariat, 2011, 313-333.

Cariou, Pierre. 2000. "*Les alliances stratégiques dans le transport maritime de lignes régulières : Efficacité ou pouvoir de marché* ? ". Unpublished doctoral dissertation, University of Nantes, Nantes, France.

Clark, Ximena, David Dollar, and Alejandro Micco. 2004. "Port Efficiency, Maritime Transport Costs and Bilateral Trade." *Journal of Development Economics*, 75: 417-450.

Clarkson Research Studies. 2004. "The Tramp Shipping Market".
http://www.pfri.uniri.hr/~bopri/documents/Unit26-TRAMPSHIPPINGMARKET_000.pdf

Clydes, Paul C., and James D. Reitzes. 1998. "Market Power and Collusion in the Ocean Shipping Industry: Is a Bigger Cartel a Better Cartel?" *Economic Inquiry*, 36(2): 292-304.

Containerization International Online (CI Online). Various years.
http://www.ci-online.co.uk/

Copeland, Brian, and Aaditya Mattoo, "The Basic Economics of Services Trande," in Aaditya Mattoo, Robert M. Stern, and Gianni Zanini, eds, *A Handbook of International Trade in Services*, New York: Oxford University Press, 2008, pp 84-129.

Deardorff, Alan V., and Robert M. Stern, "Empirical Analysis of Barriers to International Services Transactions and the Consequences of Liberalization," in Aaditya Mattoo, Robert M.

Stern, and Gianni Zanini, eds, *A Handbook of International Trade in Services*, New York: Oxford University Press, 2008, pp 169-219.

Eurostat. 2009. "Maritime Transport Statistics"
http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database/

Fink, Carsten, Aaditya Mattoo, and Ileana C. Neagu. 2002. "Trade in International Maritime Services: How Much Does Policy Matter?" *The World Bank Economic Review*, 16(1): 81-108.

Fox, Nancy R. 1994. "An Oligopoly Model of Ocean Liner Shipping." *Review of Industrial Organization*, 9: 343-355.

Fusillo, Mike. 2003. "Excess Capacity and Entry Deterrence: The Case of Ocean Liner Shipping Markets." *Maritime Economics and Logistics*, 5(2): 100-115.

Haralambides, Hercules, E., Albert W. Veenstra, Mike Fusillo and William Sjostrom. 2004. "Statistical Analysis on Freight Rate Stability". Final report prepared for the European Commission Competition DG Services/ Transport.

Hummels, David. 1999. "Toward a Geography of Trade Costs." Global Trade Analysis Project Working Paper 17.

Hummels, David. 2007. "Transportation Costs and International Trade in the Second Era of Globalization", *Journal of Economic Perspectives*, vol. 21, n° 3 Summer 2007.

Hummels, David, and Volodymyr Lugovskyy. 2006. "Are Matched Partner Trade Statistics a Usable Measure of Transportation Costs?" *Review of International Economics*, 14(1): 69-86.

Hummels, David, Volodymyr Lugovskyy and Alexandre Skiba. 2007. "The Trade Reducing Effect of Market Power in International Shipping." National Bureau of Economic Research Working Paper 12914.

Korinek, Jane. 2011. "Clarifying Trade Costs in Maritime Transport", OECD, Paris.

Le Marin. 2008. "Shipping 2008 : Les Clés du Transport Maritime Mondial." *Le Marin*, October 31.

Limao, Nuno, and Anthony J. Venables. 2001. "Infrastructure, Geographical Disadvantages, Transport Costs and Trade." *The World Bank Economic Review*, 15(3): 451-479.

Mandryk, Wally. 2009. "Measuring Global Seaborne Trade." Presentation at the International Maritime Statistics Forum, New Orleans, 4-6 May 2009.

Márquez-Ramos, Laura, Inmaculada Martínez-Zarzoso, Eva Pérez-García, and Gordon Wilmsmeier. 2006. "Determinants of Maritime Transport Costs: Importance of Connectivity Measures".
http://www.univ-lehavre.fr/actu/itlcsge/ramos.pdf

Martinez-Zarzoso, Inmaculada, and Felicitas Nowak-Lehmann. 2007. "Is Distance a Good Proxy for Transport Costs? The Case of Competing Transport Modes." *Journal of International Trade and Economic Development*, 16(3): 411-434.

Micco, Alejandro, and Natalia Pérez. 2002. "Determinants of Maritime Transport Costs." Inter-American Development Bank Research Department working paper 441.

New Zealand Statistics. 2009. "Overseas Trade Imports and Exports Statistics: HS2 Chapter by Country of Origin and Destination by Sea Freight." New Zealand Statistics.
http://www.stats.govt.nz/ (received September 20, 2011).

OECD. 2006. "Ad Valorem and Unitary Maritime Transport Costs." OECD Maritime Transport Costs Database.
http://stats.oecd.org/Index.aspx?datasetcode=MTC (accessed October 28, 2010)

OECD. 2002. Competition Policy in Liner Shipping.

OECD. Various years. "Globalization". OECD StatExtracts Database.
http://stats.oecd.org/Index.aspx

Pirrong, Stephen C. 1992. "An application of Core Theory to the Analysis of Ocean Shipping Markets." *Journal of Law and Economics*, 35: 89-131.

Productivity Commission. 2005. *Review of Part X of the Trade Practices Act 1974: International Liner Cargo Shipping*.

Radelet, Steven, and Jeffrey Sachs. 1998. "Shipping Costs, Manufactured Exports and Economic Growth."
http://admin.earth.columbia.edu/sitefiles/file/about/director/pubs/shipcost.pdf

Sagers, Chris. 2006. "The Demise of Regulation in Ocean Shipping: A Study in the Evolution of Competition Policy and the Predictive Power of Microeconomics." *Vanderbilt Journal of Transnational Law*, 39: 779-818.

Sanchez, Ricardo J., Jan Hoffmann, Alejandro Micco, Georgina V. Pizzolitto, Martin Sgut, and Gordon Wilmsmeier. 2003. "Port Efficiency and International Trade, Maritime: Port Efficiency as a Determinant of Maritime Transport Costs." *Maritime Economics and Logistics*, 5: 199-218

Scott Morton, Fiona. 1997. "Entry and Predation: British Shipping Cartels 1879-1929." *Journal of Economics & Management Strategy*, 6(4): 679-724.

Sjostrom, William. 2004. "Ocean Shipping Cartels: A Survey." *Review of Network Economics*, 3(2): 107-134.

Sjostrom, William. 1992. "Price Discrimination by Shipping Conferences." *Logistics and Transportation Review*, 28:207-215.

Sjostrom, William. 1989. "Collusion in Ocean Shipping: A Test of Monopoly and Empty Core Models." *Journal of Political Economy*, 97(5): 1160-1179.

Stopford, Martin. 2009. *Maritime Economics*. New York: Routledge.

The Baltic and International Maritime Council (BIMCO) and the International Shipping Federation (ISF). 2010. "Manpower 2010 Update, The Worldwide Demand for and Supply of Seafarers."

UNCTAD. Various years. *Review of Maritime Transport*. New York and Geneva: United Nations.

UNCTADStat database. 2010. "Maritime Transport, World Merchant Fleet". http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

United Nations. 2002. *Manual on Statistics of International Trade in Services*. New York: United Nations Publications.

UN Service Trade Statistics Database. 2007. http://unstats.un.org/unsd/servicetrade/ (accessed September 28, 2010)

UN Treaty Collection Database. 2009. "Multilateral Treaties Deposited with the Secretary-General, Status of Treaties." http://treaties.un.org/Pages/ParticipationStatus.aspx

US Census Bureau. Various years. "Annual Port-level Trade." USA Trade Online. https://www.usatradeonline.gov/ (accessed September 13, 2010)

von Hinten-Reed, Nils, Chipty Tasneem and Fiona Scott Morton. 2004. "Shipping Conferences: A Study of the Impact of FEFC Activity on Prices in the North Europe-Asia Trade." Charles River Associates. http://ec.europa.eu/competition/consultations/2004_6_reg_4056_86/fefc_study_redacted_en.pdf

Wilmsmeier, Gordon and, Jan Hoffmann. 2008. "Liner Shipping Connectivity and Port Infrastructure as Determinants of Freight Rates in the Caribbean." *Maritime Economics and Logistics*, 10: 130-151.

Wilmsmeier, Gordon, Jan Hoffmann and, Ricardo J. Sanchez. 2006. "The Impact of Port Characteristics on International Maritime Transport Costs", *Port Economics*, 16: 117-140.

Wilmsmeier, Gordon, and Inmaculada Martinez-Zarzoso. 2010, "Determinants of Maritime Transport Costs -- A Panel Data Analysis for Latin American Trade." *Transportation Planning and Technology*, 33(1): 105-121.

World Bank. 2008. "Maritime Transport Services." World Bank Survey on Impediment to Trade Integration. Unpublished.

World Integrated Trade Solution. 2006. "Most Favoured Nation and Applied Tariffs: HS2 Chapter by Country of Origin and Destination." Tariffs and Trade Analysis. http://wits.worldbank.org/wits/ (accessed February 16, 2011)

WTO. 2010. "Maritime Transport Services -- Background Note by the Secretariat."

8. Annex

Table: Exemptions of Liner Shipping Carriers From Competition Rules

	Australia	Canada	Chile
Main competition law	Trade Practices Act 1974 (TPA) [b]	Competition Act 1985	Law for the Defence of Free Competition 1973
Status of the liner shipping sector	Exempted from competition rules Part X of the TPA	Exempted from competition rules Shipping Conferences Exemption Act 1987 (SCEA) amended in 2001	Exempted from competition rules Ley de Fomento a la Marina Mercante 1979
Requirements			
Registration	Yes	Yes	Yes
Tariffs filling	No	No, but tariffs have to be available	Yes
Open agreement	Free withdrawal	No	-
Other	Enter into negotiations with a shippers' body	-	-
Discipline between members			
Independent actions	No provision	Allowed, must be notified by members	No provision
Individual contracts		Allowed to negotiate confidential contracts	No provision
Oversight, complaints and monitoring			
Sanction	Deregistration	Penalties and loss of the exemption	Subject to the competition rules, no particular provisions
Institutions			
Registration	Department of Transport	Canadian Transportation Agency	Ministry of Transport
Monitoring	Competition and Consumer Commission (A3C)	Canadian Transportation Agency	Ministry of transport and National Anti-Trust Commission
Discussion agreements [a]	No provision	Not exempted	No provision

	China	Colombia	New Zealand
Main competition law	Anti-monopoly Law 2007	Law on Restrictive Trade Practices	Commerce Act 1986
Status of the liner shipping sector	Agreements allowed -- specific regulation Regulations on International Maritime Transportation 2002 (RIMT)	Agreements allowed -- specific regulation Decree 80408 de 2001	Exempted from competition rules [c] New Zealand Shipping Act 1987
Requirements			
Registration	Yes	Yes	No
Tariffs filling	Yes	Yes	No
Open agreement	-	Yes "Free entry"	No
Other	Must consult shippers' associationsa and establishement of a liaison office in China	Must appoint an accredited representative in the country, reciprocity	-
Discipline between members			
Independent actions	No provision	Allowed, must be notified by members	No provisions
Individual contracts		Penalties and deregistration	
Oversight, complaints and monitoring			
Sanction	Subject to the competition rules, no particular provisions	Penalties, suspension and deregistration	No sanction, can give advices and directions
Institutions			
Registration	Ministry of Communication	Colombian Maritime Authority (DIMAR)	-
Monitoring	Anti-monopoly Commission	Superintendence of Industry and Commerce	Ministry of Transport
Discussion agreements [a]	No provision	No provision	No provision

Table: Exemptions of Liner Shipping Carriers From Competition Rules (continued)

	Japan	Korea	Singapore
Main competition law	Antimonopoly Law 1947	Monopoly Regulation and Fair Trade Act 1980	Competition Act 2004
Status of the liner shipping sector	Exempted from competition rules Maritime Transport Law 1949 - Articles 28 and 29 amended in 1999	Agreements allowed -- specific regulation Maritime Transport Act - Article 29	Exempted Block Exemption Order extended in 2010
Requirements			
Registration	Yes	Yes	Yes, if the market share exceed 50%
Tariffs filling	Yes, as independant lines	No	No
Open agreement	Yes	Yes	Free withdrawal
Other	Notification to shippers' association of the agreement's framework	Exchange sufficient information with shippers' associations and consultations	-
Discipline between members			
Independent actions	No provision	No provision	Not required to adhere to agreed tariffs
Individual contracts	No provision	No provision	Confidential contracts must be allowed
Oversight, complaints and monitoring			
Sanction	The exemption can be revised or abolished	The agreement can be modified or suspended	Cancellation of the exemption
Institutions			
Registration	Ministry of Transport	Ministry of Transport	Competition Commission
Monitoring	Fair Trade Commission	Fair Trade Commission	Competition Commission
Discussion agreements [a]	No provision	No provision	No provision

	United States
Main competition law	US Anti-trust Law
Status of the liner shipping sector	Exempted Shipping Act 1984 amended by the Ocean Shipping Refom Act 1998
Requirements	
Registration	Yes
Tariffs filling	No
Open agreement	Yes
Other	-
Discipline between members	
Independent actions	Must be allowed, must be notified by members
Individual contracts	Must be allowed, must be confidential
Oversight, complaints and monitoring	
Sanction	Removal of the immunity, penalties
Institutions	
Registration *Monitoring*	Federal Maritime Commission (FMC)
Discussion agreements [a]	No provision

Source: Author's calculation. Notes: [a] *Stricto sensus* -- i.e. agreements between conference and non-conference members. [b] Renamed the Competition and the Consumer Act 2010. [c] Outward agreements only are exempted.

Chapter II

Preferential Treatment in the Maritime Transport Sector

The Current and the Outdated

Abstract

This chapter aims at analysing preferential treatment in the maritime transport sector. This analysis is split into two parts related to two different preferential schemes corresponding to two periods. In the pre-General Agreement on Trade in Services (GATS) scheme, two types of sector-specific agreements grant preferences in the sector. In these agreements, the preference takes the shape of bilateral cargo reservations -- also called Cargo Sharing Agreements (CSAs). In the post-GATS scheme, most preferences are granted through sectoral provisions contained in PTAs.
First, concerning the pre-GATS scheme, after studying the content of sector-specific agreements, I conclude that from the early 1990s, these agreements became less and less protectionist. And, by comparing flags and operators of vessels deployed on bilateral maritime routes with bilateral cargo reservations' conditions contained in agreements, I show that today, only two CSAs are enforceable (between Brazil and Argentina and Brazil and Chile) among a sample of 156 agreements.
Second, concerning the post-GATS scheme, by comparing GATS and PTAs commitments, I show that some countries (e.g. Chile, Mexico and Japan) are likely to grant substantial preferences in the maritime transport sector to their partners. However, huge differences exist across countries. Furthermore, for each country the variance of the potential preference granted is low. In other words, countries involved in bilateral negotiations are willing to offer what they have already granted to other partners -- i.e. whatever the partner, the period of negotiation, etc... Nevertheless, the rapid development of PTAs does not mean the disappearance of maritime transport-specific agreements. Indeed, some new generation agreements (e.g. EU-China and United States-China agreements) of which the content is close to PTAs, grant relative important level of preference.

JEL Codes: L92, F13, F15

Keywords: Maritime transport, Trade policy, Preferential treatment

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1. Introduction

This chapter investigates preferential treatment in the maritime transport sector. Broadly speaking, before the entry in force of the General Agreement on Trade in Services (GATS) in 1995, few Preferential Trade Agreements (PTAs) contained provisions related to services trade. In services, preferential treatment was granted through sector-specific or horizontal agreements. Since 2000, an increasing number of PTAs in services under article V of the GATS have been signed. Maritime transport is no exception to these evolutions. Thus, in the pre-GATS preferential scheme, two types of sector-specific agreements grant preferences. In these agreements the preference takes the shape of bilateral cargo reservations -- also called Cargo Sharing Agreements (CSAs). And, in the post-GATS scheme, most preferences are granted through PTAs.

This chapter aims at analysing the degree of preference granted in the maritime transport sector. It is split into two parts related to both preferential schemes. First, concerning the post-GATS scheme, I compare flags and operators of vessels deployed on bilateral maritime routes to bilateral cargo reservations' conditions contained in agreements in order to determine which CSAs are enforceable or not. Second, concerning the pre-GATS scheme, I compare GATS and PTAs commitments in order to assess the degree of preference granted between trading partners. This study is important for the rest of the dissertation since preferential treatment is likely to affect the Most Favoured Nation (MFN) regulatory regime of countries. The chapter is based on agreements signed by 30 countries between 1960 and 2009, which represents a sample of 224 Bilateral Maritime Agreements and 49 PTAs.[1]

The paper is organized as follows: the first section is the introduction. In the second section, I review the growing literature on economics of preferences in services, I connect it to the maritime transport sector and I present the theoretical impact of the various types of preferences. The third section deals with the pre-GATS preferential scheme, it focuses on the enforceability of bilateral cargo reservations. The fourth section deals with the post-GATS

[1] The sample of countries is detailed in Annex 1.

preferential scheme, precisely I compare GATS and PTAs commitment of countries in maritime transport. The fifth section concludes and provides some policy recommendations.

2. Economics of preferences in maritime transport[2]

There is a large and established literature on the economics of preferences for goods, from the static theory on trade creation and trade diversion (Viner) to dynamic theories on location and agglomeration effects (Krugman, Venables, De Melo or Panagariya), and on economies of scale and competition (Corden, Bhagwatti, Krugman). In the meantime, the economic analysis of preferences in services has grown naturally with the development of PTAs under article V of the GATS. In this section, I apply the various theories on the economics of preferences in services to maritime transport. I describe the most often employed measures to grant preferences and explain their welfare impact -- from a static and a dynamic point of view. I focus on modes 1 and 3 of supply.

Cargo Sharing Agreements (CSAs) are a very particular form of preferences which are granted in transport sectors, and especially in international shipping. These agreements establish a system of cargo reservation between two partners based on shares of bilateral trade transported by sea. These shares can be expressed in terms of trade volume or trade value, in fixed proportions. Reservations can affect all freight, specific types of cargo or specific traffic.[3] CSAs are exceptions to the MFN principle in cross-border trade -- i.e. trade in mode 1. Contrary to the majority of measures granting preferences, CSAs are not second best opening measures. They are pure protectionist measures that exclude third countries. In fact, CSAs work like simple quotas. Therefore, the Vinerian theory of trade creation and diversion is of no interest in analysing CSAs. And, this type of preferences is necessarily welfare reducing for the country granting the preference -- by increasing the price for consumers. Moreover, as stated in Mattoo and Sauvé (2008) "*in the case of goods, the quota rents can be appropriated by domestic intermediaries* [..] that are better placed to obtain import licences [..] *like the importer rather than the foreign exporter. However intermediation is difficult* [..] concerning services because they are [..] *not storable and directly supplied by producers to consumers*. *Rents are therefore usually appropriated by exporters rather than domestic importers*." Finally, often, the CSAs welfare effects are misunderstood. For instance,

[2] This part is inspired from Mattoo and Fink (2002) and Mattoo and Sauvé (2008).
[3] CSAs are described in more details in the first part of the next section.

McGuire *et al.* (2000), by constructing a bilateral preference index assume that "*Economies with bilateral agreements on cargo sharing are considered to be more liberal than those economies without such agreements*". This is a wrong interpretation of what CSAs are.[4]

As explained in the previous chapter, some impediments to trade affect foreign firms' operations -- in other words their marginal costs. Since impediments to trade in international shipping are regulatory, they are purely frictional and do not generate revenue for local agents -- contrary to tariffs, for instance. Considering the impact of these restrictions on marginal costs, the analysis of preferential treatment is analogous to the analysis of tariffs on goods (Mattoo and Fink, 2002), but the conclusions are quite different. Indeed, in the absence of counterparts for local agents, a preferential removal of these impediments does not generate revenue losses. Therefore, there is no risk of trade diversion and the preferential liberalization is necessarily welfare-enhancing. However, it is a second best option only since multilateral liberalization is always more efficient.

Other impediments to trade in maritime transport services affect the entry of foreign providers. These impediments can increase the fixed costs associated with establishing cross border trade. For instance, some countries require foreign companies that want to operate a service to establish a commercial presence on the territory. Impediments to trade can also increase the fixed costs to establish a commercial presence by imposing burdensome and costly licensing process to foreign providers. Eliminating such impediments in a preferential way is likely to enhance welfare. However, the welfare gain would depend on the efficiency of the partner's providers (Mattoo and Fink, 2002). The greater a country is opened vis-à-vis the rest of the world, the more it will benefit from liberalization.

In some services sector, the number of providers is limited because of market failures. This is the case for some auxiliary services such as cargo handling or storage and warehousing because of the existence of economies of scale and the scarcity of port space. Generally, companies that want to provide these services must obtain concessions from port authorities through auctions or tenders -- in absence of competition in the market, port authorities introduce competition for the market. In such circumstances, preferential

[4] In only one case CSAs are not purely exclusionary. Indeed, a common policy in maritime transport is to reserve cargo unilaterally -- i.e. a country reserves a type of cargo for its own vessels. Interestingly, if a country reserves unilaterally a type of cargo and if this cargo is at the same time shared bilaterally under a CSA, it represents a second best opening measure. The best example is the US-Brazil CSA. The United States reserves government-controlled cargo for US flagged vessels and this type of cargo is shared under the CSA with Brazil. Nevertheless, today most unilateral cargo reservations disappeared, therefore this case is scarce or even non-existent.

liberalization could exclude the most efficient investors from the concession allocation process. If the selected provider is not the most efficient there is an opportunity cost in terms of price, quality or positive spillovers. Again, a non-discriminatory liberalization implies better impact on welfare than preferential liberalization. Importantly, the adoption of liberal rules of origin in preferential agreements could limit this risk (Mattoo and Sauvé, 2008).[5]

From a dynamic point of view, liberalization on a preferential basis could affect the sector's efficiency on the long term. First, concessions in auxiliary services are often allocated for long periods. For instance, according to the World Bank the average length of Build-Operate-Transfer (BOT) seaports contracts exceeds thirty years (World Bank, 2009). Second, sunk costs could be high. These two characteristics of service sectors are likely to confer a long term advantage to first newcomers.

Finally, as in the case of goods, enlarging the market through preferential liberalization in services is likely to lead to both economies of scale and increased competition. Granting preferential access to a trading partner could also attract FDI (Foreign Direct Investment) since it enlarges the market or makes a country's reforms more credible. Preferential liberalization could as well be seen as a first step before MFN liberalization -- conditional to programming further opening and remaining open vis-à-vis the rest of the world.

3. The pre-GATS preferential scheme

The pre-GATS preferential scheme comprises two types of institutional arrangements: sector-specific bilateral agreements and a multilateral treaty. In this section, I describe the two types of arrangements, I explain to what extent they are likely to grant preferences and I assess their applicability and implementation.

[5] In services, liberal rules of origin allow all suppliers established in the territory of the partner to benefit from the access provided by the agreement as long as they carry on substantial business activities there (Marchetti and Roy, 2008).

Bilateral maritime agreements

BMAs are agreements on commercial shipping and maritime transport.[6] They deal with many sectoral issues such as the recognition of documents, rights of crews, vessels in distress, etc,… In this sub-section I focus on CSAs. Since BMAs are plentiful, sensitive and not always available, an exhaustive study is difficult. I listed 224 agreements from three main sources: the UN Treaty database (UN Treaty Collection Database, 2009) and the Departments of Transport and Foreign Affairs of countries. Among these 224 agreements, 68 texts are not available, therefore, I focus on the 156 remaining agreements.[7] Most CSAs can be found in BMAs and few in south-south PTAs. Nevertheless, all BMAs do not contain CSAs provisions. CSAs could take various forms. Ideally, the agreement describes clearly the reservation conditions:

- The type of cargo reserved: Reservations can apply to some or all cargoes, a type of traffic (e.g. liner), a type of good (e.g. coal, oil) or a good ordered or financed by specific clients (e.g. government cargoes[8]);
- The type of vessels which is allowed to transport the cargo: Vessels flying the flag of the partners or vessels operated by national companies of the partners;
- The type of sharing: Equal between partners (50%-50%), equal with third countries (1/3-1/3- 1/3) or 40-40-20 (40% for partners and 20% for third countries) like in the UN Liner Code.

Most of CSAs can be found in agreements signed by Algeria, Brazil, India, Mexico, Spain and the US (Table 1). However, in many agreements, CSAs are not openly admitted -- called confusing agreements hereafter. Confusing agreements use vague and obscure expressions and contradictions that prevent from clearly identifying CSAs. This is the case for French, Chinese and former Soviet agreements.

[6] I exclude double taxation treaties on transport, treaties on maritime boundaries or maritime search and rescue agreements which are not relevant for this analysis.
[7] For a detailed description of BMAs, see Annex 2.
[8] According to the US Maritime Administration, a government cargo is a cargo that is moving either as a direct result of Government involvement through financial sponsorship of a Government program or, in connection with a guarantee provided by the Government.

Box 1: Examples of "confusing agreements"

Most agreements signed by the former USSR "[…] *encourage participation by their vessels in marine transport between the ports of their countries* […]" but they "[…] *promote the development of international shipping on the basis of the principles of freedom of navigation* […] and they "*shall not affect the right of vessels of third countries to participate in transport between the ports of one of the Contracting Parties and the ports of the other Contracting Parties".*

Chinese and intra-Asian agreements are also confusing. They might include sentences such as "*In accordance with the principle of equality and mutual benefit*". A typical clause might read: "*Vessels of either Contracting Party may sail between the ports of the two countries which are open to foreign trade and engage in passenger and cargo services (hereinafter called the "agreed services") between the two countries or between either country and a third country*", Then "*Chartered vessels flying the flags of third countries acceptable to both Contracting Parties but operated by shipping enterprises of either Contracting Party may also take part in the agreed services*."

Confusing agreements allow partners to implement or not bilateral reservations. This characteristic makes these agreements difficult to analyse. I classify the agreements of my sample in four categories: 59 BMAs contain a cargo sharing scheme (38%), 36 agreements do not contain any cargo sharing schemes (23%) and 61 agreements are "confusing" (Table 1).

Table 1: CSAs in BMAs -- By country (from 1960 to 2008)

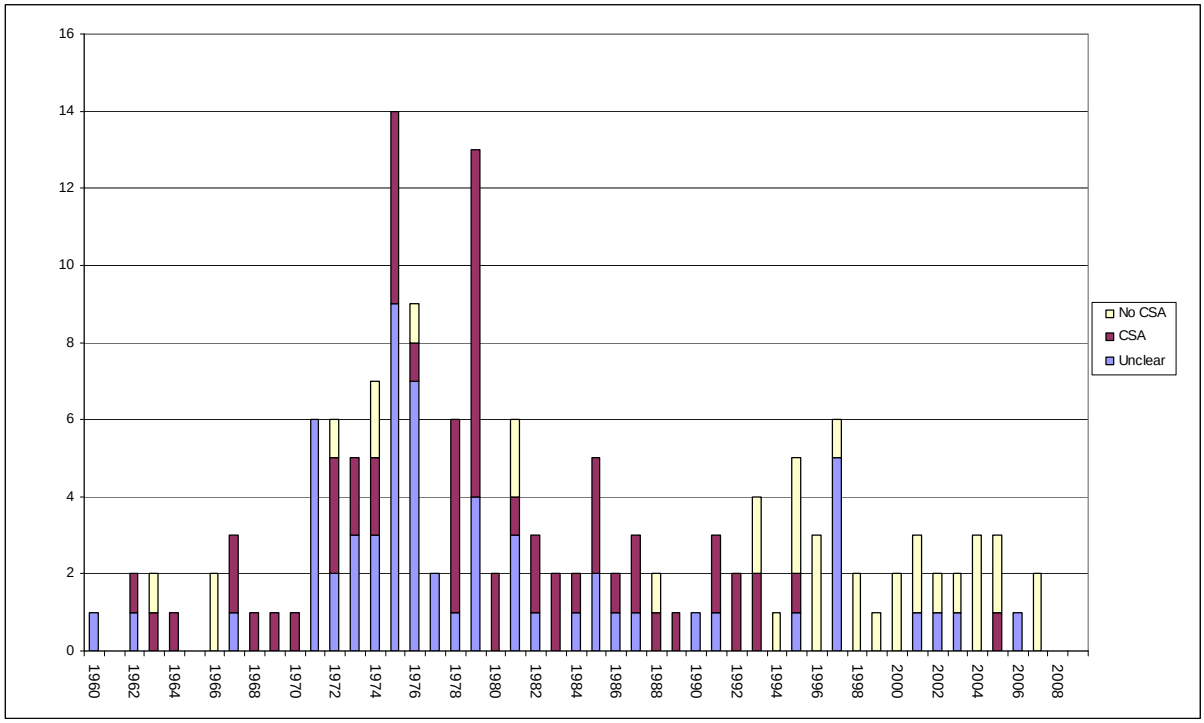
	CSA	No CSA	Confusing	Unavailable	Total BMAs
Brazil	**15**	1	3	0	19
Russia (and former USSR)	12	1	**23**	4	40
Algeria	**10**	3	6	6	25
Spain	**8**	0	0	0	8
USA	**8**	6	1	3	18
India	**6**	1	0	0	7
Mexico	**6**	0	1	1	8
France	4	8	**13**	4	29
China	3	4	**15**	9	31
Egypt	3	2	0	**24**	29
Former GDR	2	0	3	0	5
Morocco	2	0	0	1	3
Singapore	2	1	1	1	5
Chile	1	1	0	0	2
Germany (and former FRG)	1	**9**	2	5	17
Italy	1	0	1	1	3
Malaysia	1	0	2	2	5
South Korea	1	3	2	0	6
Thailand	1	2	1	1	5
Canada	0	0	1	2	3
Colombia	0	0	0	1	1
Indonesia	0	1	0	**5**	6
Saudi Arabia	0	0	0	1	1
South Africa	0	1	0	**15**	16
Sweden	0	0	2	0	2
Turkey	0	5	0	4	9
United Kingdom	0	2	0	0	2
Japan	0	0	1	0	1

Source: Author's calculation, for details see Annex 2. Notes : includes former, repealed and replaced treaties. Column "unavailable": text of the BMA is not available.

