Maritime Business Review (MABR) addresses the issues arising from the maritime business environment which is dynamic and complex. This journal covers a broad range of elements of maritime business and uses multi-disciplinary approach. Research papers accepted for publication in MABR are double blind refereed to ensure academic rigour and integrity.

Emerald Publishing Limited
Howard House, Wagon Lane,
Bingley BD16 1WA, United Kingdom
Tel +44 (0) 1274 777700; Fax +44 (0) 1274 785201
E-mail emerald@emeraldinsight.com

For more information about Emerald’s regional offices please go to http://www.emeraldgrouppublishing.com/offices

Customer helpdesk:
Tel +44 (0) 1274 785278; Fax +44 (0) 1274 785201
E-mail support@emeraldinsight.com

The Publisher and Editors cannot be held responsible for errors or any consequences arising from the use of information contained in this journal; the views and opinions expressed do not necessarily reflect those of the Publisher and Editors, neither does the publication of advertisements constitute any endorsement by the Publisher and Editors of the products advertised.

Emerald is a trading name of Emerald Publishing Limited

Printed by CPI Group (UK) Ltd, Croydon, CR0 4YY
Protectionist vs liberalised maritime cabotage policies: a review

Ana Cristina Paixão Casaca
Grupo de Estudos em Logística, Universidade Federal do Maranhao, São Luís, Brazil, and

Dimitrios V. Lyridis
School of Naval Architecture and Marine Engineering, National Technical University of Athens, Athens, Greece

Abstract

Purpose – The development of the current European economic area maritime cabotage market occurred when, at a policy level, the European Union forced the opening of its member-states cabotage markets to Community shipowners and extended this openness, in 1997, to the european free trade area countries. A two-tier cabotage market emerged, where a European economic area legislative framework co-exists with the legislative acts of each member-state. With such a unique background, this paper aims to investigate both the European economic area member-states and the rest of the world cabotage regimes and identify a list of reasons and policy measures used to implement cabotage policies.

Design/methodology/approach – By means of a desk research methodological approach, this paper analyses, from a geographical perspective, different countries’ cabotage policies and classifies them, and identifies in a systematically way a set of reasons and policy instruments that support each of chosen policies approach.

Findings – The outcome indicates that only a few countries promote free liberalised cabotage services and that most countries favour protectionist cabotage policies, whose governments can control the number of foreign vessels participating in these trades. Cabotage regimes have been categorised and the reasons behind both policies and respective policy instruments have been identified.

Originality/value – Quite often, researchers only focus on the cabotage policies of the European economic area countries, the USA, Australia, Japan and South Korea. This paper value rests on its ability to incorporate cabotage policies from other African, Asian and Latin American countries and to update existing information on the subject. Overall, this paper paves the way to broaden the cabotage knowledge.

Keywords European Union, Liberalization, Policy, Protectionism, Cabotage, Rest of the world

Paper type General review

1. Introduction

Throughout the history, political, structural and economic forces have forced countries to choose their trade policies. While for many years, protectionist trade policies ruled the world, the decision of the British Government, in the beginning of 1650, to pursue a mercantilist policy opened the world to free trade even though the assumption behind mercantilism was that a country should export more than it imported. This change in policy has influenced the economic principles that rule many countries and promoted the
establishment of opened markets where goods and services are freely moved by decreasing trade barriers and increasing international cooperation among countries. The wave of globalisation that has been taking place is an ultimate consequence of such opened trade policies, as without them, countries’ trade would still be limited from a geographical perspective. The body of literature on liberalised and protectionist market economies/policies is huge; however, a thorough analysis on both approaches is out of the scope of the present paper. They differ considerably and the next paragraphs address their main features.

A liberalised market means an economic policy that aims at freeing up world trade between countries and at breaking down the barriers that prevent such trade, in particular seaborne international trade. The basic philosophy rests on the principle of comparative advantage, which has contributed to the present industrial structure of the global economy. Many economists have addressed market liberalisation, and talks to achieve it have been ongoing for many years, initially by the General Agreement on Tariffs and Trade and recently by the World Trade Organisation. All the countries that opened up their markets to trade and foreign investment have had sustained growth and prosperity. By liberalising trade and capitalising on areas of comparative advantage, numerous economic activities, including the shipping industries, have benefitted economically from this approach.

Economic activities, that for many years adopted local and national economic policies, which often implied high production costs, have been able to reach remote areas of the globe either to produce or to sell their products and services and to benefit from scale economies, thus lowering both production costs and products selling prices. They have been able to go through different evolutionary stages, from national to international and from international to global, and participate in important economic clusters that create economic synergies and knowledge spillovers. However, Theodoropoulos et al. (2006) acknowledged that although market liberalisation measures should be taken on a multilateral basis they should be complemented by appropriate employment, labour and education policies, so that the benefits of trade can be shared. The reasons that lead countries to adopt liberalised market policies in detriment of protectionist ones through free trade policies enforced by international treaties and organisations are many, and generally, they fall within the scope of economic, legal, social, strategic and cultural perspectives.

However, there are reasons that prevent or delay the adoption of liberalised market policies. The disadvantages of liberalisation such as increased unemployment, dumping, loss of the domestic production, thus resulting in an increased dependence on foreign nations, are sufficiently valid reasons. Moreover, multilateral agreements are very difficult to achieve and implement among the different countries that have agreed with them. Usually, the implementation stage occurs at different speeds depending upon the particular interest of certain countries, which eventually affect the overall performance of the policy measures designed to promote and foster market liberalisation. Finally, free trade does not work in a global setting where capital does not flow and where trade partners are asymmetrical which prevents them from adopting more collaborative and cooperative strategies.

A protectionist market means an economic policy that restrains trade between countries through the implementation of tariffs, quotas and non-tariff barriers. Countries adopt protectionist policies for numerous economic, social, strategic and cultural reasons. All these reasons, which to a certain extent could be justifiable, have severe impacts on countries’ economic development, and for this reason, they cannot be a solution for countries’ economic and financial problems. They lead to isolationism and poverty levels, which will take eventually a long time to revert as they contribute among other issues to the development of
monopolies, high prices, products of lower quality, ineffective and inefficient production schemes, development of black economies and retaliation from other nations with which the country has established diplomatic and commercial relationships. Furthermore, the governmental subsidies and/or loans granted to economic activities for them to compete with their international counterparts, distort market competition.

In light of today’s complex trading system, the definition of a trade policy, which falls within the scope of regulatory policies, is not straightforward and it is common to see mixed policies where both protectionist and liberalised policy elements co-exist. The definition of such a policy is a lengthy complex process and independently of the type of trade policy chosen (totally free, totally protected or a mix of the two), governments need to use any of the several existing policy making models (College of the Liberal Arts, 2017) and elaborate roadmaps, which identify the corresponding policy instruments that will help governments performing a thorough assessment of their policies success/failure; without them, no policy can evolve in the right direction.

2. Literature review

The concept of “maritime cabotage”, often termed as “coastal navigation”, “domestic shipping”, “coastal shipping/trading”, “coasting shipping/trade” and “coastwise” (hereinafter cabotage), depending upon the world geographical area, is not new. Cabotage, which means excluding foreign-flagged vessels (hereinafter “foreign vessels”) from the domestic carriage of goods, is the oldest form of cargo preference (Aspinwall, 1987); its evolution appears to have started in the fifteenth century when shipping became a legal source of conflict among countries (Glisson and Jones, 1999). It is not clear when cabotage, as a legal principle, started as different authors refer to different dates; while Martin (2013) suggests that Portugal appears to have been the first country to implement cabotage laws in the fifteenth century; Woodward et al. (2015) indicate that the French promulgated the legal principle of cabotage in the sixteenth century. Independently of the dates, at that time, cabotage laws served to protect not only a country’s coastal trade and to restrict its trade to its national vessels which were owned and operated by nationals or national shipping companies but also the trade performed between the metropolitan country and its colonies. Trade and, consequently, maritime operations were concentrated in the hands of a few and many wars and battles occurred to dominate this market in the quest for the dominion of the seas. This situation lasted until the end of the Second World War when the last European colonies became independent and established their own shipping companies. The cabotage concept known until so far changed and became far more restricted.