CSAs are more or less restrictive. For instance, CSAs signed by Latin-American countries are the most protectionist -- e.g. agreements signed by Brazil and Mexico and agreements signed between Latin-American countries. Indeed, these agreements reserve all freight except strategic products such as petroleum and ore. Additionally, only vessels flying the flag of partners are allowed to transport bilateral seaborne trade. Then, the agreements signed by Spain are the most protectionist. They reserve all the liner traffic and only national shipping companies are allowed to transport it in a 40-40-20 proportion. French and Indian agreements vary across partners and time. Finally, the most recent US bilateral reservations are put on government cargoes which are reserved for vessels flying the flag or operated by a national company in a 50-50 proportion. This type of agreements is still in force with Brazil. Interestingly, in many agreements, the restrictive "flying the flag" clause disappeared in favour of "flying the flag or operated by a national company". This evolution aims at taking into account the deflagging process. Furthermore, since the mid-1990s, BMAs have contained less and less CSAs (Figure 1). More important, they emphasize freedom of traffic and free

choice of the flag. This evolution is mainly driven by the agreements signed by European Union (EU) countries (e.g. Germany[9], Netherlands, United Kingdom and France) and Turkey.

Figure 1: Evolution of CSAs in BMAs (from 1960 to 2008)



Source: Author's calculation, for details see Annex 1. Note: Includes former, repealed and replaced treaties.

According to many experts, CSAs have disappeared. However, since most BMAs have not been explicitly repealed and the information on the application of CSAs are difficult to obtain, it is necessary to investigate to what extent these preferences are still applied and implemented. The following aims at demonstrating that CSAs are not applied because they are unenforceable.

As mentioned above, the reserved cargoes must be transported in two types of vessels: vessels flying the flag of partners and/or operated by national companies of partners. According to the type of vessels allowed to transport the reserved cargoes, I check on bilateral maritime routes affected by CSAs whether vessels deployed fly the flag and/or are operated by national companies of partners.[10] In the absence of direct services or of vessels fulfilling

[9] Interestingly, Former Federal Republic of Germany has signed liberal agreements, since the early 1960s.
[10] The Containerization International (CI) Online database provides information on the world liner traffic. The database lists all existing services between each pairs of countries. For each service, it gives the vessels deployed, their flags and their operators.

the legal conditions set by the agreement to benefit from the cargo reservation, I conclude that reservations cannot be enforced. In some CSAs all freight can be reserved, however, the Containerization International (CI) Online database provides data for the liner traffic only. Hence, the methodology is relevant for the liner traffic only. However, practically, free access and non discrimination rule the bulk traffic and most CSAs are applicable to the liner traffic (OECD, 2001). CSAs are enforceable in 45 maritime routes.[11] Table 2 focuses on CSAs reserving cargoes for vessels flying the flag and Table 3 focuses on CSAs reserving cargoes for vessels flying the flag or operated by nationally-controlled companies.

Table 2: Direct services deployed on routes with potential CSAs (1)

Reserved cargo must be transported on vessels that fly the flag

Partners		Direct Services		Flag's Vessels [a]	
A	B	Carriers	Ships	A	B
Algeria	Bulgaria	X	X	X	X
Algeria	USSR	X	X	X	X
Brazil	Mexico	7	22	X	X
Brazil	Romania	X	X	X	X
Brazil	Uruguay	12	80	10 (19680)	X
Brazil	Ecuador	3	7	X	X
Brazil	Peru	3	7	X	X
Egypt	India	12	84	X	2 (8800)
France	Egypt	20	97	3 (17346)	4 (1301)
India	Pakistan	27	111	X	X
Mexico	Bulgaria	X	X	X	X
Mexico	Netherland	X	X	X	X
Russia (Former USSR)	Pakistan	X	X	X	X
Russia (Former USSR)	Mexico	X	X	X	X
Spain	Equatorial Guinea	X	X	X	X
Spain	Senegal	8	25	X	X
16		**8**		**2**	**2**

Source: CI Online (2009). Notes: Do not include former, repealed and replaced treaties. [a] Number of vessels deployed and in brackets, number of TEU.

As shown in Table 2, 16 agreements reserve cargoes for vessels that fly the flag of partners. Among them:

- 8 CSAs cannot be enforced in the absence of direct services on the route between partners;
- 5 CSAs cannot be enforced in the absence of vessels flying the flag of the partners;
- 2 CSAs, are not fully enforceable since only one partner has vessels flying its flag;
- Finally, cargo sharing is possible for the French-Egyptian agreement only. However, according to the French Ministry of Transport it has never been applied.[12]

[11] They are routes covered by an agreement which is available, in force (or that has not been explicitly repealed) and where CSAs could be clearly identified.

[12] Source: Meeting at the French Ministry of Transport, October 27 2009.

Table 3: Direct services deployed on routes with potential CSAs (2)

Reserved cargo must be transported on vessels that fly the flag or chartered/operated by a national company

Partners		Direct services		Flying the flag and/or chartered	
A	B	Carriers	Ships	A	B
Algeria	Guinea	X	X	X	X
Algeria	Belgium - Luxembourg	4	11	4 (1020)	X
Algeria	Albania	X	X	X	X
Algeria	Iraq	X	X	X	X
Algeria	Italy	9	18	X	3 (2410)
Algeria	Tunisia	5	14	X	X
Algeria	Egypt	2	6	X	2 (748)
Brazil	Portugal	2	7	X	X
Brazil	Argentina	20	137	16 (39448)	8 (21163)
Brazil	United States	10	42	3 (10569)	X
Brazil	USSR	X	X	X	X
Brazil	Germany (former FRG)	7	37	2 (11881) [b]	5 (28835) [b]
Brazil	Chile	3	7	2 (4123)	2 (4108)
Brazil	Poland	X	X	X	X
India	Poland	X	X	X	X
Malaysia	USSR	1	10	X	X
Morocco	Spain	13	67	7 (5208) [b]	2 (834) [b]
Russia (Former USSR)	Ethiopia	n.a	n.a	n.a	n.a
Russia (Former USSR)	Sri Lanka	1	10	X	X
Russia (Former USSR)	India	1	10	X	X
Singapore	China	41	547	107 (409689)	34 (192269) [b]
Singapore	Viet Nam	20	72	24 (60168) [b]	5 (3828)
South Korea	China	54	606	36 (144988)	137 (489711)
Spain	Gabon	2	6	X	X
Spain	Ivory Coast	5	33	X	X
Spain	Mexico	5	26	X	X
Spain	Russia (Former USSR)	X	X	X	X
Spain	Tunisia	X	X	X	X
Thailand	Bangladesh	X	X	X	X
29		**19**		**9**	**9**

Source: CI Online (2009). Notes: Do not include former, repealed and replaced treaties. [a] Number of vessels and in brackets, number of TEU. [b] Some vessels are registered in one country and operated by a national company of the other.

Furthermore, 29 agreements reserve cargoes for vessels flying the flag of partners or operated by nationally-controlled companies (Table 2). Among them:

- 9 CSAs cannot be enforced in the absence of direct services on the route between partners;
- 8 CSAs cannot be enforced in the absence of vessels flying the flag and operated by national companies;
- 4 CSAs are not fully enforceable since only one partner has vessels flying its flag or operated by national companies;
- Finally, CSAs can be enforced on routes between Brazil and Argentina, Brazil and Germany, Brazil and Chile, Spain and Morocco, Singapore and China, Singapore and Viet Nam and China and South-Korea.[13]

[13] For one route the information is not available.

Nevertheless, most of these agreements are not applied for various reasons. First, the agreements signed by the EU countries (Brazil-Germany and Spain-Morocco) are obsolete since the EU Regulation 4055/86 states that "*existing cargo sharing arrangements in bilateral agreements with non-Community countries have to be adjusted or phased out*". Second, according to the Chinese authorities, no CSA has never been implemented by the country (WTO, 2008). Third, Singaporean authorities stated that Singapore has not entered into any bilateral agreements on cargo-sharing (WTO, 1995). Finally, only agreements between Brazil and Argentina and Brazil and Chile are enforceable. Interestingly, the implementation of these agreements have been confirmed by the Brazilian Maritime Transport Agency -- Agência Nacional de Transportes Aquaviário (ANTAQ).[14 and 15]

Regarding confusing agreements, in the absence of precise information on the reservation conditions, the methodology used above cannot be applied. The solution consists in ascertaining that CSAs have been applied or not on these routes through discussions with experts and professionals. In the former USSR, maritime transport was managed by a government agency that tried to impose 100% Soviet vessels, whatever said the agreement. Most of these agreements were not denounced by the Russian government when the Union collapsed, however, the system disappeared in the early 1990s. France applied CSAs with Northern African countries (i.e. Algeria, Morocco, Tunisia) very imperfectly. For instance, with Morocco, only Roll-on Roll-off traffic was reserved. 70% of the traffic was transported by Moroccan operators and 30% by French ones. All agreements with North African countries were stopped during the 1990s. The agreement with Algeria was denounced and the agreement with Tunisia was renegotiated to be more liberal, in accordance with the EU requirements. The situation with West-African countries is more complex. Before the signature of the UN Liner Code, the market was a quasi-monopoly for French operators. Since the end of the 1970s, all the traffic has been governed according to the UN Liner Code principles -- for details see the sub-section below. Other CSAs (confused or not) have never been applied.[16]

To conclude, most CSAs are unenforceable today. First, they are unenforceable in the absence of direct services on routes between partners. This is mainly due to the development

[14] Source: E-mail communication by the ANTAQ (2009)
[15] Importantly, the ANTAQ also confirmed that the other CSAs listed are not implemented. This confirms the validity of the methodology used.
[16] Source: Meeting at the French Ministry of Transport, October 27 2009.

of the hub and spoke system in liner shipping, in other words because of the development of transhipment. Under this system, long journeys between main ports (hubs) are performed by larger vessels and the distribution of cargoes within regions is performed by smaller vessels called feeders. Second, CSAs are unenforceable in the absence of vessels flying the flag of countries. This is due to the deflagging process (Fink *et al.*, 2002). CSAs are also unenforceable because of the absence of vessels operated by national companies. Additionally, most CSAs have never been applied for various other reasons. Some agreements were signed between countries with insignificant fleets. Other agreements were signed between countries whose bilateral trade was insignificant. And, CSAs have never been applied since they were too costly to administer and manage. This latter factor tends to confirm a common thinking in economics of preferences in services: due to the nature of trade impediments, it is difficult and costly to grant preferences.

Finally, it would be a mistake to reduce BMAs to CSAs. Indeed, since the early 2000, a new generation of BMAs has appeared -- e.g. EC-China, France-South-Africa, United States-Viet-Nam and United States-China. Interestingly, these agreements reject CSAs and emphasize non discrimination and free access to international shipping cross-border trade. More important, new generation agreements deal with commercial presence (i.e. trade in mode 3) and are likely to provide actual preferences in this mode of supply. Thus, in many aspects, the content of these new generation BMAs is close to provisions related to maritime transport contained in PTAs. Therefore, this issue is addressed in the next section which is dedicated to the study of PTAs.

Potential sharing of cargo under the UN Liner Code

With the introduction of the UN Liner Code in the 1970s, the system of bilateral cargo reservations was "multilateralized". Indeed, the UN Liner Code established between signatories a cargo sharing system applied to trade in liner conferences. The repartition was the following: 40 % for the trading partners at each end of the route and 20 % for third countries. Article 2 on the participation in seaborne trade states that:

"*4. When determining a share of trade within a pool of individual member lines and/or groups of national shipping lines in accordance with article 2, paragraph 2, the following principles regarding their right to participation in the trade carried by the conference shall be observed, unless otherwise mutually agreed:*

(a) The group of ***national shipping lines***[17] *of each of two countries the foreign trade between which is carried by the conference shall have equal rights to participate in the freight and volume of traffic generated by their mutual foreign trade and carried by the conference;*

(b) Third-country shipping lines, if any, shall have the right to acquire a significant part, such as 20 per cent, in the freight and volume of traffic generated by that trade."

Again, the literature contains strong presumptions that the UN Liner Code is not applied. For instance, in 2004, Danny Scorpecci, declared : "*while the UN Liner Code and its cargo sharing provisions is still in force, very few States are applying it*" (OECD, 2001). Like for CSAs, I check whether potential bilateral reservations under the UN Liner Code are enforceable or not. Again, using the CI Online data, I proceed by elimination.

I assume that each pair of countries that has ratified the Convention has a potential bilateral cargo reservation on its maritime route. First, I check whether a direct service on the route exists. Second, on routes where a direct service exists, I check whether national companies operate vessels.

Table 4: Direct services on routes between UN Liner Code members

	Routes without direct service	Routes with at least one direct service			Total
		Routes with no national operator	Routes with operator(s) of one nationality	Routes with operators of both nationalities	
Amount	1855	261	51	11	2178
Percentage	85.2	12.0	2.3	**0.5**	100.0

Source: CI Online (2009).

The sample represents 2178 bilateral routes. No direct service is available on 1855 routes (Table 4). On 261 routes, at least one direct service exists but no vessel is operated by national companies of partners. On 51 routes, the existing direct services are operated by national companies of only one partner. Finally, a full implementation of the UN Liner Code is not possible on 95.5% of the routes. Again, the development of transhipment made the UN Liner Code unenforceable for most of its members. Following my methodology, the UN Liner Code can be implemented on 10 routes.[18] All of these routes involve at least one Asian country and most of them are routes between two Asian countries. However, according to the

[17] According to the UN Liner Code, a national shipping line is "*a vessel-operating carrier which has its head office of management and its effective control in that country and is recognized as such by an appropriate authority of that country or under the law of that country.*"

[18] Chile-China, China-Malaysia, China-Philippines, China-Republic of Korea, China-Saudi Arabia, India-Malaysia, India-Republic of Korea, India-Saudi Arabia, Malaysia-Korea, Republic of Korea-Russia.

literature, and confirmed by maritime transport experts, the UN Liner Code was only applied on the traffic between West African and the EU (Fink *et al.*, 2002). Precisely, West African countries applied the Code on all freight and not only on the liner conference traffic. However, the countries' fleet were not sufficient to transport their own share of the reserved traffic. Hence, African countries implemented a system of market rights. When foreign maritime transport companies wanted to transport the share of cargo reserved, they had to buy these rights. Therefore, in West Africa, even if the Code was unenforceable, it caused increasing prices of the maritime transport service. It generated rents for foreign companies and corruption in the domestic administration. Nowadays, the UN Liner Code is fully obsolete since the EU decided to repeal the Regulation 954/79 that concerned the ratification by member states of the UN Liner Code -- Regulation 1490/2007.

4. The post-GATS preferential scheme

Marchetti and Roy (2008) developed a methodology in order to assess the degree of preference granted by PTAs in services under article V of the GATS. While they assessed the degree of preference granted in services sector as a whole, in this section, I focus on maritime transport. I investigate 49 PTAs in goods and services currently in force (WTO, 2009).[19]

PTAs in maritime transport -- an overview

Among the 49 agreements listed, 34 contain commitments dealing with maritime transport, 12 do not and the text of three agreements is not available. Among the 34 agreements containing provisions on maritime transport, 7 call for cooperation and 27 really grant preferences (Table 5).

Table 5: The treatment of maritime transport in PTAs

49 Agreements [a]					
No provision on MT: 12		Agreement with provisions on maritime transport: 34			
		Only cooperation: 7		Agreements granting preference: 27	
G [b]: 10	G&S or S [c]: 2	G [b]: 6	G&S or S [c]: 1	G [b]: 2	G&S or S [c]: 25

Source: WTO (2009). Notes: [a] The texts of three agreements are not available. [b] Under article XXIV of the GATT or the enabling clause. [c] Under article V of the GATS.

[19] The country sample is similar to the one used in the previous section, for more details see Annex 1. In contrast to the previous section, the EU is taken as a single jurisdiction.

Few PTAs in goods (i.e. under Article XXIV of the GATT or the enabling clause) refer to the maritime transport sector. However, some peripheral agreements linked to south-south PTAs such as the Maritime Convention of Arab Maghreb Union signed in 1991 and the ASEAN (Association of Southeast Asian Nations) Resolution on Shipping and Trade, signed in 1980 refer to BMAs and CSAs. And, some BMAs signed by Latin American countries refer to the Latin American Integration Association (LAIA). Furthermore, some PTAs in goods signed by the EU contain provisions on maritime transport (e.g. agreements signed with Egypt, Mexico, Morocco and Tunisia). However in these agreements, the provisions related to maritime transport are only cooperative. The development of PTAs containing provisions on maritime transport is subsequent to the GATS.[20] Most PTAs in services were signed after 2000 and none of them contains CSAs since their objective is to (preferentially) liberalize services markets.

Comparing provisions in PTAs and GATS commitments in maritime transport

Hoekman (1996) and Marchetti and Roy (2008) developed a methodology in order to assess the depth of GATS and PTA commitments. The first stage of this methodology (the part developed by Hoekman) consists in coding the GATS commitments of countries as follows: a full commitment ("none" is inscribed in the schedule) is coded 1, a partial commitment (one or more limitations are inscribed in the schedule) is coded 0.5 and no commitment ("unbound" is inscribed or the sector is uncommitted in the schedule) is coded 0. However, because of the heterogeneity of trade limitations in partial commitments, this methodology does not allow to differentiate PTAs and GATS commitments. Marchetti and Roy address this issue by assigning a higher score for each improved partial commitment in PTAs: "e*ach improvement was identified adding half the difference between the score 1 and the score of the partial commitment being improved*" (Marchetti and Roy, 2008). "Absolute preference margins" are computed by subtracting PTAs from GATS scores.

[20] However, there were pioneers in this field -- such as Australia and New-Zealand with the Closer Economic Relations (CER) in 1988 and the US, Canada and Mexico with NAFTA (North American Free Trade Agreement) in 1994.

Table 6: Illustration of the Hoekman and Marchetti and Roy methodology

	GATS	PTA with country A	PTA with country B	PTA with country C
Shipping - Mode 3	No commitment 0	New commitment, although with some limitations (partial) 0.5	Better commitment than with country A, but limitations remain (partial) 0.75	Even better commitment than in the PTA with B, but limitations remain (partial) 0.875
Handling - Mode 3	No commitment 0	No commitment 0	Full commitment 1	No commitment 0
Storage - Mode 3	Partial commitment 0.5	Same as GATS: partial commitment 0.5	No better commitment than in GATS 0.5	Better commitment than in GATS, but limitations remain (partial) 0.75

Source: Marchetti and Roy (2008).

However, this methodology has two drawbacks. First, since limitations in partial commitments are not measured precisely, GATS and PTAs scores do not reflect the real degree of restrictiveness of commitments. Nevertheless, considering the resources needed to construct a composite index of restrictiveness, my "guesstimates" are sufficient to assess and compare the depth of commitments. Second, by using this methodology, I do not measure the real preference granted because of the difference between bound and applied regulatory regimes in countries. Indeed, just as there is "water in tariffs", there is "water in regulations". And, as shown by Gootiz and Mattoo (2009), the amount of "water" is important in services sector. This is likely to be due to the fact that GATS commitments have been made in Marrakech in 1994 and that countries have undertaken unilateral reforms since that date. Moreover, at Marrakech, many countries did not bind their applied regime in order to retain some room for manoeuvre to implement more restrictive regulations. As shown in Table 7, the absolute preference margins do not reveal real preferences granted (i.e. the difference between preferential and applied regimes) but potential preferences (i.e. the difference between bound and preferential regimes).[21] For these reasons, in their article, Marchetti and Roy (2008) preferred using the term "GATS+ commitments in PTAs". In the absence of extensive data on the applied MFN regime, I am not able to address this issue satisfactorily to date.

[21] Here, I assume that commitments in PTAs are really applied. However, the same comment can be made on the difference between granted and applied preferences -- as shown for CSAs. This issue is even more complicated. If the MFN applied regime is necessarily more liberal than the, in the absence of an operational dispute settlement body, the applied preferential regime could be more or less restrictive than the committed preference.

Table 7: Potential and real preferences, what is measured?

Protectionnist regime	MFN bound -- GATS commitment / MFN applied regime	Potential preference: Water in the regulation / Preferential regime committed	Real preference [a]	Liberal regime

Source: Author's elaboration. Notes: [a] I assume that there is no gap between committed and applied preferences.

My analysis focuses on international shipping, auxiliary services (i.e. cargo handling, storage and warehousing, container station and depot, maritime agency and freight forwarding) and access to port and related services according to the GATS framework.[22] I focus on mode 1 and mode 3.

Table 8: GATS commitments scores in maritime transport

		Score			Score
1	Korea	0.80	10	Indonesia	0.21
2	China	0.73	11	EC	0.19
3	Singapore	0.52	12	Algeria	No Comm.
4	Australia	0.45	13	Chile	No Comm.
5	Canada	0.43	14	India	No Comm.
6	Malaysia	0.42	15	Mexico	No Comm.
7	Thailand	0.33	16	Morocco	No Comm.
8	New Zealand	0.31	17	South Africa	No Comm.
9	Japan	0.22	18	USA	No Comm.

Source: Author's calculation. Note: Algeria is not a member of the WTO.

At the GATS, the deepest commitments were made by dynamic East-Asian countries such as Singapore, South Korea, and China. The high level of commitment offered by China can be explained by its status of new acceding country. First, the accession negotiations for China finished almost ten years after the initial negotiations. Second, accession negotiations are always more demanding than multilateral negotiations (Marchetti and Roy, 2008). In contrast, the weakest commitments were offered by developed countries with important interests in maritime transport: Japan, the EU and the United States (Table 8). Interestingly, the weak commitment made by the EU is likely to be a response of the weak US offer in the sector.

[22] In GATS, countries could commit to make port services available to international maritime transport suppliers on reasonable and non discriminatory terms and conditions.

Broadly speaking, preferences granted in the maritime transport sector are substantial. Indeed, among the sample, the median of the absolute preference margins is 0.26 and the average is 0.33. Furthermore, the variance is high. In other words, the dispersion of the absolute preference margins is significant. Preferences granted by Mexico, Chile and to a lesser extent Japan to their partners are important. In contrast, the US and the EU absolute preference margins are close to zero (Table 9).

Table 9: Absolute preference margins in maritime transport

	Provider	Partner	Year [a]	Abs. PM		Provider	Partner	Year [a]	Abs. PM
1	Mexico	NAFTA	1992	0.92	**26**	Australia	Chile	2008	0.24
2	Morocco	USA	2004	0.90	**27**	Singapore	India	2005	0.22
3	Mexico	Chile	1998	0.85	**28**	Algeria	EC	2002	0.19
4	Mexico	Japan	2004	0.85	**29**	China	Hong-Kong	2004	0.17
5	Chile	Canada	2008	0.84	**30**	South Africa	EC	1999	0.14
6	Chile	Australia	2008	0.82	**31**	Korea	Singapore	2005	0.13
7	Chile	Mexico	1998	0.77	**32**	Korea	Chile	2003	0.11
8	Chile	Korea	2003	0.73	**33**	Thailand	Japan	2007	0.10
9	Chile	USA	2003	0.73	**34**	Indonesia	Japan	2007	0.09
10	Chile	EC	2002	0.67	**35**	USA	NAFTA	1992	0.06
11	New Zealand	Australia	1988	0.64	**36**	USA	Chile	2003	0.06
12	EC	Chile	2002	0.63	**37**	USA	Australia	2004	0.05
13	Japan	Mexico	2004	0.59	**38**	USA	Morocco	2004	0.05
14	Japan	Malaysia	2005	0.55	**39**	Singapore	Korea	2005	0.04
15	Japan	Thailand	2007	0.52	**40**	Singapore	USA	2003	0.03
16	Australia	New Zealand	1988	0.50	**41**	China	New Zealand	2008	0.02
17	Canada	Chile	2008	0.45	**42**	Malaysia	Japan	2005	0 [b]
18	Japan	Singapore	2002	0.44	**43**	Singapore	China	2008	0 [b]
19	India	Singapore	2005	0.36	**44**	USA	Singapore	2003	0 [b]
20	Australia	Singapore	2003	0.36	**45**	New Zealand	China	2008	0 [b]
21	Japan	Indonesia	2007	0.34	**46**	EC	Algeria	2002	0 [b]
22	Australia	USA	2004	0.31	**47**	China	Singapore	2008	0 [b]
23	Singapore	New Zealand	2000	0.31	**48**	Singapore	Australia	2003	0 [c]
24	Singapore	Japan	2002	0.31	**49**	EC	South Africa	1999	0 [c]
25	New Zealand	Singapore	2000	0.27	**50**	Canada	NAFTA	1992	0 [c]

Source: Author's calculation. Notes: Absolute preference margin = PTA score - GATS score. [a] Year of signature. [b] The PTA score is equal to the GATS score. [c] The PTA score is lower than the GATS score, so I assume a preference margin equal to zero.

Furthermore, the variance of the absolute preference margins for each country separately is small -- less than 0.02 in most cases (Table 10). Thus, a country involved in bilateral negotiations is willing to offer what it has already granted to other partners. In other words, countries are inclined to offer to their partners a similar degree of preference regardless of the power and of what is offered by these partners -- i.e. not influenced by reciprocity. That is not so surprising since reciprocity works for the entire negotiation rather than at the sectoral level. Furthermore, except few exceptions, the year of the negotiation does not influence the degree of preference granted (Table 9). Countries can be classified in three categories: partners that grant a high level of preference (Mexico and Chile), countries granting a medium level of preference (Australia and Japan) and countries that grant a low level of preference (China, Korea, Singapore and United States).

Table 10: Variance of absolute preference margins -- By country

Level of Pref.	Provider	Obs.	Pref. Min.	Pref. Max.	Variance	Score GATS
High	Mexico	3	0.85	0.92	0.001	0
	Chile	6	0.67	0.84	0.004	0
Medium	Japan	5	0.34	0.59	0.010	0.22
	Australia	4	0.24	0.50	0.012	0.45
Low	Korea	2	0.11	0.13	0.000	0.80
	China	3	0	0.17	0.009	0.73
	Singapore	7	0	0.31	0.021	0.52
	USA	5	0	0.06	0.001	0.00
High Variance	New Zealand	3	0	0.64	0.106	0.31
	EC	3	0	0.63	0.143	0.19
	Canada	2	0	0.45	0.338	0.43

Source: Author's calculation.

The preference granted is also influenced by the level of GATS commitments. The smaller the GATS score of a country is, the greater is the level of preference granted. This is true for Mexico and Chile but also for Japan, Australia and to a lesser extent for China, Republic of Korea and Singapore. The United States is the exception since its GATS score is zero and in the same time the level of preference granted is weak.

Table 11: Absolute preference margins -- By sector and mode

	All GATS (MA&NT)	All PTAs (MA&NT)	Abs. PM (MA&NT)
Shipping - Mode 1	0.361	0.738	0.376
Shipping - Mode 3 - a [a]	0.167	0.415	0.248
Shipping - Mode 3 - b [b]	0.264	0.680	0.416
Cargo handling - Mode 3 [c]	0.097	0.535	0.438
Storage and wharehousing - Mode 3 [c]	0.292	0.559	0.267
Container Station and depot - Mode 3 [c]	0.153	0.480	0.327
Maritime agency - Mode 1	0.278	0.710	0.432
Maritime agency - Mode 3	0.208	0.695	0.487
Freight forwarding - Mode 1	0.319	0.564	0.244
Freight forwarding - Mode 3	0.347	0.592	0.245
Access and use of ports services [d]	0.444	0.469	0.025
TOTAL	0.257	0.590	0.334

Source: Author's calculation. Notes: [a] For the purpose of operating a fleet under the national flag. [b] Commercial presence that allows a foreign maritime company to undertake locally all activities which are necessary for the supply to their customers of a partially or fully integrated service. [c] For these services provision in mode 1 is not technically feasible.

In general, the level of preference granted is due to a switch from an unbound to a partial commitment, from a partial to a full commitment or from an unbound to a full commitment. Indeed, switching from one limitation (partial commitment) to a less restrictive limitation (another partial commitment) is scarce. Then, preferences granted are almost always more important in mode 3 than in mode 1. From a sectoral point of view, the most

important preferences are granted in cargo handling, maritime agency services and international freight shipping in mode 3b and to a lesser extent international freight shipping in mode 1. Interestingly, and as it is the case for countries, these are the sub-sectors for which GATS commitments are the weakest. However, this is not true for international shipping in mode 3. Potential preferences granted in some auxiliary services could be explained by the transformation that these sectors have undergone over the last ten years -- i.e. transition from tool ports to landlord ports.

As stated in Section 3, the content of some recent BMAs is close to the content of PTAs in services. These BMAs aim at preferentially liberalizing maritime transport sectors in mode 1 and 3. The preferences granted by these BMAs is substantial. Moreover, they were signed by major economies -- e.g. China, the EU and the United States. I use the Hoekman and Marchetti and Roy approaches in order to assess the level of preferences granted by these BMAs of new generation.

Table 12: Absolute preference margins -- New generation BMAs

Provider	Partner	Score PTAs	Abs. PM
EC	China	0.88	0.69
China	EC	0.88	0.15
USA	Viet-Nam	0.20	0.20
France [a]	South Africa	0.19	0.00
China	USA	0.20	0 [b]
USA	China	0.15	0.15

Source: Author's calculation. Notes : [a] GATS score for EU. [b] Less than zero.

Table 12 shows that preferences granted by the EU and the United States to China are more important than preferences granted in any other PTAs signed by these countries. Therefore, most BMAs are hollow and empty shells but, in their modern form, they can be used in order to grant preferences.[23] BMAs are rather complement than substitute to PTAs and their strength is to be sectoral.

[23] According to experts, no real preference is granted by the EU side in the EU/China maritime agreement while some are granted from the Chinese side.

5. Conclusion and recommendations

Three main conclusions can be drawn from this study on preferential treatment in the maritime transport sector. First, from the early 1990s the pre-GATS preferential scheme which was originally protectionist (and even exclusionary), became more and more liberal. Indeed, from this period BMAs began to reject CSAs and to emphasize on free access in cross-border trade. Additionally, most CSAs disappeared during this decade. In 2009, only two CSAs were enforceable (on the routes between Brazil and Argentina and Brazil and Chile) among a sample of 156 BMAs. The progressive extension of CSAs is likely to be due to two main changes that occurred in the sector's organization -- i.e. the deflagging process and the development of transhipment. However, even though BMAs became less protectionist, most of them do neither liberalize maritime transport markets nor grant significant preferences -- with the exception of few new generation BMAs. Second, from 2000 a shift on the form of agreements granting preferential treatment can be observed. The importance of sector-specific agreements (i.e. BMAs) declined to the benefit of PTAs in services. Importantly, PTAs are much more prone to preferentially liberalize the maritime transport sector. Indeed, PTAs provisions are more complete in terms of modes and sub-sectors' coverage. Furthermore, the comparison between GATS and PTAs commitments shows that some countries such as Chile, Mexico and Japan are likely to grant substantial preferences to their partners. However, huge differences exist across countries. Additionally, for each country the variance of the potential preference granted is low. In other words, countries involved in bilateral negotiations are willing to offer what they have already granted to other partners -- i.e. whatever the partner, the negotiation period, etc... Nevertheless, the rapid development of PTAs does not mean the disappearance of BMAs. Indeed, some new generation BMAs (e.g. EU-China and United States-China agreements) of which the content is close to PTAs, grant relative important level of preference. Third, the UN Liner Code has not been a successful initiative. Indeed, the developing countries that applied the international treaty suffer from its drawbacks (i.e. high prices and corruption) without supposed benefits for domestic maritime companies. Surprisingly, no impact assessment or monitoring has never been performed to assess the impact of the Treaty.

Considering these conclusions, the main recommendation would be to repeal (or denounce) all agreements which are currently not applied. It is the case of most CSAs and of the UN Liner Code. Even though these agreements are not applied, a risk of resurgence exists

-- above all in crisis period such as now. Repealing outdated CSAs and the UN Liner Code would enable for a better visibility on what is applied and what is not.

This study on preferential treatment is of particular interest for the next chapters since the information collected on preferential treatment will be integrated in the computation of a composite index of trade restrictiveness for the liner shipping sector.

Finally, this study calls for further research. Indeed, even though this chapter closes the debate concerning CSAs, some questions remain about the real preferences granted through PTAs. It would be of great interest to assess the real degree of preference granted by comparing applied regulatory regimes and PTA provisions. Then, other sectoral studies on PTAs in services could be interesting in order to better understand which factors influence bilateral negotiations.

6. References

Achy, Lahcen, Mongi Boughzala, Hanaa Kheir-El-Din and Sübidey Togan. 2005. "Impact of Liberalization of Trade in Services: Banking, Telecommunications and Maritime Transport in Egypt, Morocco, Tunisia and Turkey.", Femise project, FEM22-02.

Clark, Ximena, David Dollar, and Alejandro Micco. 2004. "Port Efficiency, Maritime Transport Costs and Bilateral Trade." *Journal of Development Economics*, 75: 417-450.

Containerization International Online (CI Online). 2009.
http://www.ci-online.co.uk/

Fink, Carsten, Aaditya Mattoo, and Ileana C. Neagu. 2002. "Trade in International Maritime Services: How Much Does Policy Matter?" *The World Bank Economic Review*, 16(1): 81-108.

Gootiiz, Batshur and Aaditya Mattoo. 2009. "Services in Doha: What's on the Table?", World Bank Policy Research Working Paper 4903.

Hoekman, Bernard, "Assessing the General Agreement on Trade in Services," in Will Martin and Alan L. Winters, eds, *The Uruguay Round and the Developing Countries*, Cambridge: University Press, 1996, pp. 88-124.

Kang, Jong-Soon, "Price Impact of Restrictions on Maritime Transport Services," in Christopher Findlay and Tony Warren, eds, *Impediments to Trade in Services: Measurement and Policy Implications*, London: Routledge, 2000, pp. 189-200.

Marchetti, Juan A., and Martin Roy, "Services Liberalization in WTO and in PTAs," in Juan A. Marchetti and Martin Roy, eds, *Opening Markets for Trade in Services: Countries and Sectors in Bilateral and WTO Negotiations*, Cambridge: Cambridge University Press, 2008.

Mattoo, Aaditya, and Carsten Fink. 2002. "Regional Agreements and Trade in Services: Policy Issues." World Bank Policy Research Working Paper 2852.

Mattoo, Aaditya, and Pierre Sauvé. "Regionalism in Services Trade," in Aaditya Mattoo, Robert M. Stern, and Gianni Zanini, eds, *A Handbook of International Trade in Services*, New York: Oxford University Press, 2008, pp 169-219.

McGuire, Greg, Michael Schuele and Tina Smith, "Restrictiveness of International Trade in Maritime Services," in Christopher Findlay and Tony Warren, eds, *Impediments to Trade in Services: Measurement and Policy Implications*, London: Routledge, 2000, pp. 189-200.

OECD (2001), Regulatory Issues in International Maritime Transport, Directorate for Sciences Technology and Industry, Division of Transport. August 2001, Paris.

UN Treaty Collection Database. 2009. "Multilateral Treaties Deposited with the Secretary-General, Status of Treaties."
http://treaties.un.org/Pages/ParticipationStatus.aspx

World Bank. 2009. "Private Participation in Infrastructure Database." Project Data.
http://ppi.worldbank.org/ (accessed November 26, 2009)

WTO. 2009. "Regional Trade Agreements Notified to the GATT/WTO." Regional Trade Agreements Information System.
http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx

WTO. 2008. Trade Policy Review: China, Geneva.

WTO. 1995. WTO Questionnaire: Singapore. Geneva.

7. Annexes

Annex 1: country sample

Algeria, Australia, Brazil, Canada, Chile, China, Colombia, Egypt, France, Germany, Hong-Kong, India, Indonesia, Italy, Japan, Malaysia, Mexico, Morocco, New Zealand, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, Thailand, Turkey, United Kingdom, United States.

Annex 2: Summary of Bilateral Maritime Agreements

Partners		Signature	Status	Type of CSA	Port and related services	Commercial presence	MFN exemption	
A	B						A	B
France	Gabon	1960	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
France	Ivory Coast	1961	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Niger	1961	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Ivory Coast	1962	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	India	1962	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Brazil	Germany (former FRG)	1963	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Germany (former GDR)	India	1963	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Egypt [a]	India	1964	unk.	CSA	No pref.	No	Valid	Valid
Germany (former FRG)	Tunisia	1966	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Germany (former FRG)	India	1966	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
France	Algeria [b]	1967	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	France	1967	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	India	1967	unk.	CSA	No pref.	No	Non member	Valid
Turkey	Austria	1967	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Brazil	Argentina	1968	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Algeria	Bulgaria	1969	unk.	CSA	No pref.	No	Non member	Not valid
Egypt	Bulgaria	1969	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Russia (Former USSR)	Netherland	1969	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
India	Poland	1970	unk.	CSA	No pref.	No	Not valid	Valid
Russia (Former USSR)	Bulgaria	1971 [c]	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Hungary	1972 [c]	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Poland	1973 [c]	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Germany (former GRD)	1974 [c]	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	Romania	1975 [c]	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Czechoslovakia	1976 [c]	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Algeria	Libya	1972	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	Guinea	1972	unk.	CSA	Other	No	Non member	Valid
Brazil	Russia (Former USSR)	1972	unk.	CSA	Pot. pref.	No	Valid	Non member
Egypt	Romania	1972	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	Belgium	1972	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Italy	1972	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	United States	1972	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Algeria	Russia (Former USSR)	1973	unk.	CSA	Pot. pref.	Yes	Non member	Non member
Brazil	Peru	1973	unk.	CSA	Other	No	Valid	Valid
France	Poland	1973	unk.	Confusing	No pref.	No	n.r.	n.r.
Russia (Former USSR)	Sweden	1973	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Denmark	1973	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Brazil	Chile	1974	unk.	CSA	Other	No	Valid	Valid
Brazil	Mexico	1974	unk.	CSA	Other	No	Valid	Valid
China	Denmark	1974	unk.	Confusing	No pref.	No	n.r.	n.r.
China	Japan	1974	unk.	Confusing	No pref.	No	n.r.	n.r.
France	Congo	1974	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
France	Romania	1974	unk.	Confusing	No pref.	No	n.r.	n.r.
France	Senegal	1974	unk.	No CSA	Other	No	n.r.	n.r.
Algeria	Poland	1975	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Brazil	Romania	1975	unk.	CSA	No pref.	No	Valid	Valid
Brazil	Uruguay	1975	unk.	CSA	Other	No	Valid	Valid
Brazil	France	1975	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
China	France	1975	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
China	Belgium [d]	1975	unk.	Confusing	No pref.	No	n.r.	n.r.
China	Netherland	1975	unk.	Confusing	No pref.	No	n.r.	n.r.
China	Germany (former FRG)	1975	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
France	Benin	1975	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
France	Egypt	1975	In force	CSA	Pot. pref.	No	Valid	Valid
India	Pakistan	1975	unk.	CSA	No pref.	No	Valid	Valid
Russia (Former USSR)	Greece	1975	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Guinea Bissau	1975	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	United States	1975	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Sweden	China	1975	unk.	Confusing	No pref.	No	n.r.	n.r.
Algeria	Cape Verde	1976	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Brazil	Poland	1976	unk.	CSA	Pot. pref.	No	Valid	Valid
China	Romania	1976	unk.	Confusing	No pref.	No	n.r.	n.r.
France	Ivory Coast	1976	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Libya	1976	unk.	Confusing	No pref.	No	n.r.	n.r.
France	Togo	1976	unk.	Confusing	Other	No	n.r.	n.r.
Italy	Egypt	1976	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Russia (Former USSR)	Mozambique	1976	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Angola	1976	unk.	Confusing	Other	No	n.r.	n.r.
Russia (Former USSR)	Libya	1976	unk.	Confusing	No pref.	No	n.r.	n.r.
Russia (Former USSR)	Zaire	1976	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
United States	Romania [e]	1976	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
China	Finland	1977	unk.	Confusing	No pref.	No	n.r.	n.r.

Annex 2: Summary of Bilateral Maritime Agreements (continued)

Partners		Signature	Status	Type of CSA	Port and related services	Commercial presence	MFN exemption	
A	B						A	B
Egypt	Poland	1977	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Gabon	1977	unk.	Confusing	No pref.	No	n.r.	n.r.
Brazil	Portugal	1978	unk.	CSA	Pot. pref.	No	Valid	Valid
France	Djibouti	1978	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Mexico	Bulgaria	1978	unk.	CSA	Pot. pref.	Yes	Valid	Not valid
Russia (Former USSR)	Ethiopia	1978	unk.	CSA	No pref.	No	Non member	Valid
Russia (Former USSR)	Mexico	1978	unk.	CSA	Pot. pref.	No	Non member	Valid
United States	Argentina	1978	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Algeria	Belgium [d]	1979	unk.	CSA	Pot. pref.	No	Non member	Valid
Brazil	Germany (former FRG)	1979	unk.	CSA	Pot. pref.	No	Valid	Valid
Brazil	China	1979	unk.	Confusing	No pref.	No	n.r.	n.r.
China	Thailand	1979	unk.	Confusing	No pref.	No	n.r.	n.r.
Germany (former GDR)	Mexico	1979	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Germany (former GDR)	Belgium	1979	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Morocco	Spain	1979	unk.	CSA	Other	No	Valid	Valid
Morocco	France	1979	unk.	CSA	Pot. pref.	No	Valid	Valid
Russia (Former USSR)	Madagascar	1979	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Pakistan	1979	unk.	CSA	Pot. pref.	No	Non member	Valid
Spain	Equatorial Guinea	1979	unk.	CSA	Other	No	Valid	Non member
Spain	Senegal	1979	unk.	CSA	Other	No	Valid	Valid
Spain	Ivory Coast	1979	unk.	CSA	Pot. pref.	No	Valid	Valid
Thailand	Viet-Nam	1979	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
China	United States	1980	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Spain	Mexico	1980	unk.	CSA	Pot. pref.	No	Valid	Valid
Egypt	Greece	1981	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Germany (former GDR)	Greece	1981	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Russia (Former USSR)	Malta	1981	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Sao Tomé	1981	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
South Korea	Singapore	1981	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Spain	Gabon	1981	unk.	CSA	Pot. pref.	No	Valid	Valid
United States	Bulgaria	1981	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Brazil	Ecuador	1982	unk.	CSA	Other	No	Valid	Valid
Brazil	Bulgaria	1982	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Russia (Former USSR)	Sri Lanka	1982	unk.	CSA	Pot. pref.	Yes	Non member	Valid
Algeria	Albania	1983	unk.	CSA	No pref.	No	Non member	Valid
Spain	Russia (Former USSR)	1983	unk.	CSA	Pot. pref.	Yes	Valid	Non member
China	Mexico	1984	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Mexico	Netherland	1984	unk.	CSA	Pot. pref.	No	Valid	Valid
United States	Bulgaria	1984	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	Iraq	1985	unk.	CSA	Pot. pref.	No	Non member	Non member
Brazil	Argentina	1985	unk.	CSA	Other	No	Valid	Valid
Egypt	Jordan	1985	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Malaysia	Belgium [d]	1985	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
Russia (Former USSR)	Cyprus	1985	unk.	Confusing	No pref.	No	n.r.	n.r.
Spain	Tunisia	1985	unk.	CSA	Pot. pref.	Yes	Valid	Valid
France	Burkina Faso	1986	unk.	Confusing	Pot. pref.	No	n.r.	n.r.
United States	Brazil [f]	1986	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Algeria	Italy	1987	unk.	CSA	Pot. pref.	No	Non member	Valid
China	Malaysia	1987	unk.	Confusing	Other	No	n.r.	n.r.
Malaysia	Russia (Former USSR)	1987	unk.	CSA	No pref.	Yes	Valid	Non member
Turkey	Albania	1987	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
United States	Peru	1987	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
China	United States [g]	1988	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Egypt	Bangladesh	1988	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Turkey	1988	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Iraq	1988	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Malaysia	Indonesia	1988	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Thailand	Bangladesh	1988	unk.	CSA	Pot. pref.	No	Not valid	Valid
Egypt	Morocco	1989	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Tunisia	1989	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Singapore	China	1989	unk.	CSA	No pref.	No	Valid	Not valid
Egypt	Syria	1990	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Russia (Former USSR)	United States [h]	1990	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Saudi Arabia	Egypt	1990	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Brazil	United States	1991	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Germany	Russia (Former USSR)	1991	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Indonesia	Viet-Nam	1991	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
United States	Venezuela	1991	n.v.	CSA	n.v.	n.v.	n.r.	n.r.
Egypt	Libya	1992	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Tunisia	1992	unk.	CSA	No pref.	No	Valid	Valid
Indonesia	Iran	1992	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Singapore	Viet-Nam	1992	unk.	CSA	No pref.	No	Valid	Valid
United States	Ukraine	1992	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.

Annex 2: Summary of Bilateral Maritime Agreements (continued)

Partners		Signature	Status	Type of CSA	Port and related services	Commercial presence	MFN exemption	
A	B						A	B
Algeria	Tunisia [i]	1993	unk.	CSA	Other	Yes	Non member	Valid
Germany	Ukraine	1993	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
Germany	Viet-Nam	1993	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
South Korea	China	1993	unk.	CSA	No pref.	Yes	Valid	Not valid
Canada	Viet-Nam	1994	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Korea	Uk (& Nothern Ireland)	1994	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
Algeria	Egypt	1995	unk.	CSA	Other	No	Non member	Valid
Algeria	Germany	1995	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Chile	Germany	1995	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
South Africa	Netherland	1995	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Korea	Netherland [j]	1995	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
South Korea	Viet-Nam	1995	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
China	Uk (& Nothern Ireland)	1996	unk.	No CSA	No pref.	Yes	n.r.	n.r.
Egypt	North Korea	1996	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	China	1996	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Turkey	1996	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Germany	Indonesia	1996	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Indonesia	Jordan	1996	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
South Africa	Mozambique	1996	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	Jordan	1997	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Algeria	Cyprus	1997	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
China	Israel	1997	unk.	Confusing	No pref.	Yes	n.r.	n.r.
China	Canada	1997	In force	Confusing	No pref.	Yes	n.r.	n.r.
Egypt	Yemen	1997	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Ukraine	1997	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Russia	1997	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
France	Latvia	1997	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Malaysia	South Africa	1997	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Singapore	Myanmar	1997	n.v.	Confusing	n.v.	n.v.	n.r.	n.r.
Egypt	China	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Lebanon	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	South Africa	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Germany	Egypt	1998	In force	No CSA	Pot. pref.	Yes	n.r.	n.r.
Germany	South Africa	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Greece	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Algeria	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	France	1998	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
Turkey	Algeria	1998	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Georgia	1999	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Tunisia	1999	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Iran	1999	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Thailand	Peru	1999	unk.	No CSA	No pref.	No	n.r.	n.r.
France	Ukraine	2000	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
France	Viet-Nam	2000	unk.	No CSA	No pref.	Yes	n.r.	n.r.
Singapore	Germany	2000	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	China	2000	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	Soudan	2001	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Algeria	Germany	2001	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Indonesia	China	2001	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Russia	United States	2001	In force	No CSA	No pref.	No	n.r.	n.r.
South Africa	Cuba	2001	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Thailand	Germany	2001	unk.	No CSA	Other	Yes	n.r.	n.r.
Algeria	Syria	2002	unk.	Confusing	No pref.	Yes	n.r.	n.r.
China	EC	2002	n.v.	No CSA	n.v.	n.v.	n.r.	n.r.
Egypt	Romania	2002	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Egypt	Soudan	2002	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	South Korea	2003	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
China	Germany	2003	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
China	United States	2003	In force	No CSA	No pref.	Yes	n.r.	n.r.
Russia	Israel	2003	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	France	2004	unk.	No CSA	Pot. pref.	Yes	n.r.	n.r.
China	Latvia	2004	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Turkey	Sudan	2004	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Turkey	Syria	2004	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Brazil	United States	2005	In force	CSA	Pot. pref.	Yes	Valid	Valid
Colombia	Ecuador	2005	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Mexico	China	2005	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Russia	South Africa	2005	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Gabon	2005	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Turkey	Albania	2005	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
Turkey	Ethiopia	2005	unk.	No CSA	No pref.	No	n.r.	n.r.
Algeria	Congo (D.R.)	2006	unk.	Confusing	Pot. pref.	Yes	n.r.	n.r.
Egypt	Cyprus	2006	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Congo (D.R.)	2006	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
Algeria	Libya	2007	unk.	No CSA	Pot. pref.	No	n.r.	n.r.
China	Lituania	2007	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
South Africa	Tanzania	2007	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
United States	Viet-Nam	2007	In force	No CSA	No pref.	Yes	n.r.	n.r.
Canada	China	2009	n.a.	n.a.	n.a.	n.a.	n.r.	n.r.
	224							

Sources: UN Treaty website, Ministry of Transport and Foreign Affairs websites. Notes: n.a. = non available. n.v = non valid agreement. unk. = unknown status. [a] With United Arab Republic. [b] Modified in 1972. [c] Only one agreement between all the members. [d] Extended to Luxembourg. [e] Extended in 1984. [f] Addendum to the agreement in 1998. Add an exception for government. [g] Extended in 1992. [h] Extended in 1994. [i] In the AMU framework. [j] Extended to Aruba.

Chapter III

The Impact of Liner Shipping Trade Restrictions on Maritime Transport Cost and Trade Flows

Abstract

This chapter aims at assessing the impact of liner shipping barriers to trade in mode 3 on MTCs and seaborne trade flows. In order to quantify the overall level of restrictions in mode 3 in the liner shipping sector, I construct an original Service Trade Restrictiveness Index (STRI). The original STRI is included in a two-stage econometric analysis. Since barriers to trade in mode 3 are likely to influence seaborne trade through transport costs, in a first stage, I assess the impact of trade restrictions on MTCs. And, in a second stage I assess the impact of MTCs on seaborne trade flows. Following an IV-like approach developed by Limao and Venables (2001), this two-stage structure allows to address the endogeneity issue arising in the second stage. This two-stage framework also allows disentangling direct and indirect effects of distance and restrictions in mode 3 on seaborne trade flows.

Concerning barriers to trade in mode 3, I find a monotonically, positive and significant impact of my STRI split into quartiles on MTCs. After controlling for a data reporting issue, I conclude that MTCs are 25% higher on the routes classified in the second quartile than on the routes classified in the first quartile. And, on the routes classified in the third and the fourth quartile, MTCs are 52% and 79% higher than on the routes classified in the first quartile, respectively. Then, since barriers to trade in mode 3 affect MTCs and MTCs affect seaborne trade flows, barriers to trade in mode 3 affect indirectly seaborne trade flows.

Concerning distance, I show that it affects positively MTCs. And, consistently with the literature, I show that distance explains a small share of the MTCs variance. Then, the results suggest that besides affecting negatively seaborne trade through MTCs, distance also affect directly and positively seaborne trade. Thus, the farer trading partners are from each other, the more likely their containerizable trade will be transported by sea. This result confirms a pattern often stated but never proved -- to my knowledge.

JEL Codes: L92, F1, F13

Keywords: Service trade restrictiveness index, Maritime transport costs, International trade

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1. Introduction

This chapter deals with the liner shipping sector with a focus on the impact of barriers to trade in services on Maritime Transport Costs (MTCs) and seaborne trade flows. Liner shipping is a key intermediate service. The sector is of particular interest since most manufactured and semi-manufactured goods are transported in liner shipping vessels (Chapter 1). Furthermore, the sector's efficiency is a determinant of countries' competitiveness and is crucial for their integration into international trade. Since barriers to trade in goods have sharply decreased over the last decades, the share of MTCs in total trade costs has become substantial (Chapter 1). Most determinants of MTCs are exogenous (e.g. distance, trade volume and trade imbalance). Therefore, restrictions on trade in the liner shipping service are the only field upon which policy makers can bear to decrease MTCs.

Many experts and professionals claim that the liner shipping market is free. However, some restrictions remain and are likely to affect MTCs. In this chapter, I focus on regulations restricting commercial presence -- barriers to trade in mode 3. Such a choice stems from three aspects. First, since the 1980s the most significant barriers to cross-border trade (i.e. mode 1 of supply) have disappeared. For instance, nowadays cargo reservations only affect very specific goods and they represent a tiny share of total seaborne trade (Chapter 1). Therefore, they are not likely to affect MTCs (Fink *et al.*, 2002). Second, the regulatory information available in mode 1 and the form of my sample and model do not allow to take restrictions in mode 1 into account. Third, even though mode 1 is the key mode of supply for international shipping services, mode 3 is likely to be crucial in order to efficiently provide liner shipping services (Chapter 1). Eventually, several heterogeneous restrictions affect trade in international liner shipping in mode 3 (Chapter 1). Therefore, to assess and quantify the overall level of restrictions in the sector, I construct a composite index of restrictiveness.

This chapter aims at assessing the impact of barriers to trade in mode 3 on MTCs and seaborne trade flows. It comprises two parts: the construction of a liner shipping Service Trade Restrictiveness Index (STRI) in mode 3 and an econometric analysis. The econometric analysis is, in turn, organized in two stages. Since barriers to trade in mode 3 are likely to

influence seaborne trade through transport costs, in a first stage, I assess the impact of trade restrictions on MTCs. And, in a second stage I assess the impact of MTCs on seaborne trade flows. Following an IV-like approach developed by Limao and Venables (2001), this two-stage structure allows to address the endogeneity issue arising in the second stage -- i.e. when the MTCs are included in the seaborne trade flow gravity equation. This two-stage framework also allows disentangling direct and indirect effects of distance and restrictions in mode 3 on seaborne trade flows.

The sample comprises two importers (New Zealand and the United States) and 56 exporters. Among exporters, ten are high income countries, 42 are middle income and 4 are low income.[1] MTCs as trade costs are of particular interest for developing countries since most restrictions remain in these countries. Additionally, trade integration is a crucial issue for them.

The Chapter is organized as follows: the first section is the introduction. In the second section, I present the methodology used to construct the original STRI. In the third section, I estimate a MTC equation. In the fourth section, I estimate a gravity equation. The fifth section concludes and provides some policy recommendations.

2. A liner shipping Service Trade Restrictiveness Index (STRI)

In this section, I present the methodology used to construct the liner shipping STRI in mode 3. First, I motivate my choice to measure barriers to trade in services by computing an STRI. Second, I detail how the STRI is constructed. Third, I present the results.

Measuring barriers to trade in services

Considering the nature of services, barriers to trade are essentially regulatory. For economists working on this issue, one challenge consists in measuring the restrictiveness of regulations -- in other words, to quantify qualitative information. Toward this goal, various methodologies have been developed. Broadly speaking, they are categorized in two types, bottom-up and top-down approaches -- also called direct and indirect measurement, respectively (Deardorff *et al.*, 2004). In this paper, I opt for the direct measurement methodology, precisely for the construction of a restrictiveness index. It consists in observing

[1] The sample is detailed in Annex 1.

policies to construct a composite index. STRIs are powerful tools providing a broad vision of the regulatory regimes' restrictiveness. They are useful for policy-makers and economists since they allow comparison and benchmarking across countries and sectors (OECD, 2009a). Furthermore, STRI are of particular interest for economists because they can easily be included in quantitative impact assessments.

STRIs have been developed first by the Australian Productivity Commission (OECD, 2009a). Then, the OECD extended and refined the methodology.[2] Various STRIs have been constructed for a large amount of services sector -- see Deardorff and Stern (2008) for a review of this literature. With regards to maritime transport I found two attempts, by McGuire *et al.* (2000) and Li and Cheng (2007).[3] McGuire *et al.*'s set of indexes was used by Kang (2000) in order to compute price impacts, while Li and Cheng use their index to investigate determinants of maritime policies. One contribution of this paper is to use of the most relevant regulatory data available on the applied regulatory regime of countries. Another novelty is to use state of the art methodological developments in order to construct the best possible index. Finally, my index is constructed as closely as possible to the reality thanks to discussions and debates with experts and professionals.

Constructing the Service Trade Restrictiveness Index (STRI) in liner shipping[4]

The construction of an STRI comprises five steps: the selection of restrictions, the scoring of restrictions' modality, the weighting of restrictions, their aggregation and the robustness checks.