The loss of control over very important shipping markets that guaranteed the employment of European fleets led many European countries to consider their cabotage as a national strategic asset, and in one way or another their shipping policies have always incorporated policy measures that address it. Other worldwide countries have followed similar approaches and quite often countries’ socio-economic and political interests and geographic characteristics influence the definition of the cabotage policies. Today, cabotage refers to shipping services performed within a restricted maritime area and includes:

- services among ports located along a country’s coastline;
- island cabotage services; and
- off-shore supply services.

At a European Union (EU) level, the cabotage market represents a small part of the broad EU short sea shipping market almost 20 per cent in what concerns goods and 45 per cent in what concerns passengers (Commission of the European Communities, 2009).
Cabotage has been addressed within the body of literature. European cabotage has been addressed either from the scope of the EU short sea shipping concept or from a geographical perspective. For instance, Giannopoulos and Aifandopoulou-Klimis (2004) addressed the Greek cabotage before and after market liberalisation while Chlomoudis et al. (2007) analysed maritime liberalisation within the EU and its influence on the Greek Islands. On the other side of the world, Boske (2001) investigated cabotage policies in North and Latin Americas and Brooks et al. (2014) analysed the cabotage of six Latin American countries (Brazil, Uruguay, Argentina, Chile, Peru and Ecuador). Of the six countries, Brazil has drawn the attention of both national and international research communities; Paixão Casaca et al. (2017a) and Paixão Casaca et al. (2017b) investigated the Brazilian cabotage policy taking into account the demand and supply and the integration of cabotage within multimodal transport chains. Brooks (2009) reviewed the Australian, New Zealand, the European, Canadian, US, Japanese and Chinese cabotage markets. Each of these countries have also been analysed individually by several authors. The Australian cabotage has been analysed by Bendall and Brooks (2011), Everett and Kittel (2010) and Brooks (2014). Aspinwall (1987), Magee (2002) and Michaeli (2014) performed a detailed analysis of the US cabotage policy and Hodgson and Brooks (2012) investigated the Canadian cabotage. New Zealand cabotage was reviewed before and after the new cabotage regime had entered into force (Cavana, 1994, 2004). The Korean, Chinese and Japanese cabotage policies have also been the focus of Park and Medda (2015). Nevertheless, certain countries (such as Uruguay, Argentina, Panama and Bangladesh) and regions (such as Africa) are yet to be analysed.

A similar situation applies to the analysis of the reasons behind the chosen policies and to the analysis of the policy instruments within a cabotage context, which is limited. Much focus is given to countries shipping policy in general terms and quite often, the reasons behind them are drawn from the body of literature on protectionism and liberalisation trade policies. Moreover, only few papers refer to policy instruments, quite often referred to as policy measures. Gardner et al. (1984) considered different forms of investment incentives, namely tax and investment allowances, investment grants and favourable credit terms to promote the investment in the British fleet. Heaver (1993) presented a set of specific tax and financial measures to allow the expansion of the Canadian-flag deep-sea shipping. Gardner et al. (1996) acknowledged that shipping policy measures in the post-war era fell within the scope of three categories, namely, fiscal incentives and financial assistance measures, labour, manning and training issues measures and external shipping policy measures. McConville and Glen (1997) addressed fiscal issues when investigating the impacts that the declining British fleet had on employment. Financial policy instruments have also been the scope of Yercan (1998) when analysed the Turkish maritime policy. Thanopoulou (1998) refers to social and fiscal policy measures that the European fleet already benefits when investigated shipping competitiveness. In 2004, the Sjöfartens Analys Institut Research analysed, on a country basis, the implementation of the 2004 Community guidelines on state aid to maritime transport and identified the measures that EU Member-States have implemented which to a certain extent fall within the scope of policy instruments. More recently, Slack and Notteboom (2013) identified a set of transport policy instruments when addressing transport planning and policy from a generic perspective. An insight into these studies suggests that policy issues are analysed from a broad perspective, sometimes focussing on a particular aspect such as labour and flagging out, and that the identified policy instruments target the shipping industry has a whole and not specifically the cabotage market.

To overcome the gap in the literature, this paper analyses, from a geographical perspective, different countries’ cabotage policies and classifies them and identifies in a
systematically way a set of reasons and policy instruments that support each of chosen policies approach.

3. Methodology
To achieve its objective, this paper adopts a desk research methodological approach, namely, the external desk research technique, because it allows access to a wide variety of information published in hardcopies and online although it does not guarantee the availability of the information needed. Quite often, it is necessary to send emails, perform surveys or interviews to obtain the missing information or even to check the information available, which results in a lengthy and time-consuming process to complete. The chosen methodological approach is structured into three stages (Figure 1).

Stage 1 divides the world into following seven geographical areas to facilitate the analysis; the identified geographic areas are:

1. the European Economic Area (EEA);
2. Africa;
3. Former Soviet Union and Middle East;
4. Asia;
5. Oceania;
6. North America; and
7. Latin America.

Stage 2 identifies potential sources of information and retrieves the information needed to perform the analysis. The analysis considered both offline and online sources of
information, and while the potential “offline sources of information” is clearly identified, the quest for “online sources of information” is a lengthy and time-consuming process. Concerning the latter, attention was drawn to the search engine and keywords used; the choice fell on Google because it visits as many websites pages as possible and indexes these pages, which assist researchers finding the information needed (Harris, 2003). As to the keywords, the choice fell on “maritime cabotage”, “domestic shipping”, “coastal shipping”, “coastal trading”, “coastal navigation”, “coasting shipping”, “coasting trade” and “coastwise”. Furthermore, to investigate the Portuguese and the Spanish speaking countries’ cabotage regimes, the terms “cabotagem” and “cabotaje” were used, respectively, because those countries’ legislative acts are written in their native language. Finally, Stage 3 discusses liberalised vs protectionist policies in the cabotage market, lists the reasons and policy instruments behind the existing cabotage policies and draws conclusions. The sections that follow address each of the geographic cabotage areas under study.

4. The European economic area cabotage
For many years, beyond the signing of the Treaty of Rome (TOR) in 1957 and the enlargements that took place in 1973, 1981 and 1986, national laws ruled the several EU member-states cabotage markets. Articles 81 to 86 and Articles 87 to 89 of the TOR only applied to the international shipping industry. The first step towards changing this situation occurred when the European Commission released the 1985 White Paper on “Completing the Internal Market” listing 300 measures destined to eliminate existing physical/border controls, technical/rules and regulations and fiscal/different tax rates, which prevented the completion of the Single European Market. Only then, has the cabotage market liberalisation been seen as an important step to achieve the Single European Market and therefore needed to be regulated according to the EU principles; however, the path taken to achieve this purpose was not a straightforward one.

The 1986 maritime package excluded cabotage. The Uruguay Round of the General Agreement on Trade and Services participating countries also adopted a similar approach when they eliminated cabotage from the negotiations on shipping matters. Cabotage had always been considered a very delicate subject in what concerns the application of EU competition rules. Southern member-states favoured the carriage of mainland cargo and inland passenger on board ships carrying their national flag (Greaves, 2011) even though the UK, Ireland, Denmark, The Netherlands and Belgium had liberalised their cabotage markets in accordance with Council Regulation (EEC) No. 4055/86. No further progress was made until 1989, when the Commission presented two Communications on different shipping matters, which included the removal of cabotage restrictions. It is understood that the cabotage negotiation process became a complex one because of disputes that mainly concerned manning rules, because some EU lawyers considered that the agreement reached, in December 1990, was in breach of the TOR (Paixão and Marlow, 2001).