In the first Chapter, I described all regulations which are likely to act as trade barriers in mode 3 in the liner shipping sector. However, considering the difficulty to collect regulatory information (due to source limitation) it is not possible to include in the index all trade restricting regulations presented in Chapter 1. I use information collected through the World Bank survey on impediments trade integration (World Bank, 2008). Nevertheless, it is important to note that considering data availability the most **relevant restrictions** are included in the composite index (Table 1).

[2] See Conway *et al.* (2005), Conway and Nicoletti (2006) and OECD (2008, 2009a and 2009b).
[3] The McGuire *et al.* methodology was used to construct STRIs in maritime transport for Russia (Kimura *et al.*, 2003) and Maghrebian countries (Achy *et al.*, 2005).
[4] A detailed description of the STRI construction is presented in Annex 2.

Table 1: Summary of restrictions in international shipping services in mode 3

Regulatory measures	Type of variable	Restrictiveness
Form of the ownership (Greenfield)	Multiple binary	Additive
% of ownership in Greenfield project	Continuous	Gradual
% of ownership in private entity	Continuous	Gradual
% of ownership in public entity	Continuous	Gradual
Joint Venture	Multiple binary	Additive
Licensing	Multiple binary	Gradual
Regulatory body	Multiple binary	Additive
% of national employees	Continuous	Gradual
% of nationals on the board of director	Continuous	Gradual
Repatriation on earnings	Multiple binary	Additive

Notes: gradual restrictiveness means that it is possible to classify modalities from the less to the most restrictive. Additive restrictiveness means that it is not possible to classify modalities from the less to the more restrictive. Thus, the level of restrictiveness is determined according to the number of modalities applied in the country.

The **scoring** consists in transforming information on the restrictiveness level of regulatory measures (i.e. principally qualitative information) in scores. In countries, each restrictions takes the shape of a modality. Each modality is ranked according to its level of restrictiveness and a numerical value is assigned from the least to the most restrictive. Scores increase with the restrictiveness of modalities. They are normalized on a 0 to 6 scale.[5] I assume that the test case represents the entire population of reference. Thus, the least and the most restrictive modalities respectively take the value 0 and 6. For matters of interpretation and transparency it is not advisable to include binary and continuous variables in a composite index (OECD, 2009a). Considering the dataset, I choose to reject "pure" binary scores (i.e. 0 and 1) because they prevent from taking into account the variations in the data. And, considering the dataset, continuous scores are not more appropriate. Hence, I transform all measures into multiple binary scores. According to the measures, the level of restrictiveness can be gradual or additive. A gradual level of restrictiveness means that it is possible to classify modalities from the least to the most restrictive. On the contrary, additive restrictiveness means that it is not possible to classify modalities from the least to the most restrictive.[6] Thus, the level of restrictiveness is determined according to the number of modalities applied in the country (e.g. repatriation of earnings, quality of the regulator). Continuous scores (e.g. percentage of ownership limitation) are transformed into binary scores through specific thresholds. Importantly, thresholds are based on economic

[5] The 0 to 6 scale has been chosen arbitrarily. Obviously, the scale does not affect the results of the index.

[6] For instance, it is not possible to rank different level of restrictiveness concerning measures on the form of commercial presence -- e.g. a restriction on branches is not more restrictive than a restriction on subsidiaries. The important for foreign investors is the freedom in choosing the appropriate form of commercial presence with respect to their objectives.

explanations. For instance, for ownership limitation I choose 0.5 as a threshold based on the fact that 50% represents the majority control of a firm. Two thresholds of 1/3 and 2/3 are introduced reflecting minority ratios granting rights to block management decisions (OECD, 2009b). The number of modalities within each measure has to be as close as possible from the number of modalities within the others measures.

The **weighting** scheme captures the relative importance of measures in terms of trade restrictiveness. I use equal weights -- summed to one. This weighting scheme has two benefits. First, it is transparent. Second, it makes the value of the index independent of the number of measures within each category (OECD, 2008).

Table 2: Construction of the liner shipping STRI in mode 3 -- Summary

Measures	Modality (mo) scoring (s_i)			
Form of the ownership (Greenfield)	Branch and subsid. allowed 0	Only subsidiary allowed 3	Green. project not allowed 6	
% of ownership in Greenfield project	100-66% 0	65-50% 2	49-33% 4	33-0% 6
% of ownership in private entity	100-66% 0	65-50% 2	49-33% 4	33-0% 6
% of ownership in public entity	100-66% 0	65-50% 2	49-33% 4	33-0% 6
Joint Venture	Not required 0	For one type of entity 2	For two types of entities 4	For three types of entities 6
Licensing	No license required 0	Criteria av. and auto. 2	Criteria av. but not auto. 4	Criteria non av. 6
Regulatory body [a]	3 criterions on 3 0	2 criterions on 3 2	1 criterion on 3 4	0 criterion on 3 6
% of national employees	33-0% 0	49-33% 2	65-50% 4	100-66% 6
% of nationals on the board of director	33-0% 0	49-33% 2	65-50% 4	100-66% 6
Repatriation on earnings [b]	3 criterions on 3 0	2 criterions on 3 2	1 criterion on 3 4	0 criterion on 3 6
Country score (0-6)		**Σs_i**		

Notes: For each measure the first line corresponds to modalities and the second line to scores. [a] Criteria: right to appeal regulatory decision and regulatory changes noticed. [b] Criteria: free transfer, free convertibility and free use.

The fourth step consists in the **aggregation** of the categories. Again, for a question of transparency and interpretation, I choose a linear method of aggregation.

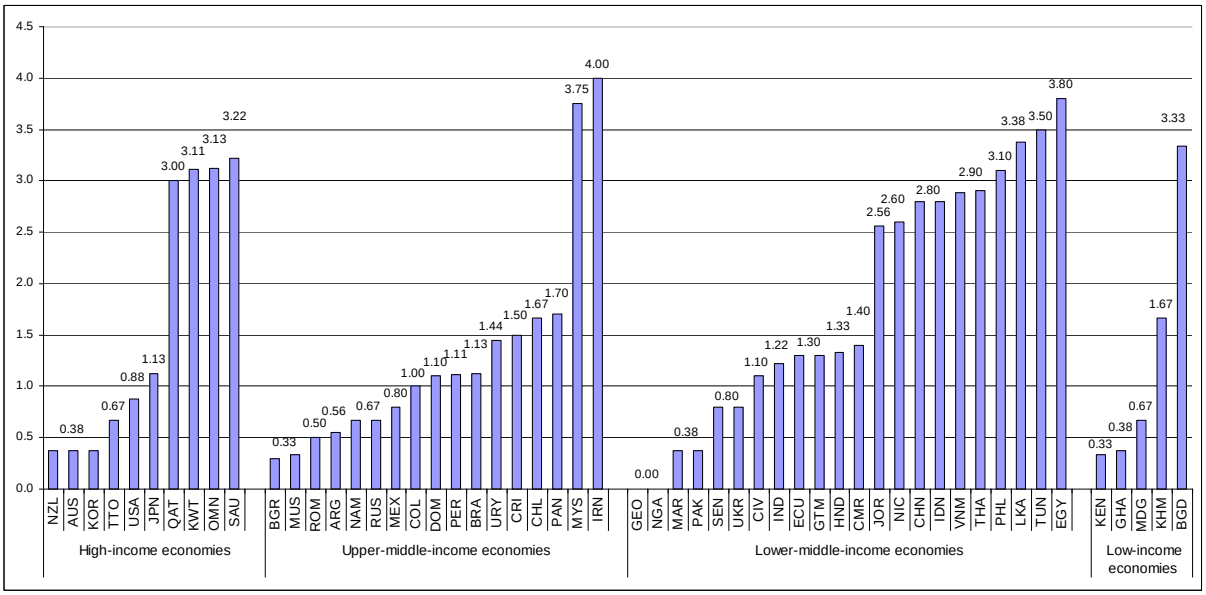
Finally, I **check the robustness** of the index. First, I test the relevance to include the measures selected. I estimate a MTC equation that includes all measures separately. Since most regulations affect MTC negatively, I conclude that restrictions selected have their rightful place in the index. Second, I test the sensitivity of my index with respect to the use of various weighting schemes. Considering that I use the index split into quartile, I use the Spearman rank correlation methodology in order to check whether the ranking of countries is

driven by a particular weighting scheme. The result of the Spearman rank correlation allows to confirm that the ranking of countries are strongly robust to the weighting scheme.[7]

Results

Broadly speaking, and as suggested by the existing literature, the liner shipping sector is relatively opened to foreign trade in comparison to other services. This is not so surprising considering that the sector is international by nature (Kumar and Hoffmann, 2003). No country has a very restrictive regulatory regime. The index ranges from 0 to 4. The median of the index is 1.17, the average 1.58 and the standard deviation is 1.18.

Figure 1: Service Trade Restrictiveness Indexes (STRI) in mode 3



Sources: Author's calculation. Note: Level of development according to World Bank (2010).

The level of openness of the liner shipping sector in mode 3 measured by my STRI is not easily explainable. By computing simple correlations, I do not find any relationship between the STRI and the countries' GDP per capita and level of trade integration.[8] Geographical and political characteristics of countries are more satisfactory to explain the intensity of restrictiveness in the sector. First, insular countries for which international shipping is key have a lower STRI (Figure 1). It is the case for Australia, New Zealand,

[7] The robustness checks are presented in Annex 2 -- including the results of MTC estimations and the Spearman rank correlation.
[8] Simple correlations do not provide any evidence. Figures are available upon request.

Mauritius and Trinidad and Tobago -- a Caribbean's maritime transport hub. Then, cultural and political ties are likely to explain the countries' level of restrictiveness. Indeed, geographical groups of countries as Arabian Gulf countries or Caribbean and the South-American countries have very close indexes (Figure 1).

Bilateralize the restrictiveness index

In the previous sub-section, I computed a set of unilateral STRIs. However, considering the form of my empirical models (in which the index will be included), I have to compute a set of bilateral indexes. In other words, I have to construct a set of STRIs for bilateral maritime routes. To "bilateralize" the STRI, it is important to understand how liner shipping services are affected by restrictions in mode 3. For shipping lines, it is important to establish a commercial presence abroad (or at least have the possibility to do so) in order to provide some sub-services and therefore provide the final service more efficiently.[9] Importantly, the sub-services mentioned here are provided in countries of origin and destination. Thus, restrictions in mode 3 are likely to affect the efficiency of sub-services at both ends of the journey. Therefore, on a maritime route the restrictions in mode 3 applied at both end of the journey are likely to affect MTCs. Considering that potential inefficiencies in ports of origin and destination (resulting from restrictions) add-up together, I assume that on a given route, the restrictions in mode 3 in the origin country add up to the restrictions in the destination country. Therefore, in order to obtain a bilateral STRI, origin and destination countries' indexes are add up together.

3. The Maritime Transport Costs (MTC) equation

This section aims at assessing the impact of trade restrictions on liner shipping MTCs. I regress MTCs on policy variables created in the previous section and on other common control variables. The censored data issue is addressed by running tobit estimations and the endogeneity issue is addressed by running IV regressions. This section is organized as follows, first, I review the literature about determinants of MTCs. Second, I present the empirical model and the data. Third, I present results of estimations.

[9] These sub-services are the followings: administration and organization of vessels' calls, management of cargoes in ports of origin and destination and administration and organization of intermodality in countries of origin and destination (Chapter 1).

Determinants of maritime transport costs -- Review of the literature

In the related literature, few papers include **policy variables** as determinants of MTCs. Fink *et al.* (2002), Micco and Pérez. (2002) and Clark *et al.* (2004) focus on the impact of competition rules in the liner shipping sector. Particularly, they assess the impact of price-fixing and cooperative agreements -- e.g. conferences and consortia. To do so, they include simple dummy variables. Fink *et al.* (2002) go further by adding a dummy variable in order to assess the impact of cargo reservations. They also include simple indexes to assess the impact of restrictions in cargo handling and port services sectors. Finally, a recent paper by Wilmsmeier and Martinez-Zarzoso (2010) includes several variables in order to assess the impact of being an open registry country on MTCs. The main contribution of this paper is to include refined policy variables related to trade restrictions as a determinant of MTCs.

Maritime distance can be used as a proxy for various operating costs such as fuel and labour costs (Korinek, 2011). Hence, it is likely to be an important determinant of MTCs. Unsurprisingly, it is included as an explanatory variable in all papers quoted in this section. However, most of these empirical works, show that the explanatory power of the distance is actually weak. This could be explained by the features and the functioning of the sector. Indeed, in liner shipping, most maritime journeys between two countries are not direct. Some services sail along the coast and call at many ports -- the so-called "dash of milk" model. For other services, long journeys between main ports are performed by large vessels and the distribution of cargo within regions is performed by feeders after a transhipment -- this is the "hub and spoke model". For instance, among the routes of my sample, a direct service exists on 51 routes while a transhipment is needed on 59. With few exceptions, accurate data that reflects the true distance covered by vessels (i.e. data that takes into account calls at ports and transhipments) does not exist.[10] In order to address this issue, some papers include time at sea instead of maritime distance as an explanatory variable. However, these studies fail to take into account neither time of calls due to transhipments nor variations of vessels' speed along journeys -- related to canals, straits or cape passages.

[10] Data from the "Trade Trans -- Spanish Trade Flows" database is one of these exceptions. Marquez-Ramos *et al.* (2006) and Martinez-Zarzoso and Nowak-Lehmann (2007) use this data.

Considering above-mentioned imperfections of the distance variable, the absence of direct liner shipping services between two trading partners have to be taken into account -- in other words, it means that a transhipment is needed to link these countries. Marquez-Ramos *et al.* (2006) and Wilmsmeier and Hoffmann (2008) include transhipment as a single dummy variable. Marquez-Ramos *et al.* (2006), Wilmsmeier and Hoffmann (2008) and Wilmsmeier and Martinez-Zarzoso (2010) include transhipment within composite indexes of connectivity. Connectivity indexes are proxy variables for the regularity and the quality of services to and from countries.[11] They are composite indexes of the following variables: number of carriers on the route between the two countries, total TEUs deployed on the route, number of vessels on the route, maximum ship size on the route, number of shipping possibility between each ports on the route and number of direct services.

The level of **competition** in the sector is also an important determinant of MTCs. It is particularly important in the liner shipping market which is exempted from competition regulations in many developed countries and where collusive practices have been the rule until the 1990s. In order to take the level of competition on routes into account, Wilmsmeier *et al.* (2006) include the number of direct liner services per month between partners as a proxy. Marquez-Ramos *et al.* (2006) include the number of lines deployed between partners while Wilmsmeier and Hoffmann (2008) include a dummy variable coded one when more than three carriers deploy vessels on the route.

Economists acknowledge that international shipping is an industry facing increasing returns to scale. In order to reflect this reality, most papers include **bilateral trade volume** as a determinant of MTCs..[12] However, considering the feature and the functioning of the shipping market, this variable is challenging to design. On a given route, vessels call at many ports and serve many countries. And, the volume of seaborne trade between regions would be more appropriate than the volume of trade between countries. For instance, concerning a liner shipping service between Auckland and Shenzhen it is more relevant to use the volume of trade between "Australasia" and the Far East rather than between New Zealand and China. Unfortunately, this data is not available.

[11] The first connectivity index has been developed by the UNCTAD, the so called Liner Connectivity Index (LCI). Other connectivity indexes are inspired by this work.

[12] See Fink *et al.* (2002), Micco and Pérez (2002), Clark *et al.* (2004), Marquez-Ramos *et al.* (2006), Wilmsmeier *et al.* (2006) and Wilmsmeier and Martinez-Zarzoso (2010).

Trade imbalance on the route is also a determinant of MTCs. It is especially true for liner shipping which is a regular service. Indeed, liner carriers have to transport empty containers in one direction or the other. Carriers are aware that the demand for transport services (and so the share of vessel capacity utilisation) varies based on the direction travelled. Therefore they adapt prices based on the leg of the trip. Hence, the service is relatively more expensive for the leg of the trip where more goods are being traded. On the opposite, MTCs are higher on the leg of the trip with the larger amount of traffic. To take into account this phenomenon, Clark *et al.* (2004), Wilmsmeier *et al.* (2006) and Wilmsmeier and Hoffmann (2008) include a directional imbalance ratio.[13] Marquez-Ramos *et al.* (2006) include two variables: a trade imbalance in absolute terms and an interaction of the absolute terms with an imbalance dummy variable. Finally, Wilmsmeier and Martinez-Zarzoso (2010) include a simple dummy variable that takes the value one when the trade imbalance on the route is negative.

Some papers on determinants of MTCs show that **port infrastructure** plays an important role in MTCs, notably because the cost and the time of the port passage impacts the final shipping cost. Micco and Pérez (2002) and Clark *et al.* (2004) include GDP per capita and a composite index of the overall quality of countries infrastructures as a proxy for the quality of their ports. They also include (as Wilmsmeier *et al.*, 2006) the index of perception of port quality developed by the World Economic Forum in its Global Competitiveness Report. Wilmsmeier and Hoffmann (2008) include a composite index of port infrastructure endowment composed of the following variables: port area, storage area, length of quays and maximum draft.

In most papers, the variable used for MTCs includes insurance costs. In order to control for insurance costs various product-specific variables are included. The **unitary value of products** are included by Wilmsmeier and Martinez-Zarzoso (2010), Martinez-Zarzoso and Nowak-Lehmann (2007), Marquez-Ramos *et al.* (2006), Wilmsmeier *et al.* (2006), Clark *et al.* (2004), Micco and Pérez (2002). Some papers include dummy variables for **refrigerated** or for **time sensitive cargo** -- Marquez-Ramos *et al.* (2006) and Wilmsmeier and Martinez-Zarzoso (2010). Finally, some papers choose a more radical (and simpler) approach by including a **product fixed-effect**.

[13] In Clark *et al.* (2004), the ratio is measured as exports minus imports divided by total trade. Wilmsmeier *et al.* (2006) and Wilmsmeier and Hoffmann (2008) compute a simple ratio -- imports divided by exports.

Finally, most variables discussed above are included in my empirical model -- i.e. the equation [1.4], below. However, I do neither include country-specific (such as port and infrastructure variables) nor product-specific variables (such as the unitary value of products, refrigerated and time sensitive dummies) since I include country and product fixed-effects. Additionally, my variable of interest is the STRI in mode 3. It is likely to affect the competition in the sector. Therefore, I do not include competition variables since they would absorb the effects of the STRI variable.

Model specifications and data[14]

As a theoretical basis, I use the model of liner shipping prices developed by Fink *et al.* (2002).[15] In this model, the MTC for a product k on a maritime route between two countries (hereafter, a route), denoted by MTC_{odk} is assumed to be equal to the marginal cost for the service, C_{odk} multiplied by a mark-up term, M_{odk}.[16] The reduced form, once log-linearized is:

$$mtc_{odk} = c_{odk} + \mu_{odk} \qquad [1.1]$$

Where,

- o corresponds to the origin country (exporter);
- d corresponds to the destination country (importer);
- k corresponds to the containerizable product, disaggregated at 2-digits of the Harmonized System (HS) classification.[17]

[14] Data sources are detailed in Annex 3.
[15] This model is also used in Micco and Pérez (2002), in Clark *et al.* (2004) and in Wilmsmeier and Martinez-Zarzoso (2010).
[16] MTC is a term used by the literature, even if it rather corresponds to the price paid by consumers. As a rule, I keep using the term MTC.
[17] Following the OECD Maritime Transport Costs Database (2006), I assume that containerizable cargo corresponds to all lines except 10, 12, 15, 25-29, 31, 72, and 99 in the Harmonized System (HS) disaggregated at 2-digits.

The marginal cost is assumed to take the following form:

$$c_{odk} = \beta_1 distance_{od} + \beta_2 transhipment_{od} + \beta_3 tv_{od} + \beta_4 ti\_absolute_{od} + \beta_5 ti\_interaction_{od} + \varpi_o + \theta_d + \lambda_k + \varepsilon_{odk} \qquad [1.2]$$

Where,

The first term ($distance_{od}$) is the maritime distance between the two main container ports of trading partners. It corresponds to the shortest way by capes, straits or canals expressed in nautical miles. When countries have coasts on various oceans and/or seas (as Colombia, Mexico, Russia and the United States) ports for which the journey is the shortest are chosen. For example, in the case of the US, it is more relevant to choose the port of Los Angeles for a transport to China whereas the port of New York/New Jersey is more relevant for a journey to Europe. For this variable I expect a positive coefficient.

The second term ($transhipment_{od}$) is a dummy variable that expresses the connectivity on bilateral routes. The variable is coded 1 if a direct liner shipping is not available between trading partners, and 0 otherwise. For this variable, a positive coefficient is expected.

The third term (tv_{od}) is the total bilateral seaborne import volume of containerized products. The variable is included to take into account economies of scale. For this variable a negative coefficient is expected.

The fourth and the fifth terms ($ti\_absolute_{od}$ and $ti\_interaction_{od}$) are trade imbalance variables. I include two variables because both the direction and the "magnitude" of the trade imbalance are likely to have an impact on MTCs. The latter term is a magnitude variable, it is calculated as a trade imbalance in absolute terms.[18] The former term is an interaction between the magnitude variable in absolute terms and a directional imbalance dummy variable -- it takes the value of 1 if the trade imbalance of containerized products of the origin country[19] in volume is negative, and 0 otherwise. A positive coefficient is expected for this interaction variable. Concerning the absolute terms variable, I expect either a positive or a negative sign, as it depends on the direction of the trade imbalance (Marquez-Ramos *et al.*, 2006).

[18] More precisely, it is the absolute term of the following expression [(Exports - Imports)/Max (Exports, Imports)]

[19] i.e. if exports of the origin are greater than its imports.

The sixth, seventh and eighth terms (ω_o, θ_d and λ_k) are origin, destination and commodity fixed effects. The first two variables control for country-specific characteristics which are likely to affect the cost to provide international shipping services as port efficiency for instance. The last variable controls for product characteristics (e.g. products stowage factor, refrigerated or time-sensitive products) and insurance costs that are likely to influence the dependant variable. An product fixed effect is mush more effective in controlling for product characteristics than a value to weight ratio which is incomplete.

Theoretically, cargo reservations affect the marginal cost. Hence, ideally I should include a variable for this restriction in the equation. Considering the information available and considering that cargo reservations affect imports of the country applying the restriction (i.e. the destination country), the only solution to take them into account consists in including a dummy variable when the destination country applies cargo reservations. However, the sample comprises two destination countries and, among them only the US applies cargo reservations. Therefore, the information available, the shape of the sample and the form of the equation prevents me from assessing the impact of cargo reservations because the related dummy variable would be perfectly collinear with the US fixed-effect. In other words, include would be cargo reservation dummy variable is equivalent to include a destination country fixed-effect.

Then, the shipping companies' mark-up is assumed to has the following form:

$$\mu_{odk} = \beta_1 mode\_3_{od} + \chi_o + \nu_d + \rho_k \qquad [1.3]$$

Where,

The first term ($mode\_3_{od}$) is the variable of interest. It is a set of dummy variables that measures restrictions to trade in mode 3 in liner shipping on routes. The set is constructed by splitting the distribution of my bilateral STRI into quartiles.[20] By doing this, I define four

[20] I split the STRI into quartile for three main reasons. First, it is a division commonly use in economics. Second, it allows defining four types of routes: liberal, middle liberal, middle restrictive and restrictive. Third, considering my sample, the division of the distribution in quartile allows to take into account most of the variation in the data. Importantly, to test whether the division of the STRI into quartile influences the results, it also include it split into terciles.

dummy variables associated to four types of routes: from least to most restrictive (that correspond to the first and to the fourth quartile dummy variables, respectively -- *mode_3_1* and *mode_3_4*). I assume that restrictions in mode 3 affect the entry of new carriers in the market. Hence, they affect the intensity of competition in markets and are determinants of the mark-up term. For this variable, a positive coefficient is expected.

The three last terms (χ_o, υ_d, ρ_k) are origin, destination and product fixed-effects.

Finally, by substituting equations [1.2] and [1.3] in equation [1.1], I obtain the following empirical model:

$$mtc_{odk} = \beta_1 distance_{od} + \beta_2 transhipment_{od} + \beta_3 tv_{od} + \beta_4 ti\_absolute_{od} + \beta_5 ti\_interaction_{od} + \beta_6 mode\_3_{od} + \varphi_o + \psi_d + \delta_k + \varepsilon_{odk} \quad [1.4]$$

Where,

The dependant variable (mtc_{odk}) is the MTC paid by the service's consumers. It represents the transport cost from the point of the shipment (i.e. the moment when the good is loaded by a carrier) to the point of entry into the importing country. It includes the price of the transport, insurance costs and cargo handling but not customs charges. It is an unitary cost and it is expressed in Dollar per tonne.

Where,

$\varphi_o = \omega_o + \chi_o$
$\psi_d = \theta_d + \upsilon_d$,
$\delta_k = \rho_k + \lambda_k$

And where, ε_{odk} is the error term.

Finally, total import volume is endogenous to MTCs because of a reverse causality relationship. Indeed, MTCs have an impact on the choice of the transport mode, therefore on total seaborne import volume. To address the endogeneity issue, I run IV Two-Stage Least Squares (2SLS) regressions in the empirical part below. In the existing literature various instruments were used for total import volume. For instance, Clark *et al.* (2004) used the

exporting country's GDP and Marquez-Ramos *et al.* (2006) used the population of the importing country. However, these instruments vary across one dimension while the endogenous variable vary across country-pairs. In this chapter, I use an index of tariff protection (precisely, the average of bilateral Most Favoured Nation -- MFN -- tariffs) as an instrument for total import volume. My instrument varies across country-pairs. Furthermore, it is correlated with the endogenous variable (import volumes) and influences only the dependant variable (MTCs) through the endogenous variable. In other words, my instrument satisfies the exclusion conditions. In this respect, the instrument chosen is more relevant than instruments used previously in the literature.

Results of estimations

The sample includes 2 importers (destination countries) and 56 exporters (origin countries).[21] It represents 9,284 observations. The sample accounts for 32% of New Zealand total seaborne imports and for 48% of US total seaborne imports. I run cross-section estimations of the model given by the equation [1.4] for the year 2006. Variables *mtc*, *distance*, *tv,* and *ti_absolute* are included in logarithms. The error term is assumed to be independently distributed across countries and products. Since, the dependant variable (*mtc*), is derived from trade flows, the MTCs data is censored for zero trade flow observations -- this represents around 50% of the sample. MTCs are censored insofar as they exist but I am not able to observe them. In order to deal with this issue, I estimate an upper limit tobit model by assuming that trade does not occur because of too high MTCs (Limao and Venables, 2001). In other words, for zero trade flow observations, MTCs are systematically replaced by the highest value of MTCs in the dataset (Carson and Sun, 2007). The results of regressions are presented in Table 3. Tobit estimations are presented in columns 1 to 4 and 5 while the IV tobit estimations are presented in columns 5 and 7.

First, I focus on the results of the tobit estimations. The specifications 1 to 3 are basic, they include control variables only. The set of policy variables is included in the specification 4. In these specifications, most variables are very significant and coefficients have the expected sign. In specifications 1 and 2, coefficients attached to distance and transhipment variables are significant at the 1% level. Consistently with results of the existing literature, the

[21] For details on the sample, see Annex 1.

explanatory power of both variables included separately is similar. With regard to the full control variables model (column 3), the distance and total seaborne import volume variables are significant at the 1% level while the transhipment variable is significant at the 5% level. Trade imbalance variables are never significant. As mentioned previously, this could be due to the difficulty in designing these variables. Turning to specification 4, all variables (except the trade imbalance) are significant at the 1% level and coefficients hold the expected sign. According to this specification, if the distance increases by 100% (i.e. if the distance double), unitary MTCs increase by 74%. Moreover, whether a transhipment is needed in order to connect two countries, unitary MTCs increase by around 79%. In other words, transhipment leads to an increase in MTCs which is higher than doubling the transport distance. Concerning economies of scale, if the total volume of seaborne import increases by 1%, unitary MTCs decrease by 0.41%.