The solution to overcome the barriers that prevented the liberalisation of the EU cabotage market would occur later in 1992 when the Council of the European Communities took action and released Council Regulation (EEC) No 3577/92 granting Community shipowners the freedom to provide cargo and passengers cabotage services within a member-state other than the member-state where their vessels were registered as long as these vessels complied with all the legal conditions for carrying out cabotage in member-state of the vessels’ flag. To meet the interests of the Southern European member-states, a schedule was established and the liberalisation of cabotage services was carried out in a phased way. However, this granting of freedom is not so straightforward in light of the three possible types of derogations foreseen in the Regulation. Freedom may be limited by:
the imposition of

- manning rules which are the responsibility of the flag States and whose rules vary from one register to another; or
- public service obligations to guarantee the quality and regularity of maritime transport services.

(2) the temporary suspension of the Regulation provisions because of serious disturbances in the internal transport market.

Furthermore, the provisions made for the establishment of public service contracts may promote unfair competition practices because they may lead to the implementation of defensive measures if these public service contracts are not addressed from a non-discriminatory basis.

From a policy perspective, a two-tier cabotage market emerged, where an EU legislative framework co-exists with the legislative acts of each member-state. It is clear that Community shipowners can immediately offer cabotage services, but their participation in the cabotage markets very much depends upon their vessels registries. From the legislation in force, vessels registered in member-state’s first register have unrestricted access to cabotage in other member-states; however, this principle of freedom does not apply to all vessels registered in the EU member-states second registers. Vessels registered under the Spanish Canary Islands, the Portuguese Madeira and the Gibraltar registries have unrestricted access to cabotage. Cargo vessels registered in the Danish International Ship Register have access to cabotage while passenger vessels do not. Vessels registered in the German International Register and in the Finnish list of cargo vessels in foreign traffic have no access to regular cabotage but on a case-by-case basis only. Vessels under the Italian second register are allowed on a case-by-case basis up to six cabotage journeys per month or up to unlimited cabotage journeys, if these are over 100 nautical miles. Finally, limited access to cabotage also applies to vessels flying the flag of the French International Register.

Norway and Iceland also benefit from the principle of freedom to provide cabotage services by Decision 70/97 of 4 October of the EEA Joint Committee to extend Council Regulation (EEC) No 3577/92 to the European Free Trade Area countries. Iceland transposed into its national legislation the EU Regulations on the freedom to provide maritime services, on maritime cabotage, on the transfer of cargo and passenger ships between registers and on the free access to cargoes in ocean-going trades (European Commission, 2012). The situation with Norway was more complex because of its Norwegian International Ship Registry. Although Norway does not impose cabotage restrictions and different flagged vessels can provide services in its cabotage trades, all vessels registered under the Norwegian International Ship Registry (NIS) were prevented from participating in the EEA cabotage market. The exception being those cabotage markets with whom Norway had negotiated bilateral agreements and in countries, which had adopted full-liberalised cabotage policies. However, as from 1 January and 1 March 2016 onwards, the legislative changes taken place have allowed NIS registered cargo vessels to be employed in the cabotage market (Ernest and Young, 2016). Five reports have been drawn to evaluate its implementation and the status of cabotage liberalisation; the last one dates from 2014 (Commission of the European Communities, 2014).

Figure 2 provides an overview of the EEA cabotage current situation for vessels registered in member-states’ first register. EEA member-states are still able to decide the extent to which vessels registered in the EEA member-states second registers and vessels registered in non-EEA member-states and operated by non-EEA member-states shipowners can participate in their cabotage. Changes are expected to occur in the future with the exit of
the UK from the EU, as the country will be prevented from having access to the EU-27 cabotage market. Therefore, to acknowledge that the EEA cabotage market is fully liberalised is a wrong assumption, as different degrees of freedom exist.

5. Cabotage in the rest of the world

5.1 African cabotage

Unlike other regions, the literature on African cabotage is limited, and the information gathered shows that the region favours protected cabotage regimes, despite the World Economic Forum having suggested that they impose numerous restrictions on international trade (Van, 2013). The enforcement of protected cabotage regimes is highlighted by the cabotage provisions established under Article 11 of the African Maritime Transport Charter enacted in 1993 (Faculty of Law, 2016). This enforcement was reinforced by the 2010 African Union’s Revised African Maritime Transport Charter, which not only supports the establishing of national cabotage shipping companies but also of regional maritime cabotage shipping lines to promote intra-African trade and facilitate the African economic and socio-economic integration (African Union, 2010). The introduction of cabotage laws along the 38 African coastline nations appears to be taking place at different speeds and the development of an African cabotage area is far from being a reality.

Cabotage between two Moroccan ports is reserved exclusively for vessels flying the Moroccan pavilion because of national security reasons (Centro de Navegacion Argentina, 2015). The same principle applies to Libya and Tanzania. Nigerian cabotage is ruled by the “Coastal and Inland Shipping (Cabotage) Act, 2003” (Houses of the National Assembly of Nigeria, 2003). It aims at giving Nigerian shipping companies a competitive edge over their foreign counterparts that are still doing business in Nigerian waters, even though the Act foresees the granting of waivers whenever the market lacks:

- Nigerian flagged vessels to provide cabotage services;
- capacity to build and repair cabotage vessels; and
- capacity to supply crews.

<table>
<thead>
<tr>
<th>Country</th>
<th>Liberalized to EEA Member States</th>
<th>Liberalized to Non-EEA Member States</th>
<th>Fully liberalized</th>
<th>Country</th>
<th>Liberalized to EEA Member States</th>
<th>Liberalized to Non-EEA Member States</th>
<th>Fully liberalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Norway</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>France</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Iceland</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Germany</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Malta</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Italy</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Cyprus</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>No maritime cabotage</td>
<td></td>
<td></td>
<td>Estonia</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Latvia</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Denmark</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Lithuania</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ireland</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Poland</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Czech Republic</td>
<td>No maritime cabotage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Slovakia</td>
<td>No maritime cabotage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Hungary</td>
<td>No maritime cabotage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Slovenia</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Finland</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Bulgaria</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Sweden</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Romania</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Austria</td>
<td>No maritime cabotage</td>
<td></td>
<td></td>
<td>Croatia</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: Authors
However, the Act is yet to be implemented and the Cabotage Vessel Financing Fund is yet to be spent among the six local shipping companies selected by the Ministry of Transport (Footprint to Africa, 2016). Nigerian cabotage regime remains liberalised.

Angola, South Africa and Mozambique have long coastlines, which offer great potential for developing cabotage. Angolan cabotage can only be performed by Angolan shipowners who can either use national registered or chart-in foreign vessels (Presidente da República de Angola, 2014; Assembleia Nacional Angolana, 2012). Angolan specific laws on cabotage were revoked but cabotage cargo still benefits from special port charges (Ministério dos Transportes e Comunicações de Angola, 1989a, 1989b; Ministérios das Finanças e dos Transportes de Angola, 2008). Namibia has no cabotage restrictions; all vessels, including the foreign ones, can engage in cabotage trades without operational permits, but seaworthiness permits apply. South Africa has one of the world’s most liberal maritime policy regimes (Chasomeris, 2006). The country allows local and foreign vessels on international trades to carry its cabotage cargo because it completely lost its domestic flagged vessels and the existing national shipping companies were bought by international ones (South African Department Transport, 2008; Shipping Position, 2012).

Mozambican cabotage follows an approach similar to the Angolan one. The government determined that only nationals could operate cabotage services although waivers could be granted to foreign vessels whenever necessary (Ministério dos Transportes e das Comunicações de Moçambique, 1996; Conselho de Ministros de Moçambique, 2007). Recently, in an attempt to revitalise the cabotage market and to reduce existing competitiveness disparities and commodity prices, the government created a special ship’s registry granting foreign vessels the possibility to offer cabotage services subject to a set of conditions, one of which is flying the Mozambican flag (MacauHub, 2017; Conselho de Ministros de Moçambique, 2016). In Kenya, cabotage is restricted to vessels flying the Kenyan flag, but foreign-owned vessels can enter the cabotage market as long as the Minister of Transport approves the issuance of licences and the granting of waivers. Finally, Egypt allows private ownership and foreign ownership in the provision of cabotage services but no limits are placed on the companies’ shares. However, vessels flying the Egyptian flag and holding coastal navigation licences have priority over the other cabotage services when carrying containers; foreign vessels will only be temporarily allowed in the container carriage if no Egyptian flag capacity is available (Togan, 2009).