Table 3: Estimation results -- the MTCs equation

						Robustness check	
	1 Tobit	2 Tobit	3 Tobit	4 Tobit	5 IV Tobit	6 Tobit	7 IV Tobit
distance	1.848***		0.656***	0.742***	0.646	0.479***	0.310
	(0.179)		(0.214)	(0.189)	(0.432)	(0.102)	(0.221)
transhipment		1.508***	0.417**	0.582***	0.548**	0.184**	0.118
		(0.312)	(0.168)	(0.131)	(0.244)	(0.0785)	(0.139)
tv			-0.416***	-0.406***	-0.448***	-0.227***	-0.294***
			(0.0633)	(0.0578)	(0.163)	(0.0317)	(0.0863)
ti_absolute			-0.162	-0.123	-0.151	-0.0577	-0.110
			(0.110)	(0.121)	(0.184)	(0.0595)	(0.0908)
ti_interaction			0.459	0.440	0.564	0.271	0.522
			(0.321)	(0.327)	(0.622)	(0.170)	(0.325)
mode_3_second				0.682***	0.683***	0.224**	0.221**
				(0.153)	(0.151)	(0.0914)	(0.0872)
mode_3_third				1.009***	0.998***	0.417**	0.438***
				(0.296)	(0.306)	(0.166)	(0.168)
mode_3_fourth				1.183***	1.181***	0.584***	0.611***
				(0.404)	(0.420)	(0.201)	(0.210)
Pseudo-R-squared	0.195	0.187	0.200	0.201	-	0.273	-
Observations	9,284	9,284	9,284	9,284	9,113	8,739	8,582

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is a unitary maritime transport cost, it is expressed in dollars per kilogram and in logarithm. The variables *distance*, *tv* and *ti_absolute* are in logarithms. Cross section for year 2006. Model 1 to 4 and 6 are estimated by tobit. Model 5 and 7 are estimated by IV tobit and the instrument is an MFN simple average tariff. For these estimations the amount of observations falls from 9,284 to 9,113 and from 8,739 to 8,582 because MFN tariffs are not available for Cameroon. Coefficients correspond to the marginal effects for the unconditional expected value of the dependant variable. The pseudo R-squared is the McFadden's pseudo R-squared. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Origin, destination and commodity fixed-effects are included in all regressions. Intercepts are included in all specifications but not reported. The correlation matrix is available in Annex 4.

Regarding variables of interest (*mode_3*), since I do not include the dummy variable corresponding to the first quartile (corresponding to the less restrictive routes) it is taken as

the benchmark. All policy dummy variables are significant at the 1% level and positive. Interestingly, they increase monotonically across quartiles. Thus, MTCs are 97% higher on the routes classified in the second quartile than on routes classified in the first quartile. MTCs are 174% and 227% higher on the routes classified in the third and the fourth quartile than on routes classified in the first quartile, respectively. It is important to note that the bilateral STRI included directly in the equation is not statistically significant. This suggests that the impact of the index is not linear. However, this is not so surprising since the index has been constructed from a combination of various measures.

Obviously, my model overestimates the impact of MTCs determinants. On the one hand, coefficients associated with control variables are high in comparison to coefficients obtained in the existing literature. On the other hand, coefficients associated with policy variables are too high to be realistic. I will show in the next sub-section ("*Robustness check*") that this is likely to be due to a bias in the data.

Turning to the IV tobit estimation (column 5), results of statistical tests are very satisfactory. Indeed, in the first stage of the regression the coefficient of the instrument is significant at the 1% level and negative. And, in the second stage the Wald test indicates that explanatory variables are jointly significant at the 1 % level.[22] Furthermore, results of the specification 5 are consistent with results of the specification 4. Policy variables are still very significant even though results for the control variables are less satisfactory. The distance variable becomes insignificant and the level of significance of the transhipment variable decreases. Finally, the size of the coefficients for the IV estimation are similar to the coefficients for the simple tobit estimation. This is likely to indicate that the endogeneity issue is negligible. The Wald test for exogeneity which is not rejected confirms this intuition.[23] I conclude that specification 4 is a better estimation than specification 5.

Robustness check

In order to check the robustness of results obtained above, I estimate the specification 4 of the MTC equation using different policy variables and various samples. First,

[22] When running the regression with the robust option only, Wald chi2(149) = 9330.36 with Prob > chi2 = 0.0000.
[23] Wald test of exogeneity: chi2(1) = 0.07 with Prob > chi2 = 0.7846.

observations for which the weight of trade reported is low are likely to suffer from a data reporting issue (Baldwin and Harrigan, 2007). Therefore, I drop all observations for which the weight of trade reported is less than one metric tonne. The amount of observations decreases from 9,284 to 8,739. Results of this regression is presented in the column 6. Interestingly, although the number of observations decreases, the Pseudo-R-squared increases sharply -- even though the significance of the transhipment, the second and the third quartiles decreases. More interestingly, the coefficients associated with control and policy variables become much more credible. Thus, according to this specification, doubling the distance leads to an increase in MTCs of 48% and when transhipment is needed in order to connect two countries, unitary MTCs increase by 20%. Concerning barriers to trade in mode 3, MTCs are 25% higher on the routes classified in the second quartile than on routes classified in the first quartile. And, the routes classified in the third and the fourth quartile, MTCs are 52% and 79% higher than on routes classified in the first quartile, respectively. Results for the IV tobit estimations are still relevant -- column 7. As a second robustness check, I test whether the division of the STRI into quartile influences the results by including the index split into terciles instead of quartiles. For this estimation, the level of significance remains stable for the control variables *distance, transhipment* and *total trade volume*, while the level of significance increases for *trade imbalance* variables, making them significant. Policy variables are significant at the 1% level and still increase monotonically. The sizes of coefficients remain consistent with previous results. Third, in these estimations I control for the competition between maritime and air transport by including a commodity fixed-effect. Since trading partners sharing a border are likely to transport their international trade by road, I check for the competition with surface transport modes by dropping observations that involve direct neighbours -- this is the case of the US-Mexican trade that represents 85 observations (Chapter 1). Unsurprisingly, the results remain consistent.[24]

The results obtained in this section suggest two important comments. First, one contribution of this chapter is showing that restrictions in mode 3 affect MTCs non-linearly. Indeed, I find a monotonically, positive and significant impact of my set of restrictiveness indexes on MTCs. Second, consistently with other papers in the literature, my results suggest that distance explains a small share of the MTC's variance. Therefore, contrary to what is assumed in many gravity equation estimations, distance is likely to be a poor proxy for

[24] Results of other robustness check estimations are available upon request.

transport costs. It demonstrates the importance to choose a better proxy variable (Korinek and Sourdin, 2009b). Section 4 aims at addressing this issue by including MTCs directly in the gravity equation.

4. The seaborne trade flow equation

This section aims at assessing the impact of MTCs on seaborne trade flows. I estimate a seaborne trade gravity equation augmented with MTCs. The endogeneity issue is addressed by using an IV-like approach developed by Limao and Venables (2001). This approach also allows disentangling direct and indirect effects (i.e. through MTCs) of some variables such as distance on seaborne trade flows. This section is organized as follows, first, I review the literature assessing the impact of transport costs on trade flows. Second, I present the empirical model and the data. Third, I present results of estimations.

Review of the literature

In the literature, several papers assess the impact of MTCs (or the determinants of MTCs) on seaborne trade flows.[25] The approach followed by these papers is very similar and it is also the approach followed in this Chapter. In a first stage, it consists in measuring MTCs determinants (Section 3). In a second stage, it consists in estimating a gravity equation including MTCs and/or its determinants as explanatory variables (Section 4).

It is critical to study the relationship between transport costs and trade flows in a gravity framework, at least for two reasons. First, in gravity model estimations, distance is often taken as a proxy for transport costs (Korinek and Sourdin, 2009b). However, as shown in the previous section, it explains only a small share of the MTCs' variance. Second, some determinants of MTCs (e.g. distance) are likely to have direct and indirect effects on trade flows. Therefore, by including MTCs in the gravity equation an endogeneity issue appears. However, the existing literature does not succeed in addressing satisfactorily this issue. For instance, some papers do not refer to the endogeneity issue at all -- e.g. Martinez-Zarzoso *et al.* (2008). Other papers such as Martinez-Zarzoso and Suarez-Burguet (2005), Marquez-Ramos *et al.* (2006) Korinek and Sourdin (2009b) run IV 2SLS. All these papers use the

[25] Radelet and Sachs (1998), Limao and Venables (2001), Martinez-Zarzoso and Suarez-Burguet (2005), Marquez-Ramos *et al.* (2006), Martinez-Zarzoso and Nowak-Lehmann (2007), Martinez-Zarzoso, Perez-Garcia and Suarez-Burguet (2008), Korinek and Sourdin (2009b).

unitary value of goods transported as an instrument for MTCs. Although, the unitary value of goods corresponds to the products' price. In this respect, it influences trade directly and not only through the endogenous variable. Therefore, in these papers, the exclusion conditions of the instrument are not satisfied. Finally, Martinez-Zarzoso and Nowak-Lehmann (2007) address the endogeneity issue of the MTC variable by estimating simultaneously a transport cost and a gravity equation. This is possible since in their system of equations, trade volume (varying across country-pairs and products) is the dependant variable in the gravity equation and an explanatory variable in the MTC equation. Nevertheless, Martinez-Zarzoso and Nowak-Lehmann do not provide justifications for including trade volume as an explicative variable in the MTC equation. It cannot be a proxy variable for economies of scale since the bilateral trade disaggregated by product is not appropriate. Indeed, in the liner shipping segment it is not the amount of the various products transported that creates economies of scale but the total amount of bilateral trade. Finally, almost no paper quoted uses state of the art gravity techniques and concepts. Only Korinek and Sourdin (2009b) mention the key concept of multilateral resistance.

As mentioned above, I deal with the endogeneity issue by using an IV-like approach developed by Limao and Venables (2001). This two-stage approach also allows disentangling the direct and indirect (i.e. through MTCs) impact of distance and STRI in mode 3 on seaborne trade flows. And, I take into account the multilateral resistance by estimating an Anderson and van Wincoop (2003) model with fixed-effects.

Model specifications and data[26]

As a theoretical basis, I use the Anderson and van Wincoop (2003) model who derived theoretically the gravity equation for trade value. Importantly, this model is applicable to cross-section estimations (Baldwin and Taglioni, 2006). In this model, the authors showed the importance of all other bilateral relations in a particular bilateral trade relation. Even though trade costs increase on all routes except on the route between the country o and the country d, the trade between o and d will be affected. This effect is called multilateral resistance. In the Anderson and van Wincoop (AvW) model the multilateral resistance effects are captured by price indices. The classic form of the model is presented in the equation [2.1] below.

[26] For more details about data sources, see Annex 3.

$$ln(M_{odk}) = ln(Y_{dk}) + ln(E_{ok}) - ln(Y) + (1-\sigma_k)[\tau_{odk} + ln\Pi_{dk} + ln P_{ok}] + \varepsilon_{odk} \qquad [2.1]$$

Where, the dependant variable (M_{odk}) is the seaborne import in value from the origin to the destination country of the product k. The first term (Y_{dk}) is the value added of the destination country in the sector k. The second term (E_{ok}) is the expenditure of the origin country in the product k. The third term (Y) is the world value added. The fourth term (σ_k) is the elasticity of substitution of product k. The fifth term (τ_{odk}) represents trade costs between o and d for the product k. The sixth and the seventh variables are respectively the inward and the outward multilateral resistance terms. And, ε_{odk} is the error term.

And where,

$$\tau_{odk} = distance_{od} + com\_lang_{od} + contiguity_{od} + pta_{od} + tariff_{odk} + mtc_{odk} \qquad [2.2]$$

Where, the first term ($distance_{od}$) is the maritime distance between o and d. The second term, (com_lang_{od}) is a dummy variable coding 1 if o and d have a common language and 0 otherwise. The third term, ($contiguity_{od}$) is a dummy variable coding 1 if o and d share a common border and 0 otherwise. The fourth term (pta_{od}) is a dummy variable coding 1 if o and d are parts to the same PTA (Preferential Trade Agreement) and 0 otherwise. The fifth term ($tariff_{odk}$) is the average MFN tariff between o and d for the product k. Here, I provide an adjustment to classical gravity specification by adding the transport cost variable (mtc_{odk}) directly in the trade costs equation. Concerning this variable, I use either the actual either the predicted values computed through the best specifications of the MTC equations in Section 3.

The model presented above has one important drawback since the data for certain variables is not observed and/or not available. It is the case for the sectoral value-added and expenditures and for the crucial relative prices representing the multilateral resistance terms. To control for these variables, the common way is to include fixed-effects. Precisely, since unobserved variables vary across commodity and countries (origin or destination), the solution should consists in including cross commodity-country fixed-effects -- i.e. a commodity-origin and a commodity-destination fixed-effect. However, considering the sample, cross commodity-origin fixed-effects represent more than 4,500 dummy variables. Since the sample comprises around 4,500 observations (without zero values) this approach

cannot be used. In order to control for the appropriate commodity-origin dimension of unobserved variables I construct cross fixed-effects between commodities and the exporters' level of development. This approach has the advantages to generate a manageable amount of dummy variables. By including such fixed-effect I assume that relative prices vary across commodities and the exporters' level of development. By replacing the equation [2.2] in the equation [2.1] and including fixed effects, I obtain the equation [2.3] to estimate. Where π_{dk} is a cross commodity-destination fixed-effect and ρ_{ok} is a cross-fixed effects between commodity and the level of development of exporters.[27]

$$M_{odk} = \beta_1 distance_{od} + \beta_2 com\_lang_{od} + \beta_3 contiguity_{od} + \beta_4 pta_{od} + \beta_5 tariff_{odk} + \beta_6 mtc_{odk} + \pi_{dk} + \rho_{ok} + \varepsilon_{odk} \qquad [2.3]$$

Finally, as mentioned above, by estimating the gravity equation augmented with transport costs, an obvious endogeneity issue appears. Indeed, certain determinants of MTCs also affect seaborne imports. However, it is very difficult to find an IV for MTCs since it has to vary across origin, destination and commodity and to satisfy the exclusion conditions. In other words, it is very difficult to use the common IV 2SLS methodology here. Hence, in order to address the endogeneity issue, I use the IV-like approach developed by Limao and Venables (2001). Thus, I estimate the seaborne trade gravity equation by including the predicted instead of the actual value of MTCs as an explanatory variable. The predicted value is computed through the best specifications of the section 3 -- i.e. the specification 4 and 6. In these regressions, I also include determinants of MTCs which are likely to affect seaborne imports directly: the distance and the set of policy variables. Common gravity control variables are also included in these estimations.

Results of estimations

The sample is similar to the one used in the previous section, without zero trade values it represents 4,614 observations. The variables *M*, *distance* and *mtc* are included in logarithms. The error term is assumed to be independently distributed across countries and products. First, I estimate a classic gravity model augmented with the MTC variable (equation [2.3]) by OLS. These results are presented in Table 4. Then, I estimate the gravity equation *à*

[27] I use the level of development defined by the World Bank. For more details see the Annex 1.

la Limao and Venables by OLS in order to deal with the endogeneity issue. These results are presented in Table 5.

With respect to the common gravity estimations, all results are similar (Table 4). MTC and tariff variables are significant at the 1% level and as expected they are negative. In contrast, all other variables are not significant. It is important to note that common gravity variables do not become significant when the MTC is not included -- columns 3 and 6. This means that the MTC variable does not absorb the impact of *distance, com_language* and *contiguity* on seaborne trade. However, *mtc* and *tariff* are likely to be the only significant variables since they are the only variables varying across all dimensions of the dependant variable -- i.e. across origin, destination and commodity.

Table 4: Estimation results -- The gravity equation

				Robustness check		
	1	2	3	4	5	6
	OLS	OLS	OLS	OLS	OLS	OLS
distance	0.153		-0.131	0.461		0.263
	(0.481)		(0.505)	(0.447)		(0.460)
mtc	-1.028***	-1.014***		-0.746***	-0.690***	
	(0.128)	(0.133)		(0.143)	(0.151)	
com_language	0.309	0.333	0.337	0.0962	0.181	0.120
	(0.515)	(0.488)	(0.536)	(0.488)	(0.461)	(0.494)
contiguity	-0.400	-0.529	-0.330	0.125	-0.257	0.182
	(0.688)	(0.562)	(0.749)	(0.652)	(0.516)	(0.687)
pta	0.323	0.257	0.333	0.250	0.0513	0.247
	(0.548)	(0.556)	(0.595)	(0.495)	(0.491)	(0.521)
tariff	-0.0160***	-0.0157***	-0.0162***	-0.0152***	-0.0144***	-0.0153***
	(0.00425)	(0.00433)	(0.00427)	(0.00442)	(0.00443)	(0.00442)
Observations	4,614	4,614	4,614	4,076	4,076	4,076
R-squared	0.397	0.397	0.359	0.325	0.321	0.304

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is seaborne import, it is expressed in US$. Seaborne imports, distance and MTCs are in logarithms. Cross section for year 2006. Model 1 to 4 are estimated by OLS. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Cross commodity-origin and commodity-destination fixed-effects are included in all regressions. Intercepts are included in all specifications but are not reported. The correlation matrix is available in Annex 4.

Concerning the IV-like estimations, I focus on the results for the full sample -- i.e. specifications 1 and 2 (Table 5). The tariff variable is still significant at the 1% level and negative. If tariffs increase by one percentage point, trade flows decrease by 1.5 %. The predicted value of MTCs comes up very significant and negative. If MTCs double, seaborne imports decrease proportionately. Furthermore, in the specifications 1 and 2 the distance variable becomes significant at the 5% level and the contiguity variable at the 1% and 10%

level. At first sight, the coefficient of both variables could seem counterintuitive. However, since my analysis is based on seaborne trade rather than on trade as a whole, results are consistent.

Table 5: Regressions dealing with endogeneity

			Robustness check	
	1	2	3	4
	OLS	OLS	OLS	OLS
predicted_mtc_4	-1.040***	-1.025***		
	(0.0523)	(0.0505)		
predicted_mtc_6			-1.659***	-1.636***
			(0.103)	(0.103)
distance	0.499**	0.526**	0.759***	0.758***
	(0.213)	(0.228)	(0.193)	(0.190)
mode_3_2		0.160		-0.0215
		(0.260)		(0.264)
mode_3_3		0.398		0.278
		(0.290)		(0.287)
mode_3_4		0.304		0.180
		(0.282)		(0.302)
contiguity	-0.989***	-0.807*	-0.790**	-0.558
	(0.361)	(0.413)	(0.312)	(0.353)
com_language	-0.338	-0.199	-0.454**	-0.353
	(0.226)	(0.229)	(0.227)	(0.216)
pta	0.0674	0.0629	0.0556	0.0155
	(0.280)	(0.300)	(0.236)	(0.258)
tariff	-0.0147***	-0.0148***	-0.0141***	-0.0142***
	(0.00462)	(0.00456)	(0.00438)	(0.00441)
Observations	4,614	4,614	4,076	4,076
R-squared	0.643	0.644	0.593	0.594

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is seaborne import, it is expressed in US$. Seaborne imports, distance and MTCs are in logarithms. Cross section for year 2006. Model 1 to 4 are estimated by OLS. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Cross commodity-origin and commodity-destination fixed-effects are included in all regressions. Intercepts are included in all specifications but are not reported. The correlation matrix is available in Annex 4.

Concerning distance, besides affecting seaborne trade flows through MTCs (as suggested in the section 3), it also affects seaborne trade flows directly and positively. This suggests an opposite direct and indirect effect of distance on seaborne trade flows. Indeed, once the impact of distance on MTCs has been controlled, distance has a direct positive impact on seaborne trade. The farer trading partners are from each other, the more likely the cargo will be transported by sea. Interestingly, this result confirms a pattern often stated in the literature. Additionally, the negative sign of the contiguity variable is the other side of this distance story. When two trading partners share a common border, the importance of the maritime transport mode decreases significantly -- for the benefit of road transport (Chapter

1). Moreover, as suggested in specification 2 and contrary to the distance, restrictions in mode 3 do not affect trade flows directly. However, since barriers to trade in mode 3 affect MTCs and MTCs affect seaborne trade flows, I can conclude that barriers to trade affect seaborne trade flows indirectly. More interesting, it is possible to derive this indirect impact. Thus, since MTCs affect proportionally seaborne trade flows (the coefficient is close to one therefore, double MTCs lead to an equivalent decrease in seaborne trade), STRI in mode 3 affect seaborne trade flows in the same proportion as it affect MTCs. Finally, other control variables such *pta* and *com_language* are not significant. This could be due to overlaps between the *pta*, *com_language* and *contiguity* variables (e.g. the US and Mexico share a common border and they are partners in the NAFTA, Australia and New Zealand share a common language and they are partners in the CER -- Closer Economic Relation). Furthermore, countries of my sample are involved in few and not the most dynamic PTAs.[28]

Robustness check

Like in the section 3, I estimate the various specifications by dropping observations for which the weight of trade reported is less than one metric tonne. Indeed, even though the dependant variable is expressed in value, observations for which the weight of trade is low are likely to suffer from reporting errors (Baldwin and Harrigan, 2007). The amount of observations decreases from 4,614 to 4,076. These results are presented in Columns 4, 5 and 6 of Table 4 and Columns 3 and 4 of Tables 5. Except some changes in the value of coefficients, the most important results described in the previous sub-section are still true.

5. Conclusion and recommendations

One contribution of this chapter to the literature is the construction of an original liner shipping STRI measuring the overall intensity of restrictions in mode 3. To construct this index I use high quality information on the regulatory regime applied by countries (World Bank, 2008). Another novelty is to use state of the art methodological developments. Moreover, my index is constructed as closely as possible to the reality thanks to discussions and debates with experts and professionals. The study of my set of STRIs suggests that liner

[28] They are the NAFTA, the CER, the agreements between Thailand and New Zealand, between the United States and Australia, Chile, Jordan, Morocco and CAFTA -- Central America Free Trade Agreement.

shipping is an open sector. This is not surprising since it is a tradable service by nature. Finally, except geographical and political factors, it is difficult to find patterns explaining the restrictiveness of countries' regulatory regime in the sector.

Concerning the impact of trade barriers on MTCs and seaborne trade flows, first, I show that barriers to trade in mode 3 have a direct and positive impact on MTCs. Indeed, I found a monotonically, positive and significant impact of my STRI split into quartiles on MTCs. Therefore, the more maritime routes are restrictive, the more MTCs on routes are high. Precisely, after controlling for a data reporting issue, the results suggest that MTCs are 25% higher on the routes classified in the second quartile than on the routes classified in the first quartile. And, on the routes classified in the third and fourth quartiles, MTCs are 52% and 79% higher than on the routes classified in the first quartile, respectively. Beyond these quantitative results, the impact of the STRI on MTCs brings two important conclusions. First, by showing that barriers in mode 3 affect MTCs, I demonstrate that even though mode 1 is the key mode of supply in maritime transport, commercial presence (i.e. mode 3 of supply) is of crucial importance to provide efficient liner shipping services. Second, considering the methodology used to bilateralize the STRI (i.e. the additive form), these results suggest that on maritime routes, restrictions in mode 3 are crucial at both ends of journeys -- i.e. in origin and destination countries. Then, I show that barriers to trade in mode 3 do not affect seaborne trade flows directly. However, since I show that barriers to trade in mode 3 affect positively MTCs and that MTCs affect negatively seaborne trade flows, I can conclude that barriers to trade affect seaborne trade flows negatively through MTCs. More interesting, it is possible to derive this indirect impact of trade barriers on seaborne trade flows. Thus, since MTCs affect proportionally seaborne trade flows (double MTCs lead to an equivalent decrease in seaborne trade), STRI in mode 3 affects seaborne trade flows in the same proportion as it affects MTCs.

These results have important policy implications. First, I show that restrictive regulatory regimes lead to additional transport costs that, in turn, have a negative impact on seaborne trade flows. This result demonstrates that MTCs are compressible and suggests that policy-makers have a role to play in decreasing MTCs until they reach their minimum level. Second, my results suggest that commercial presence is a key issue in liner shipping. This should encourage policy-makers to pay more attention to restrictions in mode 3. Third, my results suggest that on maritime routes, trade restrictions affect both the countries of origin and destination. Thus, restrictive regulations and additional MTCs affect all trading countries

including the most liberal ones. This suggests that restrictions in maritime transport are a multilateral issue that has to be tackled within the GATS framework. Importantly, my results, suggesting a substantial impact on MTCs, are an incentive for all countries to invest in negotiations to remove barriers to trade in mode 3 in the liner shipping sector. These results are an incentive to reopen GATS negotiations which are at a standstill since 1997.

Eventually, as mentioned in Chapter 1, barriers to trade in mode 3 are likely to affect MTCs through marginal costs and the market structure. One drawback of this analysis is of not being able to disentangle both effects. It is one objective of the next chapter.

Coming to the impact of distance on MTCs and seaborne trade flows, first, I show that distance affects MTCs positively. And, consistently the literature, I show that distance explains a small share of the MTCs variance. Second, I succeed in disentangling direct and indirect effects of distance on seaborne trade flows. On the one hand, I show that distance has a positive impact on MTCs and MTCs have a negative impact on seaborne trade flows. Therefore, these results suggest that distance has a negative impact on seaborne trade flows through MTCs. On the other hand, after controlling for the indirect impact of distance through MTCs following the IV-like approach developed by Limao and Venables (2001), I show that distance affects seaborne trade positively. Thus, the farer trading partners are from each other, the more likely their containerizable trade will be transported by sea. This result confirms a pattern often stated but never proved -- to my knowledge. Interestingly these results suggest opposite direct and indirect effects of distance on seaborne trade flows. Third, consistently with another maritime transport stylized fact, I show that if trading partners share a common border, the importance of the maritime transport mode decreases sharply (Hummels, 2007 and Chapter 1).

From a theoretical and empirical point of view, the results obtained concerning distance are crucial. As stated by the literature, since distance explains a small share of the MTC's variance, it is likely to be a poor proxy variable for transport costs -- contrary to what is assumed in many gravity equation estimations. Furthermore, by showing opposite direct and indirect effects of distance on seaborne trade flows, I show that distance is definitely a poor proxy for MTCs.

Finally, this chapter calls for further research. First, the results obtained concerning distance call for similar research dealing with trade as a whole and trade for other transport modes -- notably air transport for which accurate data is available. These works should allow

to better understand the entangled direct and indirect effects of distance on transport costs and trade.

Second, once computed, the STRI could be used in different ways. One approach would consist in estimating *ad valorem* equivalents of barriers to trade in mode 3. *Ad valorem* equivalents can be computed by regressing MTCs on the STRI -- and using for the dependant variable Cif-Fob ratios instead of unitary transport costs. The step further would be to include these *ad valorem* equivalents in an international trade model to assess through a different methodology the impact of liner shipping trade restrictions on seaborne trade flows.

Third, the results obtained call for enlarging the scope of the study in terms of period, country, and product coverage. This would allow to better generalize the conclusions drawn. A decisive improvement would consist in estimating panel instead of cross-section regressions. However, this requires better regulatory information. Then, it would be interesting to enlarge the country sample and notably the number of importing countries. This is possible to some extent since accurate data (needed to compute MTCs) is available for other countries such as Australia and some Latin-American countries. This will be partly done in the next chapter since Brazil will be included to the sample. Concerning the product coverage, it is possible to use six- instead of two-digits disaggregated data. This will be done in the next chapter.

6. References

Achy, Lahcen, Mongi Boughzala, Hanaa Kheir-El-Din and Sübidey Togan. 2005. "Impact of Liberalization of Trade in Services: Banking, Telecommunications and Maritime Transport in Egypt, Morocco, Tunisia and Turkey.", Femise project, FEM22-02.

Anderson, James E., and Eric Van Wincoop. 2003. "Gravity with Gravitas: A Solution to the Border Puzzle." *American Economic Review*, 93(1): 170-192.

AXS Marine. 2010. "AXS Marine Distance Table" AXS Marine website. http://www.axsmarine.com/distance/ (accessed September 2010).

Baldwin, Robert, and Daria Taglioni. 2006. "Gravity for Dummies and Dummies for Gravity Equations." National Bureau of Economic Research Working Paper 12516.

Baldwin, Richard, and James Harrigan. 2007. "Zeros, Quality and Space: Trade Theory and Trade Evidence." National Bureau of Economic Research Working Paper 13214.

Borchert, Ingo, Batshur Gootiiz and Aaditya Mattoo. 2012. "Policy Barriers to International Trade in Services: New Empirical Evidence." World Bank, forthcoming.

Clark, Ximena, David Dollar, and Alejandro Micco. 2004. "Port Efficiency, Maritime Transport Costs and Bilateral Trade." *Journal of Development Economics*, 75: 417-450.

Containerization International Online. 2006. "Fleet Deployment Statistics" http://www.ci-online.co.uk/

Conway, Paul, Véronique Janod, and Giuseppe Nicoletti. 2005. "Product Market Regulation in OECD Countries: 1998 to 2003." OECD Economics Department Working Papers 419.

Conway, Paul, and Giuseppe Nicoletti. 2006. "Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights." Organization for Economic Cooperation and Development Economics Department Working 530.

Deardorff, Alan V., and Robert M. Stern, "Empirical Analysis of Barriers to International Services Transactions and the Consequences of Liberalization," in Aaditya Mattoo, Robert M. Stern, and Gianni Zanini, eds, *A Handbook of International Trade in Services*, New York: Oxford University Press, 2008, pp.

De Sousa, José. 2011. "Regional trade agreements Stata Do Files." International Economics Data and Programs Website.
http://jdesousa.univ.free.fr/data.htm (accessed May 31, 2011)

Fink, Carsten, Aaditya Mattoo, and Ileana C. Neagu. 2002. "Trade in International Maritime Services: How Much Does Policy Matter?" *The World Bank Economic Review*, 16(1): 81-108.