5.2 Cabotage in the former Soviet Union and Middle East

Russian cabotage is reserved to Russian Federation flagged vessels (Federation Council of Russia, 1999); as per its Merchant Shipping Code, foreign vessels can only enter the cabotage market if they have been authorised by an international treaty with Russia or if the government has granted waivers in specific cases. Turkish cabotage services are restricted to Turkish flagged and to Turkish International Ship Registry (TISR) registered vessels, which in the latter case extends the cabotage market to foreign shipowners (Ministry of Trade and Justice of Turkey, 1926; Maritime Advocate, 2000); however, vessels under the TISR need to comply with Article 940 of the Turkish Commercial Code to benefit from cabotage rights (Ernest and Young, 2016). Under the TISR, foreign direct investment is possible in cabotage shipping companies, but nationals need to control 51 per cent of the company’s capital. The TISR is more relaxed; Turkish and foreigner shipowners just have to domicile in Turkey and foreign companies need to be incorporated under the Turkish Law (University of Antwerp, 2015). No cabotage regulations are enforced in Lebanon but in
what concerns cargo declarations vessels are requested to comply with the local customs regulations. Jordan cabotage is closed to both private and foreign ownership (Centro de Navegacion Argentina, 2015). Finally, foreign vessels are allowed to move cargo between ports of the UAE.

5.3 Cabotage in Asia
Asian cabotage is a unique market made up of different policy approaches, some of which very dynamic and very interesting from the policy perspective. The analysis covers several countries, but focuses mainly on India, Malaysia, Indonesia, the Philippines, China, South Korea and Japan.

Indian cabotage is ruled by the 2016 Merchant Shipping Bill, which replaces both the 1838 Coasting Vessels Act and the 1958 Merchant Shipping Act (Ministry of Road Transport, Highways and Shipping, 2016). The 2016 Act has widen the scope of cabotage to include services/activities performed within Indian territorial waters, continental shelf, exclusive economic zones and other maritime zones of India. Indian registered vessels have immediate access to cabotage trades without having to apply for a licence; a licencing regime, which comprehends three types of licences, applies to foreign vessels, which is to be granted by the Director-General. Furthermore, cabotage vessels are exempted from having to present trading licence or other statutory certificates to obtain their port clearance.

The Malaysian cabotage market has witnessed an interesting evolutionary path where the market went from a liberalised situation to a protectionist one ending on a situation where particular cabotage market segments are being opened to foreign vessels. In January 1980, the Malaysian Government implemented a national cabotage policy to protect and promote a strong national shipping-owning industry to minimise Malaysia’s dependence on foreign vessels and outflow of foreign currency because of the incurred payments of freight, and to help developing Malaysia’s trade and logistics domestic capacity (Parliament of Malaysia, 1952). The Ordinance defines cabotage, states that only Malaysian flagged vessels can engage in cabotage trades, and determines the conditions that qualify a vessel as a Malaysian one; furthermore, it indicates that vessels need a licence granted by the Domestic Shipping Licencing Board for a period ranging from six up to 24 months to engage in cabotage services. Foreign vessels can engage in cabotage trades as long as the available number of Malaysian vessels is insufficient to meet the existing demand, which often happens in the offshore support vessels industry, where they are granted temporary licences for a maximum period of three months. Since June 2009, changes have taken place; foreign shipowners have been allowed to carry transhipped containers between certain ports in the Peninsula Malaysia and East Malaysia without having cabotage licences and later, in 2012, passenger cruise vessels were exempted from cabotage law (Metcalf and David, 2015). More recently, the states of Sabah and Sarawak in East Malaysia as well Labuan have been exempted from the cabotage law because of the high shipping costs between east and west Malaysia (Hand, 2017).

To revitalise its cabotage industry, the Indonesian Government implemented cabotage restrictions granting Indonesian companies with greater business opportunities and market share and cabotage became available only for Indonesian flagged vessels, manned by nationals (President of the Republic of Indonesia, 2008). Shipping companies must be classified as “Indonesian Sea Carriage Companies” and be incorporated under Indonesian legislation; foreign companies are allowed to participate in cabotage activities but they need to establish joint ventures with Indonesian partners and their direct investment cannot overcome 49 per cent of the overall capital. Initially, the 2008 legislation exempted foreign-owned offshore floating units from the cabotage rules, but since the activities performed by
the oil and gas companies fell under the scope of cabotage (Yee and Din, 2015), exemption tables were created, in 2011, to encourage Indonesia’s shipbuilding industry, and to meet the needs of the oil and gas sectors to avoid production losses. In 2015, in an effort to boost the tourism sector, Indonesia relaxed its cabotage rules imposed on the cruise industry by allowing foreign cruise ships to call at five of the country’s largest ports (World Maritime News, 2015).

The existing Philippine cabotage policy, designed to build a robust domestic shipping industry, prevented foreign shipowners from participating in cargo and passengers cabotage trades, unless they were granted a special permit by the Maritime Industry Authority on the condition that no national vessels were available to perform those trades (Government of the Philippines, 1957; Congress of the Philippines, 2004). Moreover, the same legislation determined that 60 per cent of companies’ capital should be in the hands of nationals. However, the divergences between an emerging liberalised economic policy and the existing cabotage policy end up causing severe economic bottlenecks at the same time that retarded the national fleet development, limited competition and encouraged inefficiency among local vessel operators (Manila Times, 2015). To support the liberalisation of the Philippine economy and to keep pace with the reforms that were taking place in the Asian region, the Aquino administration forced the introduction of amendments into the Philippine shipping industry and opened up its coastal trade to foreign vessels allowing them to carry intra-trade cargo and foreign cargo for domestic transhipment (Congress of the Philippines, 2015).

The 1992 Maritime Code rules the Chinese cabotage and determines that cabotage services are to be performed by vessels registered in China (Ministry of Commerce People’s Republic of China, 1992). Foreign ships could only enter the cabotage market if permissions were granted from the competent authorities. Moreover, Chinese authorities had to grant permission for foreign companies to invest into Chinese-foreign equity joint ventures or contractual joint ventures and that the investment proportion to be made would be limited to 49 per cent (Ministry of Commerce People’s Republic of China, 1992; People’s Republic of China State Council, 2013; Park and Medda, 2015). As from September 2013, the Chinese Government decided to relax slowly its cabotage regime by allowing foreign container ships to carry containers on the trade routes between Shanghai Free Trade Zone and other coastal Chinese ports, even though the actual relaxation only occurred in December 2014 (Yan, 2014). From April 2015 onwards, additional changes occurred in the cabotage (Yan, 2015). The Chinese cabotage finds itself in a transition period, and the extent of the Chinese cabotage relaxation is unknown.

Ever since the 1982 South Korean “Ship Act” was enacted, non-Korean vessels have been prevented from operating in the cabotage market, even though the Korean Government has relaxed its cabotage regime from time to time (Minister of Land, Transport and Maritime Affairs, 1982). Currently, only Korean ships are allowed to operate cabotage services although in specific cases they can be performed by non-Korean vessels and that cabotage services are subject to a licence issued by the Minister of Oceans and Fisheries (Ministry of Oceans and Fisheries, 2015; Ministry of Oceans and Fisheries, 2014). Foreigners are allowed to invest directly in coastal shipping operations but the controlling share of the investment made must be in the hands of the Korean partners (Park and Medda, 2015).

Japan has the strictest cabotage regime of all Asian countries, despite having a geography that favours the development of cabotage. According to the Japanese Ships Act, cabotage trade may only be carried on Japanese flagged vessels, built in Japan and manned by a Japanese crew, which implies a high cost workforce when compared to other
nationalities (Japan Federation of Coastal shipping Associations, 2011). Foreign vessels are allowed:

- if they avoid capture or a marine accident;
- if there are provisions established in the law or in treaties;
- if a permit has been granted by the Ministry of Land, Infrastructure, Transport and Tourism; and
- if there are measures of friendship, of commerce and of navigation with Japan, as long as the participation of foreign vessels does not affect the Japanese cabotage industry, and if the principle of reciprocity applies (Japan Federation of Coastal shipping Associations, 2011; Park and Medda, 2015); the permission being granted to foreign vessels is valid for a certain voyage, port and period.

Cabotage is protected in many other Asian countries. Bangladeshi cabotage is only entitled to Bangladeshi flagged vessels can provide cabotage services, unless waivers are granted by the responsible authority (Bangladeshi Ministry of Law, Justice and Parliamentary Affairs, 1982). Myanmar reserves coastal cargoes to ships registered domestically and Thai cabotage follows the same approach under the Vessels Act 1938. Transport of cargoes between Vietnamese ports and harbours is wholly reserved for vessels, which are Vietnamese owned and registered, and manned by Vietnamese crews (except for some specialised officer positions). Taiwanese cabotage legislation also restricts the carriage of goods between Taiwanese ports to domestic vessels (Ministry of Justice, 2014). On the opposite side, Brunei and Cambodia have no cabotage restrictions and the geography of Singapore makes the reservation of coastal trade to domestic flagged shipping a non-issue (Law Revision Commission, 1996).

5.4 Cabotage in Oceania

Australian cabotage policy has drawn the attention of the research community because of its unique licencing regime. Cabotage is governed by the “Coastal Trading (Revitalising Australian Shipping) Act 2012” that implemented a new licencing regime to regulate the access to cabotage trades despite the attempts made in 2015 to amend it. The 2012 legislation replaced the licence and permit systems envisaged in the Navigation Act 1912 to overcome the negative impact that the latter had on the Australian fleet (Government of Australia, 2011; Cauchi, 2014), but it was not sufficiently robust to protect Australian registered vessels from foreign vessels’ competition, which have been benefitting from unlimited access to foreign trade (McHugh, 2016). A new legislation, the Coastal Trading (Revitalising Australian Shipping) Amendment Bill 2017, is being evaluated by the different governmental institutions. The 2017 Bill aims to extend the geographical scope of the coastal trading definition to include voyages to and from places in Australian waters, to reduce industry’s bureaucracy and to simplify the coastal trading regime administration. If the Bill passes, the new legislation is certain to promote critical changes in the existing legislation (Hetherington, 2017); however, the actual impacts of these changes are unknown. New Zealand cabotage has been relaxed under the Section 198 of the 1994 Maritime Transport Act (New Zealand Ministry of Transport, 2016). The liberalisation of cabotage came into effect on 1 February 1995, within the scope of a very comprehensive reform of the New Zealand’s international trade, industrial, transport, and fiscal policy. Under Section 198, cabotage can be performed by a New Zealand ship, by a foreign ship on demise charter to a New Zealand operator, which has to employ her crew in accordance with the New Zealand Law and by a foreign ship passing through New Zealand in its international voyage and
whose carriage of coastal cargo is negligible relatively to the overall amount of international cargo being carried (New Zealand Ministry of Transport, 2016).

5.5 North American cabotage
Canadian cabotage is ruled by the Coasting Trade Act 1992 (Canadian Transportation Agency, 2016), which aims at promoting a level playing field by protecting Canadian shipowners from others that benefit from lower wage crews and/or lower safety standards. Foreign and non-duty paid ships are prevented from operating in the cabotage market unless a licence has been granted (Canadian Transportation Agency, 2016), which means that only Canadian flagged and duty paid vessels are allowed in the cabotage trades and on top of this they must be manned by Canadian crews. The Minister of Public Safety and Emergency Preparedness can grant waivers to Canadian-registered, non-duty paid vessels and foreign vessels to conduct a commercial activity in Canadian waters for a maximum period of 12 months whenever the Canadian Transportation Agency identifies that there are no suitable Canadian-registered, duty paid vessels. Relative to the US cabotage legislation, the Canadian one is more relaxed since vessels can be built abroad in foreign shipyards, although at the expense of a 25 per cent tax payment on the imported ship’s value and of additional registration costs (Hodgson and Brooks, 2012). Changes in the Canadian cabotage market are expected to occur in light of the Comprehensive Economic and Trade Agreement signed between Canada and the EU. From April 2017, certain marine activities such as the repositioning of empty containers, dredging activities, and feeder services became exempted from licence and are opened to both EU and Canadian entities (Goeteyn and Pamel, 2016).

Like Japan, the US maintains very strict cabotage legislation. Cabotage is ruled by the US Merchant Marine Act (1920) ("the Jones Act"), which is incorporated under Title 46 Appendix on Shipping, Chapters 24 § 883 and 27 of US Code (Cornell University Law School, 2016a). The Act was enacted to protect US cargo vessels from the competition of low cost or subsidised foreign vessels, to allow the application of the Federal Employers Liability Act to seamen and to support a wide range of American Industries (Vaughn, 2016; Transportation Institute, 2016); more recently, the Act was also considered a matter of national security. The last revision of the Act occurred in 2006 which results from a recodification of the US Code. Cabotage is also ruled by the Vessel Documentation Act (1980), which determines the type of vessel that may be used in the cabotage trades (Congress of the USA, 1980) even though the concept of “coastwise trade” had never been defined by any statute or regulation (Aspinwall, 1987). Such definition can be inferred from the Merchant Marine Act (1920) (Cornell University Law School, 2016b), the Passenger Ship Act (1986) (Cornell University Law School, 2016c) and Section 4370 on towing of the 1878 Revised Statutes, and whose last update took place in 1996 (Cornell University Law School, 2016d). Cargo between two US ports, i.e. within all territories and possessions of the US, the exceptions being the American Samoa, the Northern Mariana Islands and the Virgin Islands, must be carried by vessels built (or rebuilt) and registered in the US, owned by US companies, which are controlled by at least 75 per cent of US citizens, and whose crew is made up of at least 75 per cent of the US citizens, and which are defined as qualified “coastwise vessels”. Operators willing to engage in cabotage trades are requested to apply for a permit, which grants them the right to operate in these trades. Requests for waivers under the Jones Act are difficult to obtain and they are allowed only for reasons of national defence (Waldron, 2014). Waldron goes on saying that there are only two types of waivers: the one requested by the Secretary of Defence, which is granted automatically; the other granted by the Secretary of the Department of Homeland Security if the Maritime Administration indicates that there are no US-flagged vessels available. Only very short temporary waivers have been granted in cases
of national emergencies, such as the grounding of the Exxon Valdez in 1989, Hurricane Sandy in 2002 and Hurricanes Katrina and Rita in 2005, or upon the request of the Secretary of Defence. There have been attempts to change the Jones Act but all of them have been unsuccessful (Maritime Trades Department, 2015; Maritime Trades Department, 2016). According to Hodgson and Brooks (2007), cabotage trade protection ends up being contrary to the overall liberalised trade intentions established in the two primary trade agreements, the Canada–US Trade Agreement and the North American Free Trade Agreement, as the USA has decided to keep its strict cabotage restrictions. This situation created an enormous surcharge on the domestic shipping trade and has prevented coastal shipping solutions, taking cargoes off the clogged highways of the US East coast (Slater, 2016).

Mexican cabotage is restricted to Mexican shipping companies which are exempted from licences issued by the Communications and Transport Secretary and whose vessels are flagged under the Mexican pavilion (Cámara de Diputados del H. Congreso de la Unión de México, 2006). However, the Communications and Transport Secretary can issue temporary licences that allow the use of foreign vessels by Mexican shipping companies in case Mexican vessels holding special features are unavailable, or if public interest is invoked. Foreign shipowners wishing to apply for a special cabotage navigation permit need to file a petition before the Merchant Marine Direction (Lopez, 2015). A temporary licence is not applicable to foreign vessels that wish to engage in cabotage operations related to touristic and nautical services, port construction and maintenance, and dredging if the reciprocity principle applies. Only Mexican shipping companies holding 51 per cent of the overall investment capital are allowed to register Mexican flagged vessels that operate in the cabotage trades (Cámara de Diputados del H. Congreso de la Unión de México, 2015; Lopez, 2015); foreign investment in Mexican shipping companies that operate cabotage trades are therefore limited to 49 per cent.