Gootiiz, Batshur, and Aaditya Mattoo. 2009. "Services in Doha: What's on the Table?" World Bank Policy Research Working Paper Series 4903.

Head, Keith, Thierry Mayer, and John Ries. 2010. "The Erosion of Colonial Trade Linkages After Independence: Dataset" Journal of International Economics, 81(1): 1-14.
http://www.cepii.fr/anglaisgraph/bdd/gravity.htm

Hummels, David. 1999. "Toward a Geography of Trade Costs." Global Trade Analysis Project Working Paper 17.

Hummels, David, and Volodymyr Lugovskyy. 2006. "Are Matched Partner Trade Statistics a Usable Measure of Transportation Costs?" *Review of International Economics*, 14(1): 69-86.

Hummels, David. 2007. "Transportation Costs and International Trade in the Second Era of Globalization", *Journal of Economic Perspectives*, vol. 21, n° 3 Summer 2007

Kang, Jong-Soon, "Price Impact of Restrictions on Maritime Transport Services," in Christopher Findlay and Tony Warren, eds, *Impediments to Trade in Services: Measurement and Policy Implications*, London: Routledge, 2000, pp. 189-200.

Kimura, Fukunari, Mitsuyo Ando and Takamune Fujii. 2004. "Estimating the Ad Valorem Equivalent of Barriers to Foreign Direct Investment in the Maritime and Air Transportation Services sector in Russia."
http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/kimura-Ando-Fujii-RussiaTransport.pdf

Korinek, Jane, and Patricia Sourdin. 2009a. Clarifying Trade Costs: Maritime Transport and its Effects on Agricultural Trade, OECD Trade Policy Working Papers 92.

Korinek, Jane, and Sourdin. 2009b. "Maritime Transport Costs and Their Impact on Trade."
http://www.etsg.org/ETSG2009/papers/korinek.pdf

Korinek Jane. 2011. "Clarifying Trade Costs in Maritime Transport", OECD, Paris.

Kumar, Shashi, and Jan Hoffmann, "Globalization: the Maritime Nexus," in Costas T. Grammenos, ed, *Handbook of Maritime Economics and Business*, London: Lloyds List Press, 2002, pp. 35-62.

Li, Kevin X., and Jin Cheng. 2007. "The Determinants of Maritime Policy." *Maritime Policy and Management*, 34(6): 521-533.

Limao, Nuno, and Anthony J. Venables. 2001. "Infrastructure, Geographical Disadvantages, Transport Costs and Trade." *The World Bank Economic Review*, 15(3): 451-479.

Márquez-Ramos, Laura, Inmaculada Martínez-Zarzoso, Eva Pérez-García, and Gordon Wilmsmeier. 2006. "Determinants of Maritime Transport Costs: Importance of Connectivity Measures"
http://www.univ-lehavre.fr/actu/itlcsge/ramos.pdf

Martinez-Zarzoso, Inmaculada, and Celestino Suarez-Burguet. 2005. "Transport Costs and Trade: Empirical Evidence for Latin American Imports from the European Union." *Journal of International Trade and Economic Development*, 14(3): 353-371.

Martinez-Zarzoso, Inmaculada, and Felicitas Nowak-Lehmann. 2007. "Is Distance a Good Proxy for Transport Costs? The Case of Competing Transport Modes." *Journal of International Trade and Economic Development*, 16(3): 411-434.

Martinez-Zarzoso, Inmaculada, Eva Maria Perez-Garcia, and Celestino Suarez-Burguet. 2008. "Do Transport Costs Have a Differential effect on Trade at the Sectoral Level?" *Applied Economics*, 40: 3145-3157.

Mandryk, Wally. 2009. "Measuring Global Seaborne Trade." Presentation at the International Maritime Statistics Forum, New Orleans, 4-6 May 2009.

McGuire, Greg, Michael Schuele and Tina Smith, "Restrictiveness of International Trade in Maritime Services," in Christopher Findlay and Tony Warren, eds, *Impediments to Trade in Services: Measurement and Policy Implications*, London: Routledge, 2000, pp. 189-200.

Micco, Alejandro, and Natalia Pérez. 2002. "Determinants of Maritime Transport Costs." Inter-American Development Bank Research Department working paper 441.

New Zealand Statistics. 2006. "Overseas Trade Imports and Exports Statistics: HS2 Chapter by Country of Origin and Destination by Sea Freight." New Zealand Statistics. http://www.stats.govt.nz/ (received September 20, 2010).

Nicoletti, Giuseppe, Stefano Scarpetta, and Olivier Boylaud. 2000. "Summary Indicators of Product Market Regulation With Extension to Employment Protection Legislation." Organization for Economic Cooperation and Development Economics Department Working Papers 226.

OECD. 2006. "Ad Valorem and Unitary Maritime Transport Costs." OECD Maritime Transport Costs Database. http://stats.oecd.org/Index.aspx?datasetcode=MTC (accessed October 28, 2010)

OECD. 2008. "*Handbook on Construction Composite Indicators: Methodology and User Guide."* Paris: OECD Publications.

OECD, 2009a. "Methodology for Deriving the Services Trade Restrictiveness Index." Presentation at the Organization for Economic Cooperation and Development Experts Meeting on the Services Trade Restrictiveness Index, Paris 2-3 July 2009.

OECD. 2009b. "Services Trade Restrictiveness Index: Telecommunication Services." Presentation at the Organization for Economic Cooperation and Development Experts Meeting on the Services Trade Restrictiveness Index, Paris 2-3 July 2009.

Radelet, Steven, and Jeffrey Sachs. 1998. "Shipping Costs, Manufactured Exports and Economic Growth."
http://admin.earth.columbia.edu/sitefiles/file/about/director/pubs/shipcost.pdf

Sanchez, Ricardo J., Jan Hoffmann, Alejandro Micco, Georgina V. Pizzolitto, Martin Sgut, and Gordon Wilmsmeier. 2003. "Port Efficiency and International Trade, Maritime: Port Efficiency as a Determinant of Maritime Transport Costs." *Maritime Economics and Logistics*, 5: 199-218

Stopford, Martin. 2009. *Maritime Economics*. New York: Routledge.

UNCTAD. 2011. *Review of Maritime Transport 2010*. New York and Geneva: United Nations.

US Census Bureau. 2006. "Annual Port-level Trade." USA Trade Online.
https://www.usatradeonline.gov/ (accessed September 13, 2010)

Wilmsmeier, Gordon, Jan Hoffmann and, Ricardo J. Sanchez. 2006. "The Impact of Port Characteristics on International Maritime Transport Costs", *Port Economics*, 16: 117-140.

Wilmsmeier, Gordon and, Jan Hoffmann. 2008. "Liner Shipping Connectivity and Port Infrastructure as Determinants of Freight Rates in the Caribbean." *Maritime Economics and Logistics*, 10: 130-151.

Wilmsmeier, Gordon, and Inmaculada Martinez-Zarzoso. 2010, "Determinants of Maritime Transport Costs -- A Panel Data Analysis for Latin American Trade." *Transportation Planning and Technology*, 33(1): 105-121.

World Bank. 2008. "Maritime Transport Services." World Bank Survey on Impediment to Trade Integration.

World Integrated Trade Solution. 2006. "Most Favoured Nation and Applied Tariffs: HS2 Chapter by Country of Origin and Destination." Tariffs and Trade Analysis. http://wits.worldbank.org/wits/ (accessed February 16, 2011)

WTO. 2010. "Maritime Transport Services -- Background Note by the Secretariat."

WTO. 2011. "Regional Trade Agreements Notified to the GATT/WTO." Regional Trade Agreements Information System. http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx (accessed May 31, 2011)

7. Annexes

Annex 1: Sample description

Destination countries (2) Importers	
New Zealand	High-income
United States	High-income

Origin countries (56) Exporters	
Argentina	Upper-middle-income
Australia	High-income
Bangladesh	Low-income
Bulgaria	Upper-middle-income
Brazil	Upper-middle-income
Chile	Upper-middle-income
China	Upper-middle-income
Côte d'Ivoire	Lower-middle-income
Cameroon	Lower-middle-income
Colombia	Upper-middle-income
Costa Rica	Upper-middle-income
Dominican Republic	Upper-middle-income
Ecuador	Upper-middle-income
Egypt	Lower-middle-income
Georgia	Lower-middle-income
Ghana	Lower-middle-income
Guatemala	Lower-middle-income
Honduras	Lower-middle-income
Indonesia	Lower-middle-income
India	Lower-middle-income
Iran	Upper-middle-income
Jordan	Upper-middle-income
Japan	High-income
Kenya	Low-income
Cambodia	Low-income
South Korea	High-income
Kuwait	High-income
Sri Lanka	Lower-middle-income
Morocco	Lower-middle-income
Madagascar	Low-income
Mexico	Upper-middle-income
Mauritius	Upper-middle-income
Malaysia	Upper-middle-income
Namibia	Upper-middle-income
Nigeria	Lower-middle-income
Nicaragua	Lower-middle-income
New Zealand	High-income
Oman	High-income
Pakistan	Lower-middle-income
Panama	Upper-middle-income
Peru	Upper-middle-income
Philippines	Lower-middle-income
Qatar	High-income
Romania	Upper-middle-income
Russia	Upper-middle-income
Saudi Arabia	High-income
Senegal	Lower-middle-income
Thailand	Upper-middle-income
Trinidad & Tobaggo	High-income
Tunisia	Upper-middle-income
Ukraine	Lower-middle-income
Uruguay	Upper-middle-income
United States	High-income
Venzuela	Upper-middle-income
Viet Nam	Lower-middle-income
South Africa	Upper-middle-income

Source: World Bank (2010). Notes: High-income economies (Growth National Income -- GNI -- per capita of 12276 dollars or more), upper-middle-income economies (GNI per capita between 3976 and 12275 dollars), lower-middle-income economies (GNI per capita between 1006 and 3975 dollars) and low-income economies (GNI per capita of 1005 dollars or less).

Annex 2: Details on the construction of the liner shipping STRI in mode 3

The relevance of restrictions included

This section aims at checking the relevance to include the various restrictions to trade in mode 3 used in my liner shipping STRI. I include all restrictions separately in the model given by the equation [1.4] and I estimate these specifications by tobit. Each restriction is included as a dummy variable. Since the regulatory framework is very similar for both destination countries, I include the origin countries' restrictions only. Policy variables are coded as follows:

- *subs_not_allowed_o* is coded 1 if commercial presence cannot be established as a subsidiary in the origin country, 0 otherwise.

- *branch_not_allowed_o* is coded 1 if commercial presence cannot be established as a branch in the origin country, 0 otherwise.

- *rest_control_green_o* is coded 1 if the share of foreign ownership is limited to less than 50% in greenfield projects in the origin country, 0 otherwise.

- *rest_control_private_o* is coded 1 if the share of foreign ownership is limited to less than 50% in existing private entities in the origin country, 0 otherwise.

- *rest_control_public_o* is coded 1 if the share of foreign ownership is limited to less than 50% in existing public entities in the origin country, 0 otherwise.

- *jv_requiered_private_o* is coded 1 if a joint venture is required for, at least, one form of commercial presence (either on greenfield project or existing public and private entities) in the origin country, 0 otherwise.

- *lic_requiered_o* is coded 1 if a licence is required in order to establish a commercial presence in the origin country, 0 otherwise.

- *bad_reg_frame_o* is coded 1 if the regulatory framework of the origin country is of bad quality, 0 otherwise.[1]

- *restrictions_employee_o* is coded 1 if some restrictions concerning the nationality of employees exist in the origin country, 0 otherwise.

- *restrictions_board_o* is coded 1 if some restrictions concerning the nationality of the members of the Board of Directors exist in the origin country, 0 otherwise

- *rest_repat_o* is coded 1 if some restrictions on the repatriation of earnings by foreign carriers exist in the origin country, 0 otherwise

Since the individual policy variables vary across origin countries I do not include the corresponding fixed effect. Moreover, because of multicollinearity, it is not possible to include policy variables all together in the same regression. I use the correlation matrix to define the various relevant specifications. The results of these specifications are presented in the table below. Broadly speaking, the econometric analysis confirms my intuitions on the relevance to include all restrictions used in the STRI.

[1] The regulatory framework is considered of bad quality when companies do not have the right to appeal regulatory decisions and when a mechanism of prior notice of regulatory changes does not exist.

Table: Estimations results -- MTC equation including policy variables individually

	1 Tobit	2 Tobit	3 Tobit	4 Tobit	5 Tobit
distance	-0.331	-0.0558	-0.255	-0.499	-0.460
	(0.367)	(0.338)	(0.356)	(0.310)	(0.301)
transhipment	1.358*	1.694**	1.298*	0.846*	0.814*
	(0.696)	(0.711)	(0.695)	(0.476)	(0.477)
tv	-0.949***	-0.849***	-0.951***	-1.115***	-1.110***
	(0.121)	(0.124)	(0.125)	(0.0956)	(0.0952)
ti_absolute	-0.116	-0.0566	-0.115	-0.0435	-0.0461
	(0.279)	(0.288)	(0.288)	(0.159)	(0.155)
ti_interaction	2.275***	2.012**	1.864**	1.475**	1.445**
	(0.877)	(0.899)	(0.815)	(0.740)	(0.719)
branch_not_allowed_o				0.439	0.430
				(0.315)	(0.316)
rest_control_green_o				0.676*	
				(0.365)	
rest_control_private_o	0.750*				0.587*
	(0.387)				(0.349)
rest_control_public_o		0.765**			
		(0.346)			
jv_requiered_private_o			0.824***		
			(0.288)		
lic_requiered_o	-0.524	-0.692	-0.491		
	(0.743)	(0.739)	(0.708)		
bad_reg_frame_o	2.669***	3.012***	2.795***		
	(0.911)	(0.863)	(0.934)		
restrictions_employee_o	0.336	0.328	0.136		
	(0.370)	(0.362)	(0.353)		
restrictions_board_o		0.167	0.0964	0.0248	
		(0.470)	(0.499)	(0.414)	
rest_repat_o	-2.613**	-2.860*	-2.945**	-0.0574	-0.0477
	(1.207)	(1.606)	(1.232)	(0.409)	(0.402)
Pseudo-R-squared	0.187	0.191	0.187	0.178	0.178
Observations	5,495	5,166	5,495	8,943	8,943

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is a unitary maritime transport cost, it is expressed in dollars per kilogram and in logarithm. The variables *distance*, *tv* and *ti_absolute* are in logarithms. Cross section for year 2006. All models are estimated by tobit. The pseudo R-squared is the McFadden's pseudo R-squared. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Destination and commodity fixed-effects are included in all regressions. Intercepts are included in all specifications but are not reported.

First, I focus on the control variables. The distance variable is never significant while the transhipment variable is at 10% or 5% with the expected positive coefficient. In all specifications the economies of scale variable is significant at 1% and negative. The trade imbalance interaction is always significant at 5% or 1% and as expected the coefficients are positive. Turning to policy variables, the dummy variables related to restrictions on ownership (either on greenfield project or existing public and private entities), the joint venture requirement and the bad regulatory framework are significant. These variables have a positive impact on MTCs. In contrast, dummy variables related to restrictions on the establishment of branches, the licence requirement and restrictions on the nationality of employees and of the

Board of Directors are not significant. However, some explanations can be provided. Concerning the restriction on branches, many developed countries prohibit the establishment of this form of commercial presence. The main objective of this measure is not protectionist, it is rather a fiscal and legal matter. It establishes practical jurisdiction over maritime incidents in territorial waters and ensures that ships do not leave port without paying their bills (Chapter 1). Then, the insignificance of the licence requirement variable can be explained by the weakness of raw regulatory information. Indeed, in some countries the licensing process is automatic and easy while in others it is expensive and burdensome. Hence, more information are needed to reflect the real degree of restrictiveness of this variable. Concerning restrictions on employees and board of Directors, they are often applied in developed countries that enjoy relatively lower MTCs. This is likely to affect the results of the regressions. Finally, the variable corresponding to repatriation of earnings is either significant or not but negative.

Weighting

Weights capture the relative importance of measures in terms of trade restrictiveness. In order to determine weights, I explore three options generally used in the literature. The first solution consists in using an equal weighting scheme. This method offers the advantage of being transparent. However, equal weights do not reflect the potential restrictiveness of each category. The second alternative is to use the factor analysis methodology and most particularly a Principal Component Analysis (PCA). The PCA is a statistical method. It determines weights according to the categories' contribution to the entire variance of the sample. The first step of a PCA is to determine the number of latent factors (also called eigenvalues) representing the most important part of the sample's variance.[2] In a second step, loadings (i.e. the principal components, also called eigenvectors) are computed. They represent the correlation between index's components and latent factors. Third, I produce weights, normalizing eigenvectors to one. This methodology had two major drawbacks. Weights depend on the sample and could not be used in a future analysis with different countries. And, PCAs assign largest weights to variables which are responsible for the largest part of the variance. In other words, weights determined through a PCA do not necessarily reflect the real degree of categories' restrictiveness.

[2] In order to determine the relevant latent factors I use two thumb rules: the Kaiser criterion (eigenvalues below one are dropped) and the variance explained criterion (latent factors must explain more than 70% of the entire variance) (OECD, 2008)

Table: Weighting through Principal Component Analysis

	Factor 1			Factor 2			Factor 3			
Explained variance		0.475			0.146			0.125		
Indicators of restrictivness	**Loadings**	**SFL [a]**	**Weights**	**Loadings**	**SFL [a]**	**Weights**	**Loadings**	**SFL [a]**	**Weights**	**Final weights**
form	0.242	0.059	0.059	-0.290	0.084	0.084	-0.659	0.434	0.434	**0.192**
greenfield	0.451	0.203	0.203	-0.026	0.001	0.001	-0.016	0.000	0.000	**0.068**
private	0.451	0.203	0.203	-0.026	0.001	0.001	-0.016	0.000	0.000	**0.068**
public	0.373	0.139	0.139	-0.151	0.023	0.023	-0.112	0.012	0.012	**0.058**
joint venture	0.434	0.189	0.189	-0.117	0.014	0.014	0.089	0.008	0.008	**0.070**
licence	0.321	0.103	0.103	0.455	0.207	0.207	0.053	0.003	0.003	**0.104**
employment	0.006	0.000	0.000	-0.596	0.355	0.355	0.552	0.304	0.304	**0.220**
board of directors	0.300	0.090	0.090	0.362	0.131	0.131	0.466	0.217	0.217	**0.146**
regulation	-0.117	0.014	0.014	0.430	0.185	0.185	-0.145	0.021	0.021	**0.073**
repatriation of earnings	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
		1.000	0.333		1.000	0.333		1.000	0.333	

Source: Author's calculation. Note: [a] Squared Factors Loadings.

The third method is based on experts' judgement, taking into account their sector's knowledge and experience. However, considering the number and the diversity of restrictions selected, it is very difficult for experts (even with dozens of years' experience) to assess the relative restrictiveness of each measures. Additionally, it is very difficult to reach a consensus among experts. Considering the feasibility and considering advantages and drawback of the various methodologies presented, I choose to use an equal weighting scheme.

Robustness Check

One drawback when using a composite index to measure trade restrictiveness is about the subjectivity of the weighting methodology. The weighting scheme is likely to affect the final outcome of the STRI. Hence, I test the sensitivity of results to choices that have been made during the weighting step. Precisely, I check whether the countries' ranking is driven by a particular weighting scheme by using the Spearman rank correlation methodology. I compute the Spearman rank correlation between two different STRIs -- the one computed using the equal weighting and the one computed through the PCA. The result of the robustness check allows to say that the rank of countries is robust to the weighting scheme.[3]

[3] The Spearman Rho is 0.907.

Annex 3: Data description

Table: Variables included in the MTC equation

Variable	Description	Dimension	Source
mtc	Ad valorem maritime transport costs. Computed as follow: [(imports valued in cif-customs value of imports)/(imports valued in cif)]. Expressed in percentage	odk	OECD (2006)
distance	Shortest maritime distance by canal, straits and caps between main container ports, expressed in miles	od	CI Online (2006) and AXS marine (2010)
transhipment	Dummy variable coded 1 if a transhipment is needed by trade partners	od	UNCTAD (2007) [a]
tv	Total seaborne imports of containerizable products, in kilogramme	od	Computed with data from New Zealand Statistics (2006) and US Census Bureau (2006)
ti_absolute	Trade imbalance of seaborne trade of containerizable products. Computed as the absolute term of the following expression [(Exports - Imports)/Max (Exports, Imports)]	od	Computed with data from New Zealand Statistics (2006) and US Census Bureau (2006)
ti_interaction	Intercation of ti_absolute and a trade imbalance dummy variable coded 1 if the seaborne trade imbalance is negative.	od	Computed with data from New Zealand Statistics (2006) and US Census Bureau (2006)
mode_3_first	Dummy variable coded 1 if the route is clasified in the first quartile	od	Own calculation with data from World Bank (2008) [b]
mode_3_second	Dummy variable coded 1 if the route is clasified in the second quartile	od	Own calculation with data from World Bank (2008) [b]
mode_3_third	Dummy variable coded 1 if the route is clasified in the third quartile	od	Own calculation with data from World Bank (2008) [b]
mode_3_forth	Dummy variable coded 1 if the route is clasified in the forth quartile	od	Own calculation with data from World Bank (2008) [b]
MFN simple average tariff [c]	-	od	World Integrated Trade Solution (2006)

Notes: [a] I would like to thank Jan Hoffmann for sharing his data. [b] World Bank Survey on Impediments to Trade Integration. Realized between 2006 and 2008. [c] The instrument for total seaborne imports.

Table: Variables included in the gravity equation

Variable	Description	Dimension	Source
Seaborne imports	-	odk	New Zealand Statistics (2006) and US Census Bureau (2006)
contiguity	Dummy variable coded 1 if trade partners share a common border.	od	Head et al. (2010)
common language	Dummy variable coded 1 if trade partners share an official language.	od	Head et al. (2010)
pta	Dummy variable coded 1 if trade partners are part of the same Preferential Trade Agreement.	od	De Sousa (2011)
simple average AHS	-	odk	World Integrated Trade Solution (2006)
predicted_mtc_advalorem	Computed through specification 4 of the section 4.	odk	Own calculation

Notes: The distance and the policy variables are described in the table above.

Annex 4: Correlation matrixes

Table: Correlation matrix -- MTC estimations

	distance	transhipment	tv	ti_absolute	ti_interaction	mode_3_second	mode_3_third
distance	1						
transhipment	0.5017	1					
tv	-0.516	-0.7305	1				
ti_absolute	0.2548	0.2472	-0.4027	1			
ti_interaction	-0.0491	-0.266	0.4692	0.071	1		
mode_3_second	-0.142	0.1085	-0.0769	-0.094	-0.0112	1	
mode_3_third	-0.2955	-0.3024	0.2132	0.0252	0.2098	-0.3002	1
mode_3_forth	0.1871	-0.063	0.1138	0.069	-0.0326	-0.3251	-0.3016

Note: Distance, trade volume and trade imbalance in absolute term variables are included log-linearized.

Table: Correlation matrix -- Gravity estimations

	mtc	distance	predicted_mtc_4	contiguity	pta	com_language	tariff	mode_3_2	mode_3_3
mtc	1								
distance	0.1835	1							
predicted_mtc_4	0.2648	0.2122	1						
contiguity	-0.0694	-0.3533	-0.0964	1					
pta	-0.0762	-0.4181	-0.1303	0.3177	1				
com_language	0.0196	0.1729	-0.0632	-0.0739	0.009	1			
tariff	0.021	0.0078	0.0093	0.0163	0.0035	-0.0144	1		
mode_3_2	-0.045	-0.1881	0.0453	0.2406	-0.0989	-0.0378	-0.0103	1	
mode_3_3	-0.0478	-0.2699	-0.1139	-0.0761	0.1345	-0.2119	-0.0161	-0.3162	1
mode_3_4	0.0133	0.2795	0.0102	-0.0742	-0.1164	-0.1786	0.0409	-0.3082	-0.3508

Note: MTC and distance variables are included log-linearized.

Chapter IV

Regulatory Barriers to Entry in the Liner Shipping Sector -- Impact on the Market Structure and Maritime Transport Costs

Abstract
This chapter aims at assessing the impact of trade and competition regulations (acting as entry barriers) on the market structure and MTCs. It is organized in two stages. The first stage aims at assessing the impact of trade and competition regulations on the market structure. The second stage aims at assessing the impact of the market structure on prices. The two-stage framework allows to address the endogeneity issue arising in the second stage. It allows also to disentangle the impact of restrictions in mode 3 on MTCs through marginal costs and the market structure.
In the first stage, I regress the number of carriers (which is taken as a proxy for the market structure) on a bilateral Service Trade Restrictiveness Index (STRI) in mode 3, on dummy variables related to the presence of price-fixing agreements on routes and on other control variables. The results suggest that the presence of conferences does not affect the number of carriers on routes. In contrast, the presence of discussion agreements has a positive impact on the number of carriers on routes. Moreover, the first stage results suggest that when they reach a critical level, barriers to trade in mode 3 limit the number of carriers on routes.
In the second stage, I regress MTCs on the number of carriers on routes and on other control variables of which my bilateral STRI in mode 3 -- because barriers to trade in mode 3 are likely to affect MTCs through the market structure and marginal costs. I address the endogeneity issue of the number of carriers by re-injecting in the MTC equation, the residual of equations estimated in the first stage. After addressing the endogeneity issue, I show that besides affecting MTCs through the market structure, barriers to trade in mode 3 also affect them through marginal costs. Finally, I show that shipping lines charge prices above the marginal cost. I conclude that shipping lines exercise a market power even though this effect is small.

JEL Codes: L92, F13, L1, L4, D4

Keywords: Market structure, Competition regulation, Trade policy, Maritime transport costs, Strategic barriers to entry

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1. Introduction

This chapter still deals with the liner shipping sector. It focuses on regulations which are likely to affect the market structure by acting as entry barriers -- i.e. barriers to trade in mode 3 and the liner shipping-specific competition regulations. Basically, barriers to trade in mode 3 are restrictions on the establishment of firms. However, the boundary between restrictions in mode 3 and restrictions on establishment and operations of firms is fuzzy. Thus, some restrictions in mode 3 are pure restrictions on establishment such as screening and approval processes. Then, some restrictions in mode 3 are restrictions on establishment which are likely to affect operations of firms. For example, producing a service through a joint venture can lead to inefficiencies and additional costs. And, some restrictions in mode 3 such as limitations on employment are restrictions on operations which affect the establishment of new firms by discouraging investments (Chapter 1).

The previous chapter focuses on barriers to trade in mode 3. Therefore, in this chapter, I centre my attention on the liner shipping competition regulations. Historically, on many maritime routes, liner shipping companies are allowed to cooperate on prices, capacities or schedules. Usually, this particular liner shipping competition regulatory regime is justified by the sector's characteristics (e.g. high fixed costs, existence of economies of scale and scope) that would lead to destructive competition and price volatility. Practically, the carriers' cooperation takes the shape of various types of agreements: conferences, discussion and operational agreements. This chapter regards price-setting agreements (i.e. conferences and discussion agreements) with a focus on conferences because they are likely to have stronger anti-competitive effects. Conferences are a particular form of cartels. Their existence is made possible since some countries exempt shipping lines from competition rules. In fact, conferences are recognized and organized by governments. In order to benefit from these exemptions, carriers must comply with some requirements (Chapter 1). The most decisive type of requirements deals with individual actions of conferences' members. In some countries the adherence to collective tariffs is mandatory for conference members -- e.g. Chile, China, Colombia, Japan. Often, this provision is combined with the compulsory filing and/or the publication of tariffs. These provisions are crucial since they contribute to the

agreements' sustainability. Nevertheless, these provisions have lost ground consequently to the adoption of pro-competitive rules. Indeed, in other countries (e.g. Canada, Singapore and the US), confidential contracts between conference members and shippers must be allowed. This encourages conference members to cheat and to deviate from the collusive equilibrium (Chapter 1). By taking into account these characteristics, I consider conferences as institutionalized cartels.

This chapter aims at assessing the impact of trade and competition regulations on the market structure and Maritime Transport Costs (MTCs). It is organized in two stages. The first stage aims at assessing the impact of trade and competition regulations on the number of carriers deploying a service on routes. The second stage aims at assessing the impact of the number of carriers on MTCs. The two-stage framework allows to address the endogeneity issue arising in the second stage -- because the number of carriers is endogenous to MTCs. Furthermore, as mentioned above, the impact of barriers to trade in mode 3 is ambiguous. Even though I showed in the previous chapter that barriers to investment affect Maritime Transport Costs (MTC), a question remains concerning the channel(s) by which they are affected. The two-stage structure allows also to disentangle the impact of restrictions in mode 3 on MTCs through marginal costs and the market structure.