5.6 Latin American cabotage
The Latin American cabotage framework is well defined. Countries within this region have chosen to adopt protectionist policies albeit differences exist among the different legislative acts. This section reviews the cabotage policies of numerous countries located in the Caribbean/South Atlantic coast and then moves into the Pacific.

Cuban cabotage is restricted to vessels flying the Cuban pavilion and manned by Cuban crews (Asamblea Nacional del Poder Popular de Cuba, 2013). If no Cuban-flagged vessels are available to provide such services or if the services to be performed demand specific vessels, foreign vessels can be used subject to an authorisation issued by the National Maritime Authority. The concept of public service can be applied to cabotage services that need to be operated regularly to guarantee the service frequency (Asamblea Nacional del Poder Popular de Cuba, 2013).

Only Honduran-flagged vessels owned by Honduran shipping companies are entitled to cabotage trades (Congreso Nacional de Honduras, 2004); however, Dirección General de la Marina Mercante Nacional may authorise foreign vessels (particularly the Centro American flagged ones) to service these trades if no Honduran flagged vessels are available. The legal framework requests that Honduran shipowners or legal established entities incorporated under the Honduran law own 51 per cent of the vessels, and consequently of the company’s capital, and apply for a licence granted by Dirección General de la Marina Mercante (Congreso Nacional de Honduras, 2004). Vessels must be manned by a crew made up, if possible, of at least 90 per cent of Honduran citizens (Secoff, 2016).

Nicaraguan legislation determines that cabotage is to be performed by nationals, i.e. Nicaraguan shipowners or Nicaraguan legal entities, only and that they control 51 per cent
of the company’s capital, which means that these vessels must be registered in Nicaragua (Consejo de Ministros de Nicaragua, 1972). Centro American fleets can engage in these trades if no Nicaraguan vessels are available, if the same ownership principle applies, and if a reciprocity principle has been established between Nicaragua and the country where the foreign vessel is registered. Dirección General de Transporte Acuático can allow that national shipowners use foreign vessels temporarily whenever no Nicaraguan or Central American vessels are available to perform the service (Asamblea Nacional de la República de Nicaragua, 2001). To offer cabotage services, nationals must apply for a licence granted by Ministerio de Economía.

In Costa Rica, cabotage is restricted to Costa Rica flagged vessels and to nationals or legal entities incorporated under Costa Rica laws, which own 60 per cent of the shipping company’s capital (Ministerio de Obras Públicas y Transportes de Costa Rica, 1958). Shipping companies must apply for a cabotage licence granted by Ministerio de Seguridad Pública; the regular cabotage services are considered of national interest and therefore seen as public services (Ministerio de Obras Públicas y Transportes de Costa Rica, 1960).

Before June 2013, the Panamanian cabotage used to be liberalised (Presidente de la República de Panamá, 1998) and was under the control of many foreigner operators, which accounted for about 80 per cent of all cabotage companies. From June 2013 onwards, the Panamanian Government enforced new rules to protect the national industry against unfair competition and to limit the participation of foreign investment in Panamanian cabotage companies (Asamblea Nacional de Diputados de Panamá, 2013; Critica, 2013). Vessels involved in the cabotage market need to be manned by a crew made up of 90 per cent nationals and 75 per cent of shipping companies’ capital needs to be in the hands of Panamanians, even though it was expected that 80 per cent of cabotage shipping companies would still be owned by foreigners (Berrocal and Rojas, 2013).

Venezuelan cabotage services can only be provided by Venezuelan flagged vessels (Ministerio del Poder Popular para Transporte Acuático y Aéreo de Venezuela, 2014). To operate in the cabotage market, shipowners and shipping companies incorporated under the Venezuelan law need to apply for a permit granted by the Instituto Nacional de los Espacios Acuáticos independently of operating national or foreign vessels. Venezuelan flagged vessels must be manned by a crew where the Captain, 50 per cent of the officers and 50 per cent of the ratings are Venezuelan citizens. Foreign vessels need to incorporate in their crew Venezuelan students during the time they operate in the cabotage market.

Brazilian cabotage is legally defined and is seen as an alternative mode of transport within the scope of port modernisation, waterborne traffic safety and within the Brazilian trade liberalisation framework established under the Mercosur Agreement (Presidência da República do Brasil, 1997a; Paixão Casaca et al., 2017a). Subject to the 1988 Constitution, only shipping companies incorporated under the Brazilian law can serve the cabotage market even if they have been constituted with foreign capital, meaning that cabotage vessels must fly the Brazilian pavilion (Presidência da República do Brasil, 1988). Cabotage has been slightly relaxed through the introduction of two measures. The first one allows Brazilian shipping companies to charter-in foreign vessels, and the second one allows shipping companies with foreign vessels to use part of their slots to move cabotage cargoes (Presidência da República do Brasil, 1995; 1997a; 1997b). In both cases, the legislative acts determine the conditions under which the allowances apply.

Uruguayan cabotage is reserved to Uruguayan flagged vessels, i.e. vessels that fulfil with the rules that govern cabotage and are manned by crews where at least 75 per cent of their members are nationals, including the captain, the chief engineer and the radio officer (Ministerio de Defensa Nacional de Uruguay, 1954; Ministerio de Transporte y Obras...
The participation of foreign investment in cabotage shipping companies is limited, as Uruguayan citizens need to control 51 per cent of shipping companies’ capital (Ministerio de Transporte y Obras Públicas de Uruguay, 1977).

Argentinean legislation on cabotage dates back from 1944 (Dirección Nacional del Sistema Argentino de Información Jurídica, 1944) and has been subject to several amendments, the last of which occurred in 2013. Cabotage can only be performed by Argentinean vessels that are registered under the Argentinean flag and manned by a crew, made up by at least 25 per cent of Argentinians including the captain and officers. Subject to Law No. 12.980, the national executive is authorised to grant temporary permits to foreign vessels when they are needed for special undertakings, which the existing domestic vessels are not able to serve. In case foreign vessels operate the cabotage trades for period above 30 days, they must be manned by an Argentinean crew (Ministerio de Trabajo, Empleo y Seguridad Social de la Nación de Argentina, 2004). Argentinean shipping companies may engage in coastal trades without permission (CEPAL, 2001).

Similar to Brazil, the Chilean cabotage concept is legally defined (Ministerio de Transportes y Telecomunicaciones de Chile, 1979; Ministerio de Hacienda de Chile, 2005). Cabotage is reserved to Chilean flagged vessels and Chilean companies do not need to apply for a cabotage permit (CEPAL, 2001). Foreign vessels can participate in cabotage trades when cargo volumes are above 900 tons and as long as public bidding has taken place in due time. For cargo volumes equal or lower than 900 tons and if no Chilean vessels are available, the maritime authority may allow the participation of foreign vessels. A vessel or a shipping company is considered Chilean, if nationals or legal entities hold more than 50 per cent of the shipping company (Boske, 2001). Boske goes on saying that Chile has not adopted an operational subsidy policy but subsidies are granted to shipments destined to remote areas, which are not served regularly by any cabotage or passenger service.

Peru enforces a very strict cabotage regime (Congreso de la Republica de Peru, 2005, 2009, 2011); only Peruvian flagged vessels can carry cargo between two national ports, as the law prohibits the employment of foreign vessels. These vessels must be built in Peru, manned by a crew made up of at least 85 per cent of Peruvian nationals and at least 51 per cent owned by a Peruvian citizens or by Peruvian legal entities incorporated under the Peruvian law, with their head office in Peru, operating vessels either under financial leasings or bareboat chartering arrangements with mandatory purchasing options (International Business Publications, 2015). Such restrictions exist because the Peruvian government wants to protect and promote the development of national transport facilities to which should be added the limited traffic that exists between the main Peruvian generating and receiving centres and the competition from road transport, which offers a much more flexible service (Boske, 2001). Peruvian shipowners or legal entities must apply for operating permits and no special rates apply for cabotage, and when no Peruvian vessels are available to move cargo between Peruvian ports, they can charter-in foreign vessels for a period not exceeding six months. Cabotage trades can also be performed by member-states of the Andean Community in accordance with the international conventions as long as the reciprocity principle applies. According to Boske (2001), Peru has traditionally subsidised shipping companies operating in the cabotage trades through below-market fuel prices.

The Colombian cabotage market is restricted either to national shipowners or to legal entities incorporated under Colombian law, whose main domicile is located in Colombia (Republica de Colombia, 2001). They must apply for a licence, need to have at least one vessel registered under the Colombian flag and control at least 60 per cent of its ownership, which means that foreign capital cannot be over 40 per cent (Boske, 2001; Ministerio de Comercio, Industria y Turismo de Colombia, 2006). Cabotage is to be serviced by Colombian
flagged vessels, although foreign vessels can be temporarily used albeit subject to an
authorisation issued by Dirección General Marítima. Both national shipowners and legal
entities incorporated under the Colombian law can charter foreign-in vessels for certain
voyages whenever they are allowed to. Colombian flagged vessels need to be crewed by a
Colombian crew (captain, officers and ratings). Shipping companies operating in the
cabotage market are prevented from providing services in the international market.

In Ecuador, cargo and passenger cabotage is restricted to Ecuadorian flagged vessels,
which are registered under the Ecuadorian flag, even though Ecuadorian shipowners are
granted the freedom to use any foreign vessel under any chartering agreement in accordance
with the characteristics of the trade, if authorisation has been granted by Dirección General
de la Marina Mercante (Congreso Nacional de Ecuador, 1992; Dirección General de La
Marina Mercante y del Litoral de Ecuador, 2001; Congreso Nacional de Ecuador, 1992;
Presidente Constitucional Interino de La República de Ecuador, 1997). Like in Peru, cabotage
trades can be performed by Member-States of the Andean Community in accordance with
the international conventions as long as the reciprocity principle applies. The exception
applies the transport of oil, which is granted only to Ecuadorian shipping companies in
which the state holds 51 per cent of the capital (Congreso Nacional de Ecuador, 1992;
Comision de la Comunidad Andina, 2006). Vessels must be owned by Ecuadorian citizens
and companies with their head offices domiciled in Ecuador and incorporated under
Ecuadorian law and manned by an Ecuadorian crew, whose captain must always be of an
Ecuadorian nationality (Moncayo, 2011); however, Dirección General de la Marina Mercante
may authorise foreigner officers and ratings if this need is duly justified (Presidente
Constitucional Interino de La República de Ecuador, 1997). Similar to Peru, Ecuador has
traditionally subsidised firms engaged in cabotage trade through below-market fuel prices
(Boske, 2001).

6. Protectionist vs liberalised cabotage policies
The analysis on worldwide cabotage policies shows that even if one tries to split the world
in geographical areas, the analysis ends up being performed from a country’s perspective;
for this reason, the discussion is presented from regional and country’s perspectives.

From a regional perspective, the analysis suggests that countries belonging to the same
region in the world, as is the cases of the North and Latin Americas, tend to adopt very
similar cabotage regimes. While such a choice could be based on countries’ economic
development that cannot be the case, as the North and Latin American countries’ economic
development differs greatly. Out of seven regional areas, the most advanced one in what
concerns the development of cabotage policies is the EEA. The region’s has managed to
implement a two-tier legal framework because of the principles and values that govern this
economic region. The region benefits from a stable policy framework that was devised to
support the development of the internal market and which will continue to exist after the UK
leaves officially the EU. However, the impact of this exit on the UK shipowners, which
currently have access to the EU cabotage market, is unknown.

The political changes that have taken place in some African countries since they have
been granted independence had almost no or very little impact in terms of cabotage laws
and operations. Trade along the African coastal waters is still dominated by non-African
shipping companies to the extent that African commodities and raw materials, which are
often exchanged for low quality, over-priced, foreign-manufactured goods, are still carried
on board foreign vessels (Ezeanya, 2013). Ezeanya goes on saying that African coastal
waters remain largely unregulated which explains why this freedom of sailing from one
coast of the continent to another exists.
Asian cabotage also presents a wide range of well-established cabotage policies, which highlights the difference of opinion on the subject matter. While some of them have been stagnant, as is the case of the Japanese cabotage regime, others have evolved with time to accommodate market changes; this is the case of India, Malaysia, Indonesia and China; in fact, the Malaysia and Indonesia cabotage policies are two noteworthy case studies. Within the Asian cabotage context, certain countries are willing to go one-step further and promote the development of their cabotage services albeit at an international level as a means to increase economic and trade activities between countries. This is the case of the Coastal Shipping Treaty, a bilateral agreement signed between Bangladesh and India in 2015. Another example is the development of Coastal Shipping connecting Thailand–Cambodia–Vietnam. Whether this is a first step to create an Asian short sea shipping area, is too early to tell although the potential does exist.

The analysis also suggests that from a regional perspective, North and Latin Americas adopted very similar protected cabotage regimes and are stable. Out of these countries, Canada appears to be the only one that shows a potential for changes to occur in light of the Comprehensive Economic and Trade Agreement signed between Canada and the EU. Moreover, the analysis suggests that the assumption that protected cabotage regimes constitute the pillar towards the development of national shipping industries is a formula that works for some countries (Malaysia and Indonesia) but certainly not for others (Brazil). In the latter case, the connection between the maritime industry and the shipbuilding industry did not work, and the research performed by Paixão Casaca et al. (2017a, 2017b) provides some insights into the reasons for this failure.

Cabotage in Oceania has been dominated by Australia. Since 2012, Australia has been trying to find the right policy, but whether it will succeed is unknown in light of the strict working conditions that prevent Australian flagged vessels to compete with their foreign counterparts. Despite this turbulence, its neighbouring country, i.e. New Zealand, benefits from a stable cabotage environment, assuming that stable environments do exist in this industry. In the remaining geographic areas of the globe, there is a mix of protected and liberalised cabotage policies regimes, namely the EEA and the Former Soviet Union and Middle East.

From a country’s perspective, the analysis shows that that most countries tend to adopt protectionist cabotage policies either under cargo reservation schemes, through the implementation of specific cabotage legislation, under the countries’ commercial/trade codes, or within the scope of the laws that govern their maritime transport activity. The analysis also indicates that the different countries have implemented their cabotage regimes in different ways.

A reduced number of countries such as Japan, the USA and Peru have adopted strict cabotage policies. More recently, Nigeria, which for many years has operated cabotage services in a liberalised environment, also adopted a strict cabotage regime. The problem with Nigeria is that the act enforcing the new regime is far from being implemented and so market liberalisation is still in force. Strict cabotage policies imply that:

- The controlling shares of shipping companies must be, at least 51 per cent, in hands of nationals.
- The vessel ownership must be, at least 51 per cent, in hands of nationals so that vessels bought by those companies belong to a national fleet.
- Shipbuilding and repairs are performed by national companies.
- Vessels are obliged to be registered under the national flag and crewed in total or partially by nationals.
Malaysia and Indonesia at a point in time also adopted strict cabotage policies to revitalise their domestic shipping industries after having liberalised policies for a number of years. However, at a later stage, both countries’ governments have revoked those policies in certain segments of the cabotage market in order that both economies did not suffer from any bottlenecks that could affect their growth, even though this openness is clearer in Malaysia than in Indonesia.

The ability to change the direction of the policy is a lesson to be learnt; because of these changes, these countries fall today within the scope of partially protected cabotage policies (Table II). Other countries falling within the scope of these policies include Mozambique, China and Egypt. Mozambique has created a special shipping registry to allow foreign vessels in their cabotage markets. The Chinese liberalisation of cabotage falls within the scope of the container shipping market to ease the movement of containers and to foster movement, the government has allowed certain ports to relax their cabotage trades. The question that follows concerns the impact that this policy measure will have on the existing maritime routes and what will be the role of Hong-Kong as a hub port since worse case scenarios expectations indicate that it could lose about 14 per cent of its throughput (Mooney, 2017).