According to many economists and experts, price-fixing agreements are no longer a matter. However, it is interesting to reopen the issue because there is still no consensus among economists and among the sector's stakeholders on the opportunity to implement such specific competition regulations and on the impact of price-fixing agreements. Another good reason for reopening the debate about price-fixing agreements is the existence of data which has never been used to investigate this issue. Thus, I use two types of data from the Containerization International (CI) Online database. First, the CI Online database provides extensive information on the active price-fixing agreements. It details the carriers involved in each agreement and the routes covered. Additionally, the database provides accurate data on the fleet deployed by each carrier on each bilateral route. This data allows computing carriers' market shares and some indexes of competitiveness.

This chapter is organized as follows: the first section is the introduction. In the second section, I present an overview of price-fixing agreements currently operational, I discuss the theoretical impacts of conferences on the market structure and I present the model supporting my empirical analysis. In the third section, I estimate a market structure equation. In the fourth section, I estimate a MTCs equation. The fifth section concludes and provides some policy recommendations.

2. Competition rules, carrier agreements and market structure

In this section, I focus on the liner shipping-specific competition regulations. First, I present a broad picture of price-fixing agreements calling at countries of the sample. Second, I discuss the potential impacts of conferences on the markets structure. Precisely, I explain how conference members are likely to limit competition by practicing strategic entry deterrence or predatory pricing. Third, I present the theoretical model supporting the empirical part.

In this chapter, the sample comprises 3 importers (Brazil, New Zealand and the United States) and 32 exporters for the year 2010.[1]

An overview of carriers agreements today

Since the 1990s, the influence of price-fixing agreements has decreased sharply. While as of 2001 150 conferences operated in the world, in 2010 less than 30 survived (OECD, 2002 and CI Online, 2010). This is due to the combination of two trends. First, since the end of the previous century, new carriers from emerging countries (notably from Asian countries) enter in the market (Kang and Findlay, 2000). The increasing number of shipping lines in the market made the sustainability of agreements more complicated. Second, all over the world, the liner shipping-specific competition regulations have evolved deeply. The turning point was undoubtedly the passage of the Ocean Shipping Reform Act (OSRA) by the US in 1998. The most important OSRA provision consists in making confidential individual contracts mandatory. This provision made conferences virtually obsolete (Fusillo, 2006). Furthermore, the last big event was the repeal by European countries of the block exemption for liner shipping conferences (Regulation 4056/86) in 2006. Some countries such as Australia in 2005 or Singapore in 2010 decided to maintain (with marginal adjustments) the exemption of carriers from competition rules. Finally, as a response to these changes, new types of agreements emerged such as operational agreements and global alliances. Nowadays, shipping lines prefer to enter in this type of agreements which are more operational and flexible. Importantly, operational agreements and global alliances are less controversial than price-fixing agreements since their impact on competition is likely to be marginal.

[1] For details on the sample, see Annex 1.

My sample represents 90 routes. Among these routes, a conference is active on five routes and a discussion agreement is active on 24 routes (Table 1).[2] Regarding origin countries, carrier agreements are very active in Asian countries. Thus, China, Korea and Japan are the most affected by both types of agreements. No agreement calls at European Union (EU) countries since the block exemption have been repealed in 2006. Regarding destination countries, some conferences are active on routes to New Zealand only. Conferences are not formed in Brazil anymore due to the regulatory law 10.233/2001 establishing that the liner shipping sector operates with free pricing, tariff and freight rates, and in an environment of free competition.[3] And, in the US, conferences are still exempted from competition rules. However, the passage of the OSRA leads to the disappearance of significant conferences on routes the US (Table 1). Additionally, some discussion agreements are active on routes to all countries of the sample. Contrary to conferences, discussion agreements are particularly active in the United States (Table 1).

Table 1: Active price-fixing agreements -- By route (as of July 2010)

destination	origin	Conference		Discussion	
		Number	Market share	Number	Market share
Brazil	China	0	-	1	29.84
Brazil	Hong-Kong	0	-	1	29.84
Brazil	Indonesia	0	-	1	0
Brazil	Japan	0	-	1	0
Brazil	Korea	0	-	1	18.3
Brazil	Malaysia	0	-	1	0
Brazil	Russia	0	-	1	0
Brazil	Singapore	0	-	1	0
Brazil	Thailand	0	-	1	0
New Zealand	Australia	1	8.2	1	43.6
New Zealand	Canada	0	-	1	100
New Zealand	China	1 [a]	18.78	0	-
New Zealand	Hong-Kong	1	14.76	0	-
New Zealand	Japan	1 [a]	30.58	0	-
New Zealand	Korea	1	30.58	0	-
New Zealand	United States	0	-	1	100
United States	Chile	0	-	1	100
United States	China	0	-	1	92.71
United States	Colombia	0	-	1	66.39
United States	Hong-Kong	0	-	1	92.75
United States	Indonesia	0	-	1	0
United States	India	0	-	1	82.95
United States	Japan	0	-	1	90.21
United States	Korea	0	-	1	85.69
United States	Malaysia	0	-	1	98.2
United States	Russia	0	-	1	0
United States	Singapore	0	-	1	98.79
United States	Thailand	0	-	1	80.56
		5	**20.58**	**24**	**50.41**

Source: Own calculation from CI Online database (2010). [a] Agreements for which tariff filing is required.

[2] It is important to note that conferences and discussion agreements are defined on a route. Generally, they are not symmetrical. Hence, an agreement can exist for the one way but not for the return.

[3] Source: E-mail communication with the Agência Nacional de Transportes Aquaviários -- ANTAQ, 2010.

However, even though carriers agreements survive on few routes, on these routes they keep substantial market shares. Thus, the market share of conferences can reach 30% on routes from Japan and Korea to New Zealand (Table 1). Concerning discussion agreements, their market shares are even higher since, in general, they are agreements between conference and non-conference members. These figures justify investigating whether carrier agreements affect liner shipping markets structure.[4]

Theoretical impact of price-fixing agreements on the market structure

Price-fixing agreements are likely to affect the market structure of maritime routes by acting as entry barriers since their members can be tempted to take advantage of their market power to deter entry of new carriers.

In the literature, limit pricing, excess capacity and predatory pricing are the three main strategic entry barriers theories. They have been developed in order to give theoretical foundations to a firm behaviour that has often be suspected but scarcely proved empirically by academics as well as by competition authorities. In limit pricing and excess capacity models, incumbents increase their production to decrease prices under the potential rivals' average costs and make entry of new firms unprofitable. In general, in such models, the price is sufficiently high to allow incumbents to make profit but sufficiently low in order to deter new entry (Fusillo, 2003). The predatory pricing strategy is a little bit different. First, it aims at deterring the entry of new firms or at getting out firms already entered. Second, in predatory pricing models, the strategy is more aggressive since prices are set at a lower level (Ordover, 2008). In both cases, strategic entry barriers lead to lower competition, higher prices for consumers (at least in the long run), and welfare losses for the society as a whole. In the literature, strategic entry barriers theories and models have been controversial for a long time -- notably because such behaviours are not consistent in a perfect competition environment (Fusillo, 2003 and Scott Morton, 1997). However, for thirty years convincing models have been developed within imperfect competition and game theory frameworks. These models are based on information asymmetries and the importance for incumbents to be credible.[5]

[4] Importantly, in this chapter each bilateral maritime route is assumed to be a different market.

[5] Concerning limit pricing models, see Spence (1977), Dixit (1979), Kreps and Wilson (1982) and Milgrom and Roberts (1982a). Concerning predatory pricing, see the long purse models (Telser, 1966 ; Benoit, 1984 ; Fudenberg and Tirole, 1986 ; and Bolton and Scharfstein, 1990), the reputation models (Milgrom and Roberts, 1982b and Kreps and Wilson, 1982) and the signalling predation models (Saloner, 1987).

Interestingly, a part of the literature dealing with strategic entry deterrence focuses on the possibility for cartel members to adopt such strategies. Thus, a model developed by Harrington (1984) supports this idea. The author developed a two-period non-cooperative game with information asymmetries and homogenous firms. The information asymmetry comes from the fact that the potential entrant is not aware whether incumbents cooperate or not in a cartel. According to the Harrington's model, in such setting, entry deterrence is rational and successful. For Levenstein and Suslow (2008) the most successful cartels actively work to create entry barriers. More interestingly, a part of this literature focuses on the liner shipping sector. First, because of its characteristics (high fixed costs, existence of economies of scale and scope) the liner shipping sector is a concentrated market. This is the first condition under which entry deterrence is rational. Then, Scott Morton (1997) studied predatory pricing strategy of British shipping cartels between 1879 and 1929. After explaining why the liner shipping sector is particularly prone to predatory practice, Scott Morton constructed a model of collective predation where cartel members successfully deter entry. Its empirical results show the entrant firms' characteristics that are determinants of the launching of a price war or not. Relying on the fact that the liner shipping market is subject to excess capacity, Fusillo (2003) aims at disentangling excess capacity as a strategic behaviour or as the result of industry-specific supply and demand conditions. Fusillo constructs a limit pricing model where incumbents maximize their long-run rather than their short-term profits. Fusillo tests if excess capacity among conference members is not in fact a limit pricing in disguise. Fusillo's results suggest that entry deterrence strategies are an element of excess capacity observed in the sector -- even though it is of secondary importance with respect to structural sector's characteristics.

Interestingly, the Chicago school economists assert that it is even more difficult to practice entry deterrence in a cartel environment (Scott Morton, 1997). However, conferences are not common cartels. Since they are organized and recognized by governments, conferences have to be considered as institutionalized cartel. Additionally, on some maritime routes, cartelization is favoured by the regulation that makes tariffs filing compulsory (Chapter 1). Indeed, in presence of mandatory tariffs filing, carriers are discouraged from cheating and deviating from the collusive equilibrium because immediately noticed by partners. This improves the sustainability of cartels. As an illustration, in 40% of conferences of my sample, members are required to fill their tariffs (Table 1). Therefore, considering the

nature of collusion in conferences and considering rules applied in some countries, the liner shipping sector is prone to entry deterrence strategies.

As a conclusion, the nature of the service, the structure of agreements, and the contracts the conferences entered into, create an environment favourable to successful predation and/or entry deterrence.

The model[6]

As a theoretical basis, I use a common Cournot's model of oligopoly with homogenous providers and services. Liner shipping is a typical oligopoly market. First, few firms provide transport services on routes. For instance, in my sample, the average number of carriers on routes is five, the standard deviation is 5.6 and the maximum number of carriers is twenty. Additionally, the liner shipping sector is considered as a commodity market (Fusillo, 2006). Indeed, liner shipping services can be differentiated in two ways, through the speed of the journey and the nature of the container (refrigerated or not). However, on routes the speed and frequency of services are relatively homogenous. For example, among the sample, the average standard deviation of the services' rotation is eleven days, with a minimum of zero and a maximum of 27. Furthermore, in containerships the share of slots dedicated to refrigerated containers is comparable. Then, shipping lines face to substantial entry fixed costs. Indeed, in order to open new services, lines have to invest in several costly vessels to ensure the reliability of services.[7]

Finally, since most of the world fleet is made up of vessels flagged in open registry countries (55% of the world fleet capacity is flagged in the ten major open and international registries -- UNCTAD, 2010), the condition of carriers in terms of employment costs or taxation is very close. Therefore, the production function of the various carriers is likely to be similar. In other words, firms are likely to be homogenous.

[6] For details on the model derivation, see Annex 2.
[7] In March 2010, the cost of a containership (gearless) of 6500 TEU capacity was around 74 millions of Dollars (UNCTAD, 2010).

Box 1: Entry and operational fixed and sunk costs in the liner shipping sector

In the liner shipping sector fixed costs can be split into two categories: entry and operational fixed costs. On the one hand, entry fixed costs are undertaken at the moment of the opening of a new service -- e.g. investment in capacity. On the other hand, because liner shipping services are regular, a part of operational costs (such as crew and fuel costs) do not vary according to the number of customers or the loading capacity rate of vessels, in this respect they are operational fixed costs.

Then, concerning sunk costs there is no consensus among economists. Ones argue that it is easy for carriers to reallocate vessels on new routes and the second-hand market is fluent. In other words, since the capital is very mobile in the liner shipping sector, investments in new vessels cannot be considered as sunk costs. However, others argue that some marketing costs (e.g. advertising investments to create a goodwill, investments in an office network to recruit freight) and some infrastructure costs (e.g. the construction of dedicated terminal, the establishment of partnerships with port operators) are substantial and sunk (Sjostrom, 2004 and Fusillo, 2006).

Following a Cournot type model, I assume that the action of one provider affects the behaviour of others. Hence, equilibrium quantity and price are computed by maximizing profit through reaction functions.[8] Then, I assume that firms face fixed costs to enter the market. The number of firms servicing the market is determined endogenously by applying a zero cut-off profit condition. With this configuration I obtain the following equations[9]:

$$n_{od} = \frac{\alpha + c_{od}}{\sqrt{FC_{od}}} - 1 \qquad [1.1]$$

$$mtc_{odk} = \frac{\alpha + n_{od} c_{odk}}{1 + n_{od}} \qquad [1.2]$$

[8] As in Chapter 3, I use the term MTCs for prices.
[9] The model derivation is detailed in Annex 2.

Where,

- o is the origin country (exporter);
- d is the destination country (importer);
- n is the number of companies deploying a service between the origin and the destination country;
- c is the marginal cost;
- FC is the fixed costs;
- mtc is the MTC.

Considering equation [1.1], the number of shipping lines in markets increases with marginal costs and decreases with fixed costs. Considering the discussion in the second part of this section, I assume that the presence of a price-fixing agreement on a route acts as an entry barrier. In other words, the presence of a price-fixing agreement is assumed to affect the market structure (here the number of carriers) through a fixed cost. Considering equation [1.2], MTCs increase with marginal costs and decrease with the number of shipping lines.

In the next sections, I estimate a two-step empirical model inspired by the theoretical model described in this section (equations [1.1] and [1.2]). First, I estimate a market structure equation (i.e. an *n* equation) by including policy variables which are likely to act as entry barriers -- i.e. a set of STRI in mode 3 and a set of variables related to the presence of price-fixing agreements on routes -- i.e. an *mtc* equation). Then, I estimate a MTCs equation including the number of carriers (*n*) as an explicative variable.

3. The market structure equation

This section aims at assessing the impact of regulatory entry barriers (i.e. the presence of carrier agreements on routes and restrictions in mode 3) on the liner shipping market structure. I regress the number of carriers (which is taken as a proxy variable for the market structure) on policy and on other control variables.

Empirical specification and data[10]

I estimate equation [2.1] inspired by equation [1.1] of my theoretical model. Each bilateral route is assumed to be a different market and the number of carriers operating vessels is taken as a proxy for the market structure of routes.

$$n_{od} = \beta_1 distance_{od} + \beta_2 tv_{od} + \beta_3 ti\_absolute_{od} + \beta_4 ti\_interaction_{od} + \beta_5 mode\_3_{od} + \beta_6 conference_{od} + \beta_7 discussion_{od} + \beta_8 conference\_filing_{od} + \varpi_o + \delta_d + \varepsilon_{od} \qquad [2.1]$$

Where,

The dependant variable (n_{od}) corresponds to the number of carriers deploying vessels on the route between the origin and the destination country.

The first term ($distance_{od}$) is a fixed cost. It is the maritime distance between the two main container ports of trading partners. It corresponds to the shortest way by capes, straits or canals expressed in nautical miles. For this variable I expect a negative coefficient.

The second term (tv_{od}) influences the marginal cost. It is the total bilateral seaborne import volume of containerized products.[11] This variable is included to take into account economies of scale but it is rather a variable for the size of the market. For this variable I expect a positive coefficient.

The third and fourth terms ($ti\_absolute_{od}$ and $ti\_interaction_{od}$) influence the marginal cost. They are trade imbalance variables. Two variables are included because both the direction and the "magnitude" of the trade imbalance are likely to have an impact on marginal costs and therefore on the market structure. The variable ($ti\_absolute_{od}$) is the magnitude variable, it is calculated as a trade imbalance in absolute terms.[12] The variable ($ti\_interaction_{od}$) is an interaction between the magnitude variable in absolute terms and a directional imbalance dummy variable -- it takes the value 1 if the trade imbalance of

[10] For more details about data sources see Annex 3.
[11] Following the OECD Maritime Transport Costs Database (2006), I assume that containerizable cargo corresponds to all lines except 10, 12, 15, 25-29, 31, 72, and 99 in the Harmonized System (HS).
[12] Most precisely, it is the absolute term of the following expression [(Exports - Imports)/Max (Exports, Imports)]

containerized products of the origin country in volume is negative, and 0 otherwise. A negative coefficient is expected for the interaction variable. Concerning the absolute terms variable, I expect either a positive or a negative sign, as it depends on the direction of the trade imbalance (Marquez-Ramos *et al.*, 2006).

The fifth term ($mode\_3_{od}$) is a fixed cost. It is a set of dummy variables that measures restrictions to trade in liner shipping in mode 3 on routes. The set is constructed by splitting the distribution of a bilateral STRI into quartiles.[13] By doing this, I define four dummy variables associated to four types of routes, from the least restrictive to the most restrictive (corresponding to the first and to the fourth quartile dummy variables, respectively -- $mode\_3\_1_{od}$ and $mode\_3\_4_{od}$). In this section, restrictions in mode 3 are fixed costs since they are assumed to limit the entry of new carriers in markets. Hence, for these variables a negative coefficient is expected.

The sixth, seventh and eighth terms are dummy variables related to price-fixing agreements. They are fixed costs. The sixth term ($conference_{od}$) is coded 1 if a conference is present on the route between o and d and zero otherwise. For this variable I expect a negative sign. The seventh term ($discussion_{od}$) is coded 1 if a discussion agreement is present on the route between o and d and zero otherwise. For this variable I expect a negative sign. And, the eighth term ($conference\_filing_{od}$) is a set of two dummy variables. The first variable ($conference\_filing\_1_{od}$) is coded 1 if a conference is present on a route without mandatory tariffs filing and zero otherwise while the second variable ($conference\_filing\_2_{od}$) is coded 1 when a conference is present on a route where tariffs filing is required -- and zero otherwise. For *conference_filing_1* I expect a negative sign and for *conference_filing_2* I expect a negative sign with a lower value than for *conference_filing_1*.

At a first sight, these price-fixing dummy variables may be considered as endogenous. Indeed, consistently with the economics of collusion, the less there are providers in a market, the easier a cartel will be formed and the easier this cartel is sustainable. However, considering the particular competition policy existing in the sector, the rationales underlying the formation and the maintaining of conferences is totally different. Thus, conferences form on routes where they are allowed -- or at least tolerated. Furthermore, as mentioned in the

[13] For various reasons, I did not have access to the regulatory information used in the previous Chapter. Hence, the STRI constructed for this Chapter is less sophisticated. For details on the construction of the index see Annex 4.

previous section, conferences are considered as institutionalized cartels -- i.e. in some routes freight rates have to be filed and on other routes when individual actions are authorized, they have to be communicated to other members. All these characteristics limit the endogeneity of the set of agreement variables.

The ninth and tenth terms (ω_o and δ_d) are country (origin and destination) fixed effects. They are included in order to take into account country-specific characteristics.

And where, ε_{od} is the error term.

Results of estimations

The sample includes 3 importers (destination countries) and 32 exporters (origin countries).[14] It represents 90 observations.[15] I run cross-section estimations of the reduced form of the model given by the equation [2.1] for the year 2009. Variables *distance*, *tv,* and *ti_absolute* are included in logarithms. Considering the nature of the dependant variable which is a count-variable (i.e. an integer), I run Generalized Linear Model (GLM) regressions for Poisson (Cameron and Trivedi, 2010). The error term is assumed to be independently distributed across countries. The regressions results are presented in Table 2. In the first specification only control variables are included. Variables of interest are included in specifications 2 to 6.

Regarding control variables, *distance* and *tv* are always significant at the 1% level. As expected, distance is negative and trade volume is positive. In contrast, the trade imbalance variables are not significant. This can be explained by the difficulty in designing these variables. Indeed, regional trade imbalance would be more appropriate than bilateral trade imbalance.

[14] For details on the sample, see Annex 1.
[15] The sample comprises only 90 routes since data is not available for the routes between Brazil and Nigeria, Brazil and Senegal, and New Zealand and Algeria.

Table 2: Estimation results -- The market structure equation

	1	2	3	4	5	6
	GLM Poisson	GLM Poisson	GLM Poisson	GLM Poisson	GLM Poisson	GLM Poisson
distance	-0.854***	-0.861***	-0.845***	-0.929***	-0.896***	-0.821***
	(0.207)	(0.190)	(0.202)	(0.178)	(0.190)	(0.206)
tv	0.298***	0.322***	0.323***	0.309***	0.308***	0.321***
	(0.108)	(0.103)	(0.103)	(0.105)	(0.105)	(0.102)
ti_interaction	0.346	0.227	0.221	0.297	0.293	0.191
	(0.450)	(0.403)	(0.409)	(0.387)	(0.391)	(0.407)
ti_absolute	0.0415	0.0831	0.0835	0.184	0.186	0.0915
	(0.121)	(0.134)	(0.134)	(0.147)	(0.147)	(0.140)
mode_3_2		-0.409	-0.400	-0.413	-0.393	-0.350
		(0.414)	(0.421)	(0.374)	(0.382)	(0.434)
mode_3_3		-0.756**	-0.754**	-0.709**	-0.703**	-0.721**
		(0.324)	(0.327)	(0.300)	(0.303)	(0.327)
mode_3_4		-1.731**	-1.729**	-1.642**	-1.632**	-1.671**
		(0.757)	(0.762)	(0.698)	(0.707)	(0.771)
conference			0.0595		0.130	
			(0.264)		(0.244)	
discussion				0.510***	0.518***	
				(0.146)	(0.152)	
conference_filing_1						0.174
						(0.293)
conference_filing_2						-0.100
						(0.339)
Constant	3.657	3.196	3.062	4.101	3.833	2.887
	(3.014)	(2.669)	(2.835)	(2.573)	(2.691)	(2.865)
Observations	90	90	90	90	90	90

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is **. Distance, total seaborne imports and absolute trade imbalance are in logarithms. Cross section for year 2009. Model 1 to 6 are estimated by (GLM) regressions for Poisson. Coefficients correspond to the of the raw GLM Poisson results. I use iterated, re-weighted least-squares optimization of the deviance. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Origin and destination fixed-effects are included in all regressions. Intercepts are included in all specifications but not reported. The correlation matrix is available in Annex 5.

With regards to barriers to trade in mode 3 (*mode_3*), since I do not include the first quartile dummy variable (which corresponds to the less restrictive routes), it is the benchmark. Interestingly, coefficients increase monotonically across quartiles. Moreover, coefficients are significant for the third and fourth quartiles at the 5% level, while they are not significant for the second quartile. These results suggest that barriers to trade in mode 3 affect the structure of liner shipping markets. The more restrictive routes are, the less there are carriers on these routes. Furthermore, the results suggest a threshold effect; restrictions in mode 3 do not affect entry until they reach a critical level -- which is set between the second and the third quartile. Precisely, the number of carriers of routes classified in the second quartile is not affected with respect to the routes classified in the first quartile. Then, the average number of carriers deployed on routes classified in the third quartile is around 50% lesser than on routes classified in the first quartile. And, the average number of carriers deployed on routes classified in the fourth quartile is around 80% lesser than on routes

classified in the first quartile. Concerning dummy variables associated with price-fixing agreements, the conference variables are never significant while the discussion variables are. Indeed, considering specifications 3, 5 and 6, the presence of a conference does not affect the number of carriers on routes. These results suggest that conference members are not able to deter entry. This is true even though the regulation is likely to improve the cartels' stability and sustainability -- i.e. tariffs filing is required (Specification 6). Various explanations can be provided. First, considering their low market shares, conferences are not powerful enough to threaten credibly new entrants and non-conference members with entry deterrence and/or predatory pricing strategies (Table 1). Second, the inability of conference members to limit entry can be due to the contestable nature of the liner shipping market (Davies, 1986). This explanation would lead to reconsider the assumptions on the existence of sunk costs in the sector (Box 1). Finally, the particular current economical context can also be an explanation. Indeed, in 2009, consequently to the financial crisis and the world trade fall, the world liner shipping fleet suffers from over-capacities. And, such situation makes difficult the practice of entry deterrence strategies. In contrast, the discussion agreement dummy variables are significant at the 1% level and positive -- specifications 4 and 5. Therefore, the presence of a discussion agreement affects positively the number of carriers on routes. Precisely, the average number of carriers increases by two-third when a discussion agreement is active on a route. Considering this result and considering the high market share of discussion agreements, it is possible to assume that discussion agreement members have a cooperative behavior vis-à-vis new entrants. Since new entrants are aware of the insiders' behavior (i.e. that they will be invited to join the discussion agreement), they are encouraged to enter the market which is less risky.

4. The Maritime Transport Costs (MTCs) equation

This section aims at assessing the impact of the number of providers on MTCs. Since some variables affect both the number of providers and MTCs, an endogeneity issue arises. I address this issue by following a two-step approach. I re-inject in the MTC equation (equation [2.2]) the residuals of the competition equations (equation [2.1]) estimated in the previous section.

Empirical specification

Again, each bilateral route is assumed to be a different market. I estimate equation [2.2] inspired by equation [1.2] of my theoretical model.

$$mtc_{odk} = \beta_1 distance_{od} + \beta_2 transhipment_{od} + \beta_3 tv_{od} + \beta_4 ti\_absolute_{od} + \beta_5 ti\_interaction_{od} + \beta_6 n_{od} + \beta_7 mode\_3_{od} + \varpi_o + \delta_d + \kappa_k + \varepsilon_{odk} \quad [2.2]$$

The dependant variable (mtc_{odk}) is the MTC paid by the service's consumers. It represents the transport cost from the point of shipment (i.e. the moment when the good is loaded by a carrier) to the point of entry into the importing country. It includes the price of the transport, insurance costs and cargo handling but not customs charges. It is a unitary cost expressed in dollar per tonne.

The variables $distance_{od}$, tv_{od}, $ti\_absolute_{od}$ and $ti\_interaction_{od}$ are similar to the previous section. The second term ($transhipment_{od}$) is a dummy variable that takes the value of 1 if a direct maritime service is not available on the route between trading partners, and 0 otherwise. For this variable I expect a positive coefficient. The sixth term (n_{od}) is the number of carriers deploying a service between the origin and the destination country. For this variable, I use either the raw data (similar to the one used in the previous section and noted *n*) either the residuals from the competition equations (equation [2.1]) estimated in the previous section. The seventh term ($mode\_3_{od}$) is similar to the previous section. However, in this equation the variable is assumed to affect marginal costs and not the market structure. For these variables I expect a negative coefficient.

The eighth, ninth and tenth terms (ω_o, δ_d *and* κ_k) are origin, destination and commodity fixed effects, respectively. And where, ε_{odk} is the error term.

Finally, the number of carriers deploying a service on routes is endogenous to MTCs. It is endogenous because according to my two-step empirical model (equations [2.1] and [2.2]) all variables determining MTCs also affect the number of carriers on routes. Considering this particular form of endogeneity, it is difficult to find an instrument for *n* that satisfies the exclusion conditions. Indeed, since all variables determining MTCs also affect

the number of carriers on routes, variables potentially correlated with the endogenous variable (i.e. *n*) are likely to also influence the dependant variable directly (i.e. *mtc*) and not only through the endogenous variable. Thus, it is difficult to follow a common Two-Stage Least Squares (2SLS) approach. To address this particular form of endogeneity, I follow a two-stage non-conventional approach. It consists in re-injecting in the MTCs equation (equation [2.2]), residuals coming from a previous estimation of the endogenous variables (Frankel and Romer, 1999 and Terza *et al.*, 2008). Precisely, in the first stage, I regress the endogenous variable (i.e. *n*) on variables which are common to the MTC equation (i.e. which are responsible for the endogeneity issue) such as *distance*, *tv*, ti_*absolute* and *ti_interaction*. This first stage corresponds to the previous section of this chapter. Then, in the second stage, I re-inject residuals of the first step in the MTCs equations. These residuals are likely to be drained of their endogenous components -- because neutralized in the first stage. The residuals are noted from *residual_n_3* to *residual_n_6*.[16] In non-linear models such as Poisson, raw residuals are likely to be heteroskedastic. Therefore, I include deviance residuals (Cameron and Trivedi, 2010).

Results of estimations

The sample is similar to the one used in the previous section augmented with the product dimension disaggregated at 6-digits, it represents 87,873 observations. The sample accounts for 47%, 65% and 55.5% of total seaborne imports of Brazil, New Zealand and the US, respectively. I run Ordinary Least Squared (OLS) cross-section estimations of the reduced form of the model given by the equation [2.2] for the year 2009. Variables *distance*, *tv,* and *ti_absolute* are included in logarithms. The error term is assumed to be independently distributed across countries and products. The results of regressions are presented in Table 3. Specifications 1 and 2 are common OLS regressions while specifications 3 to 6 include the residuals of the endogenous variable -- i.e. the equation [2.1].

Concerning specifications 1 and 2, one important comment can be done. When the set of STRI is not included, the variable *n* is significant at the 1% level. And, when the set of STRI is included the number of carriers becomes insignificant. Therefore, the set of STRI is

[16] The variable *residual_n_3* corresponds to the residuals of specification 3 of the equation *n* estimated in the previous section, the variable, *residual_n_4* corresponds to the residuals of specification 4, etc…

likely to absorb all the impact of the number of carriers on MTCs. This result tends to confirm that barriers to trade in mode 3 affect the market structure.

Table 3: Estimation results -- The MTCs equation

	1 OLS	2 OLS	3 OLS	4 OLS	5 OLS	6 OLS
distance	0.287***	0.327***	0.346***	0.357***	0.357***	0.348***
	(0.0368)	(0.0343)	(0.0369)	(0.0330)	(0.0329)	(0.0365)
transhipment	0.0249	-0.0323	-0.0876*	-0.178***	-0.170***	-0.106**
	(0.0460)	(0.0311)	(0.0512)	(0.0513)	(0.0507)	(0.0498)
tv	-0.0169	-0.0310*	-0.0394**	-0.0484***	-0.0472***	-0.0409**
	(0.0269)	(0.0185)	(0.0175)	(0.0159)	(0.0160)	(0.0171)
ti_absolute	-0.00723	-0.0136*	-0.0160**	-0.0243***	-0.0236***	-0.0173**
	(0.00974)	(0.00788)	(0.00780)	(0.00744)	(0.00734)	(0.00777)
ti_interaction	0.0299	0.0191	0.000398	0.00101	8.11e-05	-0.000532
	(0.113)	(0.0849)	(0.0866)	(0.0818)	(0.0820)	(0.0857)
mode_3_2		0.219**	0.192**	0.132	0.134	0.179*
		(0.0922)	(0.0936)	(0.0906)	(0.0908)	(0.0910)
mode_3_3		0.229***	0.229***	0.201***	0.201***	0.223***
		(0.0842)	(0.0741)	(0.0645)	(0.0651)	(0.0704)
mode_3_4		0.718***	0.710***	0.644***	0.644***	0.697***
		(0.167)	(0.152)	(0.137)	(0.138)	(0.146)
n	-0.0103*	-0.00329				
	(0.00567)	(0.00417)				
residual_n_3			-0.0203			
			(0.0157)			
residual_n_4				-0.0556***		
				(0.0170)		
residual_n_5					-0.0536***	
					(0.0169)	
residual_n_6						-0.0270*
						(0.0157)
Observations	87,873	87,873	87,873	87,873	87,873	87,873
R-squared	0.290	0.292	0.292	0.292	0.292	0.292

Source: Author's calculation. Notes: * Significant at the 10 % level. ** Significant at the 5 % level. *** Significant at the 1 % level. The dependant variable is a unitary transport cost expressed in dollar per tonne. Distance, total seaborne imports and absolute trade imbalance are in logarithms. Ordinary Least Squares (OLS) cross section for year 2009. T-statistics are given in parentheses. Estimations use White heteroskedasticity-consistent standard errors and standard errors are adjusted for clusters in country-pairs. Origin, destination and commodity fixed-effects are included in all regressions. Intercepts are included in all specifications but not reported. The correlation matrix is available in Annex 5.

Then, I focus on specifications 3 to 6. Distance is always significant at the 1% level and it has a positive impact on MTCs. Trade volume is always significant (either at the 10%, 5% or 1% level) and it has a negative impact on MTCs. The trade imbalance interaction variable is still not significant for the reasons explained in the previous section. The transhipment variable is significant (either at the 10%, 5% or 1% level) but with an unexpected negative sign. Various assumptions can be done to explain this result. First, a liner shipping services comprising a transhipment are likely to be slower and therefore of lesser quality service in comparison to direct services. This could explain the negative impact of

transhipment on MTCs. Second, liner shipping services comprising a transhipment are likely to be provided more efficiently than "dash of milk" services where vessels call at a many ports during the journey. In other words, in the hub and spoke system, over-costs due to transhipments (e.g. cargo handling, immobilization of vessels) are likely to be offset by economies of scope allowed by the use of biggest vessels.

Concerning policy variables, they are significant either at the 10%, 5% or 1% level and when they are not significant they are very close of being. Their coefficients are still positive and increase monotonically across quartiles. These results suggest that even though the impact of restrictions to trade in mode 3 on the market structure has been controlled, these restrictions continue to affect MTCs. Therefore, barriers to trade in mode 3 affect MTCs through the market structure and marginal costs. Finally, in most specifications the residuals of *n* are significant -- and in specification 3, it is very close to be significant at the 10% level. Furthermore, the coefficients associated the variable *n* is negative. From a theoretical point of view this suggests that shipping lines are able to charge prices above the marginal cost and earn a mark-up. In other words, they exercise a market power, even though the effect is small.

Robustness check

In order to check the robustness of results obtained above, I re-estimate the MTC equation by using different policy variables and various samples. First, I test the robustness of policy variables. Precisely, I test whether the division of my STRI into quartile influences the results obtained by including the index split into terciles instead of quartiles. For these estimations, the level of significance of variables and the r-squared value remain stable. The two STRI variables are significant at the 1% level and still increase monotonically. The size of coefficients remains consistent with the previous results. Second, as in the previous chapter, I check the competition between liner shipping and surface modes of transport. Since trading partners sharing a border are likely to transport their international trade by road, I drop observations that involve trade between direct neighbours -- i.e. the observation for Colombia and Brazil, Mexico and Canada and the US. The amount of variables falls to 86,093. Interestingly, all policy variables become significant, the r-squared increases slightly and other results stay stable. Third, observations for which the weight of trade reported is low are likely to suffer from a data reporting issue (Baldwin and Harrigan, 2007). Therefore, I drop all

observations for which the weight of trade reported is less than one metric tonne. The amount of observations decreases to 71,622. Here, the significance and the size of coefficients are very stable. For these regressions the pseudo-r-squared increases to 0.31.

5. Conclusion and recommendations

Under pressure of new carriers from emerging countries and the evolution of some countries' regulation, the influence of price-fixing agreements has declined sharply during the last decades. First, the number of conferences decreased from 150 in 2001 to less than 30 in 2010. Additionally, the market share of conferences which are still active is substantial but not dominating. Among other things, the decline of conferences is due to adoption of pro-competitive regulations that made obsolete the establishment of conferences on some routes. For instance, by allowing confidential contracts between conference members and shippers the OSRA accelerated the disappearance of conferences on US maritime routes. In contrast, discussion agreements are in greater numbers and more powerful in terms of market share.

In spite of a regulatory environment that is likely to favour entry deterrence and/or predatory pricing practices by agreements members, the results obtained suggest that the presence of a conference on a route does not affect the number of carriers deploying a service. Three explanations can be provided. First, it can be due to the decline of the conferences' power (in terms of market share notably) and influence in markets. Second, it can be explained by the characteristics of the liner shipping market. In absence of sunk costs, the market would be contestable. In such conditions entry deterrence and/or predatory pricing practices are doomed to failure. Third, it can be explained by the current over-capacities existing in the sector and resulting for the drop of world trade consecutive to the 2008 crisis. Then, in contrast, the results suggest that the presence of a discussion agreement on a route increases the number of carriers. This can be explained by assuming a cooperative behaviour of agreement's members vis-à-vis new entrants. This assumption is plausible since discussion agreements represent hegemonic market shares on routes where they operate. This would mean that discussion agreements are likely to decrease the risk for carriers to invest in markets where they are active.

Turning to trade regulations, even though barriers to trade in mode 3 are theoretically restrictions on the establishment of firms, the boundary between restrictions in mode 3 and restrictions on establishment (affecting the market structure) and operations (affecting

marginal costs) of firms is fuzzy. Interestingly, the two-stage framework used in this chapter allows to disentangle the competition and marginal cost effect of barriers to trade in mode 3 on MTCs. The results suggest that barriers to trade in mode 3 affect the number of carriers, therefore, that they act as entry barriers. And, after controlling for the indirect impact of barriers to trade on MTCs (i.e. through the number of carriers), my results suggest that barriers to trade still affect MTCs. In other words, I show that barriers to trade in mode 3 affect MTCs through markets structure and through marginal costs. Finally, based on a Cournot model of oligopoly, I show that the number of carriers affects MTCs. It means that carriers charge prices above marginal costs and therefore, exercise a market power -- even though this effect is small.

Importantly, these results strengthen the policy recommendations provided in the previous chapter. First, since barriers to trade in mode 3 affect MTCs through both channels (i.e. marginal costs and the market structure), they have to become a key issue for policy-makers and at the GATS. Second, the comparison of the impact of barriers to trade in mode 3 and price-fixing agreement calls for more balance. Indeed, policy-makers but also economists have to shift their attention from competition policies (which are overrepresented in debates and in the literature) to barriers to investment. However, even though the impact of conferences is likely to be insignificant, the counter-intuitive impact of discussion agreements on markets structure has to be investigated.

Finally, this chapter deals with the impact of trade and competition policies on MTCs through the market structure with a focus on price-fixing agreements. Thus, inevitably, some issues are left aside. Considering the data available, I could not deal with operational agreements. Considering the data available and the form of my model, I could not investigate the impact of price-fixing agreements on price stability, services quality or reliability.

6. References

APEC. Various years. "Transport Services: Maritime." Electronic Individual Action Plans. http://www.apec-iap.org/

ALADI Statistics Division. 2009. Seaborne Trade Flows Statistics. http://www.aladi.org/ (received May 12, 2011).

AXS Marine. 2010. "AXS Marine Distance Table." AXS Marine website. http://www.axsmarine.com/distance/ (accessed September 2010).

Baldwin, Richard, and James Harrigan. 2007. "Zeros, Quality and Space: Trade Theory and Trade Evidence." National Bureau of Economic Research Working Paper 13214.

Benoit, Jean Pierre. 1984. "Financially Constrained Entry in a Game with Incomplete Information." *RAND Journal of Economics*, 15(4): 490-499.

Bertho, Fabien. "Maritime Transport in Australia," in *The Impacts and Benefits of Structural Reforms in the Transport, Energy and Telecommunications Sectors in APEC Economies*, APEC Policy Support Unit Report, Singapore: Asia-Pacific Economic Cooperation Secretariat, 2011, 290-312.

Bolton, Patrick, and David S. Scharfstein. 1990. "A Theory of Predation Based on Agency Problems in Financial Contracting." *American Economic Review*, 80(1): 93-106.

Cameron, Colin A., and Pravin K. Trivedi. 2010. *Microeconomics Using Stata*., College Station: Stata Press.

Containerization International Online. 2010. "Fleet Deployment Statistics." http://www.ci-online.co.uk/

Davies, John E. 1986. "Competition, Contestability and the Liner Shipping Industry." *Journal of Transport Economics and Policy*, 20(3): 299-312.

Dixit Avinash. 1979. "A Model of Duopoly Suggesting a Theory of Entry Barriers." *Bell Journal of Economics*, 10(1): 22-32.

Francois, Joseph, and Ian Wootton. 2000. "Trade in International Transport Services.", Tinbergen Institute Discussion Paper 057/2.

Frankel, Jeffrey A., and Davis Romer. 1999. "Does Trade Cause Growth?", The American Economic Review, 89(3): 379-399.

Fudenberg, Drew, and Jean Tirole. 1986. "A 'Signal-jamming' Theory of Predation." *RAND Journal of Economics*, 17(3): 366-376.

Fusillo, Mike. 2003. "Excess Capacity and Entry Deterrence: The Case of Ocean Liner Shipping Markets." *Maritime Economics and Logistics*, 5(2): 100-115.

Fusillo, Mike. 2006. "Some Notes on Structure and Stability in Liner Shipping." *Maritime Policy & Management*, 33(5): 463-465.

Harrington, Joseph E. 1984. "Noncooperative Behavior by a Cartel as an Entry-Deterring Signal." *RAND Journal of Economics*, 15(3): 426-433.

Kang, Jong-Soon, and Christopher C. Findlay, "Regulatory Reform in the Maritime Industry," in Christopher Findlay and Tony Warren, eds, *Impediments to Trade in Services: Measurement and Policy Implications*, London: Routledge, 2000, pp. 162-188.

Kreps, David M., and Robert Wilson. 1982. "Reputation and Imperfect Information." *Journal of Economic Theory*, 27(2): 253-79.

Levenstein, Margaret C., and Valerie Y. Suslow. "Cartels," in Steven N. Durlauf and Lawrence E. Blume, eds, *The New Palgrave Dictionary of Economics*. Hampshire: Palgrave Macmillan, 2008.

Márquez-Ramos, Laura, Inmaculada Martínez-Zarzoso, Eva Pérez-García, and Gordon Wilmsmeier. 2006. "Determinants of Maritime Transport Costs: Importance of Connectivity Measures."
http://www.univ-lehavre.fr/actu/itlcsge/ramos.pdf

Milgrom, Paul, and John Roberts. 1982a. "Limit Pricing and Entry Under Incomplete Information: an Equilibrium Analysis." *Econometrica*, 50(2): 443-459.

Milgrom, Paul, and John Roberts. 1982b. "Predation, Reputation and Entry Deterrence." *Journal of Economic Theory*, 27(2): 280-312.

New Zealand Statistics. 2006. "Overseas Trade Imports and Exports Statistics: HS6 Chapter by Country of Origin and Destination by Sea Freight." New Zealand Statistics.
http://www.stats.govt.nz/ (received September 20, 2010).

OECD. 2002. Competition Policy in Liner Shipping

Ordover, Janusz A., "Predatory Pricing," in Steven N. Durlauf and Lawrence E. Blume, eds, *The New Palgrave Dictionary of Economics*. Hampshire: Palgrave Macmillan, 2008.

Saloner, Garth. 1987. "Predation, mergers and incomplete information." *RAND Journal of Economics*, 18(2): 165-186.

Scott Morton, Fiona. 1997. "Entry and Predation: British Shipping Cartels 1879-1929." *Journal of Economics & Management Strategy*, 6(4): 679-724.

Sjostrom, William. 2004. "Ocean Shipping Cartels: A Survey." *Review of Network Economics*, 3(2): 107-134.

Spence, Michael A. 1977. "Entry, Capacity, Investment Oligopolistic Pricing". *Bell Journal of Economics*, 8(2): 534-44.

Telser, Lawrence G. 1966. "Cutthroat Competition and the Long Purse." *Journal of Law and Economics*, 9: 259-277.

Terza, Joseph V., Anirban Basu, and Paul J. Rathouz. 2008. "Two-Stage Residual Inclusion Estimation: Addressing Endogeneity in Health Econometric Modeling." *Journal of Health Economics*, 27(3): 531-543.

UNCTAD. 2010. *Review of Maritime Transport*. New York and Geneva: United Nations.

US Census Bureau. 2006. "Annual Port-level Trade." USA Trade Online. https://www.usatradeonline.gov/ (accessed September 13, 2010)

World Bank. 2008. "Maritime Transport Services." World Bank Survey on Impediment to Trade Integration.

WTO. various years. Trade Policy Reviews.

7. Annexes

Annex 1: Sample description

Destination countries (3)	
BRA	Brazil
NZL	New Zealand
USA	United States

Origin countries (32)	
DZA	Algeria
AUS	Australia
BEL	Belgium
BRA	Brazil
CAN	Canada
CHL	Chile
CHN	China
COL	Colombia
EGY	Egypt
FRA	France
DEU	Germany
HKG	Hong-Kong
IND	India
IDN	Indonesia
ITA	Italy
JPN	Japan
KOR	Korea
MYS	Malaysia
MEX	Mexico
MAR	Morocco
NZL	New Zealand
NGA	Nigeria
RUS	Russia
SEN	Senegal
SGP	Singapore
ZAF	South Africa
ESP	Spain
THA	Thailand
TUN	Tunisia
TUR	Turkey
GBR	United Kingdom
USA	United States

Annex 2: Derivation of the Cournot Model

Considering a Cournot oligopoly model with n identical firms supplying an homogenous service.

The demand function for the service has the following common form:

$$p = \alpha - Q = \alpha - \left[\sum_{i=1}^{n} q_i \right] \qquad [3.1]$$

With $\alpha > 0$ and where,

- p is the price of the service.
- q_i is the quantity produced by firm i.
- Q is the total quantity of service produced by the n firms.

Hence, the profit function of firm i can be written as

$$\Pi_i = pq_i - cq_i - F = q_i[p - c] - F = q_i\left[\alpha - \sum_{i=1}^{n} q_i - c \right] - F \qquad [3.2]$$

Where,

- c is the marginal costs of production.
- F is a fixed cost of production.

Firm i chooses its supply by maximizing its profits with respect to quantity q_i:

$$\underset{q_i}{Max}\, \Pi_i = q_i\left[\alpha - \sum_{i=1}^{n} q_i - c\right] \qquad [3.3]$$

$$\Rightarrow \frac{\partial \Pi_i}{\partial q_i} = \alpha - \sum_{i=1}^{n} q_i - c - q_i = 0 \qquad [3.4]$$

Given that firms are identical, $q_i = q^*$ for all i and the first order condition can be written as :

$$q^* = \alpha - c - nq^* \qquad [3.5]$$

$$\Rightarrow q^* = \frac{\alpha - c}{1+n} \qquad [3.6]$$

Total service output produced at the equilibrium is:

$$Q^* = nq^* = \frac{n(\alpha - c)}{1+n} \qquad [3.7]$$

Therefore, the equilibrium price is equal to:

$$p^* = \alpha - Q^* = \frac{\alpha + nc}{1+n} \qquad [3.8]$$

By replacing equilibrium values of prices and quantities (equations [3.9] and [3.12]) in the profit function (equation [3.3)], I obtain the following equilibrium profit:

$$\Pi^*_i = p^* q^* - cq^* - F \qquad [3.9]$$

$$\Pi^*_i = \left(\frac{\alpha - c}{1+n}\right)^2 - F \qquad [3.10]$$

Assuming that market entry and exit are free, the number of firms operating in the market, n^*, is determined endogenously the zero-profit condition.

$$\Pi^*_i = \left(\frac{\alpha - c}{1 + n^*}\right)^2 - F = 0 \qquad [3.11]$$

$$\Rightarrow n^* = \left(\frac{\alpha - c}{\sqrt{F}}\right) - 1 \qquad [3.12]$$

Annex 3: Data description

Table: Variables included in the MTC equation

Variable	Description	Dimension	Source
n	Number of carriers deploying at least one vessel on the route	od	CI Online (2010)
distance	Shortest maritime distance by canal, straits and caps between main container ports, expressed in miles	od	CI Online (2010) and AXS marine (2010)
tv	Total seaborne imports of containerizable products, in kilogramme	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
ti_absolute	Trade imbalance of seaborne trade of containerizable products. Computed as the absolute term of the following expression [(Exports - Imports)/Max (Exports, Imports)]	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
ti_interaction	Interaction of ti_absolute and a trade imbalance dummy variable coded 1 if the seaborne trade imbalance is negative	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
mode_3_1	Dummy variable coded 1 if the route is classified in the first quartile	od	Own calculation with data from various sources [a]
mode_3_2	Dummy variable coded 1 if the route is classified in the second quartile	od	Own calculation with data from various sources [a]
mode_3_3	Dummy variable coded 1 if the route is classified in the third quartile	od	Own calculation with data from various sources [a]
mode_3_4	Dummy variable coded 1 if the route is classified in the forth quartile	od	Own calculation with data from various sources [a]
conference	Dummy variable coded 1 if a conference is present on the route	od	CI Online (2010)
conference_1	Dummy variable coded one if a conference is present on a route without mandatory tariffs filing	od	CI Online (2010)
conference_2	Dummy variable coded one if a conference is present on a route with mandatory tariffs filing	od	CI Online (2010)
discussion	Dummy variable coded 1 if a discussion agreement is present on the route	od	CI Online (2010)

Notes: [a] For more details on these sources, see Annex 4.

Table: Variables included in the gravity equation

Variable	Description	Dimension	Source
mtc	Unitary maritime transport costs. Computed as follows: [(imports valued in cif-customs value of imports)/(imports weight)]. Expressed in dollar per kilogramme.	odk	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
distance	Shortest maritime distance by canal, straits and caps between main container ports, expressed in miles	od	CI Online (2010) and AXS marine (2010)
transhipment	Dummy variable coded 1 if a transhipment is needed by trade partners	od	CI Online (2010)
tv	Total seaborne imports of containerizable products, in kilogramme	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
ti_absolute	Trade imbalance of seaborne trade of containerizable products. Computed as the absolute term of the following expression [(Exports - Imports)/Max (Exports, Imports)]	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
ti_interaction	Intercation of ti_absolute and a trade imbalance dummy variable coded 1 if the seaborne trade imbalance is negative.	od	Computed with data from ALADI (2009), New Zealand Statistics (2009) and US Census Bureau (2009)
n	Number of carriers deploying at least one vessel on the route -- actual value	od	CI Online (2010)
residual_n_*	Residuals from estimations of the n equation	od	-
mode_3_1	Dummy variable coded 1 if the route is classified in the first quartile	od	Own calculation with data from various sources [a]
mode_3_2	Dummy variable coded 1 if the route is classified in the second quartile	od	Own calculation with data from various sources [a]
mode_3_3	Dummy variable coded 1 if the route is classified in the third quartile	od	Own calculation with data from various sources [a]
mode_3_4	Dummy variable coded 1 if the route is classified in the forth quartile	od	Own calculation with data from various sources [a]

Notes: [a] For more details on these sources, see Annex 4.

Annex 4: Details on the construction of the liner shipping STRI in mode 3

This annex aims at detailing the information and the methodology used to construct the liner shipping STRI in mode 3 included in the market structure and price equations. The construction of the index includes five steps: the choice of relevant measures to be included, the scoring of the measures, the weighting, the aggregation and robustness check.

Regulatory information sources and restrictions included in the index

In the previous chapter, I included twelve types of restrictions in the STRI in mode 3. However, for a question of data exclusive rights, I do not have access to the same regulatory information. Hence, for this Chapter, I carried out a desk study in order to collect the regulatory information. As the main source, I use the regulatory information collected through the World Bank Survey on Impediments to Trade Integration (World Bank, 2008) published in an APEC report (Bertho, 2011). Then, I complete it by information available in APEC Individual Action Plans and WTO Trade Policy Reviews. Considering the difficulty in collecting regulatory information (because of limited sources and information), it was not possible to include all trade restricting regulations in the index. However, the most relevant barriers to trade are included in the index.

The most obvious barrier to commercial presence is the limitation to foreign ownership that prevents foreigners from controlling entirely liner shipping companies. Then, some restrictions on the form of the commercial presence exist. In some countries, the creation of new affiliates has to take the form of a subsidiary and the establishment of branches is prohibited. Furthermore, in some countries, foreign investors must obtain a prior authorization before investing in a sector. This restriction is also called screening and approval process. It is common in strategic and sensitive sectors such as maritime transport. The authorization can be automatic or subject to some requirements and evaluations by the related Ministry or a governmental agency.

Scoring

The scoring consists in transforming the information on the restrictiveness level of regulatory measures (i.e. principally qualitative information) in scores. Considering the dataset, I transform measures into binary and multiple binary scores. The continuous variable (percentage of ownership limitation) is transformed into multiple binary scores through specific thresholds. Thresholds are determined in terms of the values' economic significance. The first threshold is set on the [0.99; 0.50] interval. It represents a joint venture requirement based on the fact that this restriction is likely to discourage foreigners to invest in the sector. The second threshold is set on the [0.49; 0] interval based on the fact that 50% represents the majority control of a firm.

Weighting

The weighting scheme captures the relative importance of measures in terms of trade restrictiveness. In order to determine categories' weights I explore three options generally used in the literature. The first solution consists in using an equal weighting scheme. The second alternative is to use the factor analysis methodology and most particularly the Principal Component Analysis (PCA).

Table: Weighting through Principal Component Analysis

		Factor 1			Factor 2		
Explained variance		0.434			0.386		
Indicators of restrictivness	**Loadings**	**SFL [a]**	**Weights**	**Loadings**	**SFL [a]**	**Weights**	**Final weights**
form	0.555	0.308	0.308	-0.604	0.364	0.364	**0.336**
ownership	0.314	0.098	0.098	0.789	0.623	0.623	**0.361**
screening	0.770	0.593	0.593	0.114	0.013	0.013	**0.303**
		1.000	0.500		1.000	0.500	

Source: Author's calculation.

The third method is based on experts' judgement, taking into account their sector's knowledge and experience. Considering the feasibility and the advantages and drawbacks of the various methodologies presented, I decided to use an equal weighting scheme.

Aggregation

Again, for a question of transparency and interpretation, I choose a linear method of aggregation.

Table: Summary, the International Shipping TRI in mode 3

Measures	Weights (w)	Modality (mo) scoring (s_i)		
Form of the ownership (Greenfield)	1/3	Branch and subsid. allowed 0	Only subsidiary or branch allowed 0.5	Green. project not allowed 1
% of ownership in Greenfield project	1/3	100% 0	99-50% (JV requirement) 0.5	Less than 50% 1
Screening and approval	1/3	No screening and approval 0		Screening and approval 1
Country score (0-6)			**Σws_i**	

Notes: [a] Criterions: right to appeal regulatory decision and regulatory changes noticed. [b] Criterions: free transfer, free convertibility and free use.

Robustness check

One drawback when using a composite index to measure trade restrictiveness is the subjectivity of the weighting methodology. Actually, the weighting scheme is likely to have an important impact on the final outcome of the restrictiveness index. So, I should test the sensitivity of results to choices that have been made during the weighting step. Here, I check whether the ranking of countries is driven by a particular weighting scheme. To this end, I use the Spearman rank correlation methodology. I calculate the Spearman rank correlation for two different STRIs -- i.e. calculated using the equal weighting and computed through PCA. The result of the robustness check allows me to confirm that the ranking of countries are strongly robust to the weighting scheme -- The Spearman's rho is 0.9982.

Annex 5: Correlation matrixes

Table: Correlation matrix -- Market structure estimations

	distance	tv	ti_interaction	ti_absolute	mode_3_2	mode_3_3	mode_3_4	conference	discussion	conference_1
distance	1									
tv	-0.2992	1								
ti_interaction	-0.2071	0.2327	1							
ti_absolute	0.0736	-0.355	-0.0339	1						
mode_3_2	-0.1482	-0.0583	0.1215	0.0333	1					
mode_3_3	0.0859	0.1611	0.0571	0.0411	-0.2413	1				
mode_3_4	0.0085	-0.0905	-0.1532	0.1748	-0.2413	-0.2329	1			
conference	-0.1796	0.0513	-0.1186	-0.0289	-0.1213	-0.117	0.0069	1		
discussion	0.1623	0.3418	-0.0159	-0.1957	0.0754	-0.0342	0.0941	-0.0366	1	
conference_1	-0.186	0.012	-0.0908	-0.1109	-0.0928	-0.0896	-0.0896	0.7656	0.028	1
conference_2	-0.0525	0.0651	-0.0737	0.0901	-0.0754	-0.0728	0.1198	0.6216	-0.0909	-0.028

Note : Distance, total seaborne imports and absolute trade imbalance are in logarithms.

Table: Correlation matrix -- MTC estimations

	distance	transhipment	tv	ti_absolute	ti_interaction	mode_3_2	mode_3_3	mode_3_4	n
distance	1								
transhipment	0.3205	1							
tv	-0.3196	-0.455	1						
ti_absolute	0.0544	-0.1883	-0.1971	1					
ti_interaction	-0.2428	-0.1399	0.4111	0.0522	1				
mode_3_2	0.0357	0.0582	-0.0679	0.0048	0.1487	1			
mode_3_3	0.0912	-0.0512	-0.0148	0.1803	-0.0578	-0.1989	1		
mode_3_4	0.0428	-0.0043	0.1943	0.1359	-0.0043	-0.1624	-0.2238	1	
n	-0.2866	-0.5485	0.6547	0.0174	0.2279	-0.048	-0.1102	0.2037	1
residual_n_3	-0.0203	-0.5191	0.0965	-0.0837	-0.016	-0.1234	-0.0132	-0.0705	0.252
residual_n_4	-0.0221	-0.5618	0.1204	-0.0919	-0.008	-0.1249	0.0027	-0.0596	0.2112
residual_n_5	-0.0174	-0.5551	0.1234	-0.0938	-0.0074	-0.1244	0.0032	-0.0645	0.2209
residual_n_6	-0.0213	-0.5215	0.0943	-0.0817	-0.0215	-0.1254	-0.0181	-0.0621	0.2403

Note : Distance, total seaborne imports and absolute trade imbalance are in logarithms.