Controlled protectionist cabotage policies have been the scope of a wide range of countries as is the case of South Korea, Myanmar, Thailand, Vietnam, Taiwan, Canada and Mexico among many other countries; they allow the participation of foreign vessels in their cabotage trades whenever necessary. A recent example is Panama, which introduced a cabotage law mainly for market and employment control purposes after having in place a liberalised cabotage policy for many years.

It is also clear from the analysis that countries, which have adopted protected cabotage policies, tend to incorporate within their legislation a set of policy elements that are very similar to each other. These include:

- the nationality of the shipping company;
- the ownership structure of the shipping company;
- the limitation to foreign investment;
- the flag under which vessels operating in cabotage are registered;
- the percentage of nationals within the crew that man the vessels;
- the necessity or not to apply for a licence;
- the possibility to charter in foreign-flagged vessels if no national vessels are available; and
- if the principle of reciprocity applies.

Australia falls within the scope of controlled liberalised cabotage policies because of its unique licence scheme. Finally, numerous countries have chosen to adopt liberalised cabotage regimes; they include the UK, South Africa, Namibia, UAE and Lebanon. The result of this long and complex analytical process is summarised in Table I, which allocates the different cabotage policies within the scope of one of the five categories of cabotage policies.

Based on the liberalised and protectionist trade policies assumptions and taking into account:

- the maritime industry body of literature; and
- the policy documents used in the analysis performed in Sections 4 and 5, the analysis lists the potential reasons that lead decision makers choose liberalised or protectionist cabotage policies.
Table II lists the reasons for adopting liberalised cabotage policies; the outcome suggests that they fall within the scope of strategy, economy, operations, marketing, education and environment. An insight into the list of economic, strategic operational and marketing reasons shows that they are related to the economy of the country and to the economy of vessel. Liberalised cabotage policies can support the competitiveness of economic activities, which results in an increasing market share at regional, international and global levels. From the perspective of the vessel’s economy, they can contribute to find new ways of operation that contribute to lower freight rates as ship operators will be able to outsource their supplies worldwide. In the end, only the most effective and efficient companies will survive.

The focus on education and environmental reasons is particularly relevant. First, liberalised cabotage policies allow ship operators to be innovative through the operation of more technological advanced units, which may require a specific maritime expertise, i.e. highly qualified personnel that possess skills and competencies that are hard to imitate, and who are prepared to deal with new technologies. This comes up as an opportunity to nautical schools to update their training programmes to meet market needs and to engage

<table>
<thead>
<tr>
<th>Type of policy</th>
<th>Definition</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully protected cabotage policies</td>
<td>Policies that fully protect the maritime cabotage industry and which do not allow foreign shipowners. When they do, very strict conditions apply for very short periods</td>
<td>Japan, the USA, Peru</td>
</tr>
<tr>
<td>Controlled protectionist cabotage policies</td>
<td>Policies that protect the maritime cabotage industry, but which allow the entrance of foreign owners under controlled condition through the granting of permits or licences</td>
<td>France, Germany, Italy, Greece, Portugal, Spain, Finland, Sweden, Lithuania, Slovenia, Bulgaria, Romania, Croatia, Angola, Morocco, Libya, Tanzania, Kenya, Turkey, Russia, Jordan, India, South Korea, Myanmar, Thailand, Vietnamese, Taiwan, Canada, Mexico, Cuba, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Brazil, Uruguay, Argentine, Chile, Colombia, Ecuador, The Philippines, New Zealand</td>
</tr>
<tr>
<td>Partially protected cabotage policies</td>
<td>Policies that protect the maritime cabotage industry, but which have adopted liberalized measures in certain cabotage market segments</td>
<td>Mozambique, Malaysia, Indonesia, China, Egypt</td>
</tr>
<tr>
<td>Controlled liberalized cabotage policies</td>
<td>Policies that allow the entrance of foreign shipowners into the maritime cabotage industry at the expense of a licensing system</td>
<td>Australia</td>
</tr>
<tr>
<td>Fully liberalised cabotage policies</td>
<td>Policies that allow the entrance of foreign shipowners into the maritime trades. No limitations exist</td>
<td>Belgium, The Netherlands, Denmark, Ireland, United Kingdom, Norway, Iceland, Malta, Cyprus, Estonia, Latvia, Poland, Nigeria, South Africa, Namibia, United Arab Emirates, Lebanon, Brunei, Cambodia, Singapore</td>
</tr>
</tbody>
</table>

Source: Authors

Table I. Classification of countries’ cabotage policies
### 3A: Reasons for adopting liberalised cabotage policies

<table>
<thead>
<tr>
<th>Category</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Contribute to the development of a robust national logistics strategy</td>
</tr>
<tr>
<td></td>
<td>Overcome the inefficiencies of a protected cabotage market</td>
</tr>
<tr>
<td>Economic</td>
<td>Support the internationalisation and the globalisation of economic activities</td>
</tr>
<tr>
<td></td>
<td>Support the development of the national and of the international economy</td>
</tr>
<tr>
<td></td>
<td>Support the development of national economic activities</td>
</tr>
<tr>
<td></td>
<td>Support a country’s export-oriented industrial strategy</td>
</tr>
<tr>
<td></td>
<td>Promote intra-regional trade</td>
</tr>
<tr>
<td></td>
<td>Promote foreign direct investment within the national cabotage industry</td>
</tr>
<tr>
<td></td>
<td>Get access to international financing</td>
</tr>
<tr>
<td></td>
<td>Get access to the international shipbuilding industry/Allow the ordering of vessels in the foreign market</td>
</tr>
<tr>
<td></td>
<td>Removing import duties on foreign built vessels and on 2nd hand vessels</td>
</tr>
<tr>
<td></td>
<td>Promote the development of maritime logistics</td>
</tr>
<tr>
<td></td>
<td>Promote the use of new innovative technologies</td>
</tr>
<tr>
<td></td>
<td>Lower the overall costs of cabotage operations</td>
</tr>
<tr>
<td></td>
<td>Lower vessels operating costs particularly those related to crewing</td>
</tr>
<tr>
<td></td>
<td>Lower maritime cabotage freight rates</td>
</tr>
<tr>
<td>Operational</td>
<td>Promote competition among the different transport modes</td>
</tr>
<tr>
<td></td>
<td>Contribute to a level playing field among the different transport modes</td>
</tr>
<tr>
<td></td>
<td>Avoid the destruction of the commercial freedom of the seas</td>
</tr>
<tr>
<td></td>
<td>Eliminate cabotage market distortions</td>
</tr>
<tr>
<td></td>
<td>Promote and enhance the cooperation among the different transport modes operators</td>
</tr>
<tr>
<td></td>
<td>Promote competition among the different cabotage companies</td>
</tr>
<tr>
<td></td>
<td>Enlarge the freedom of shippers’ choice</td>
</tr>
<tr>
<td></td>
<td>Enlarge the range of services offered by cabotage vessels</td>
</tr>
<tr>
<td>Educational</td>
<td>Contribute to the development of the nautical/maritime education and training</td>
</tr>
<tr>
<td></td>
<td>Promote R&amp;D at different maritime levels</td>
</tr>
<tr>
<td>Environmental</td>
<td>Promote the development of integrated transport operations</td>
</tr>
<tr>
<td></td>
<td>Promote the development of multimodality/intermodality/co-modality</td>
</tr>
<tr>
<td></td>
<td>Contribute to modal shift from road to sea</td>
</tr>
<tr>
<td></td>
<td>Promote the development of an integrated and environmentally friendly transport policy</td>
</tr>
</tbody>
</table>

### 3B: Reasons for adopting protectionist cabotage policies

<table>
<thead>
<tr>
<th>Category</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Cabotage is seen as a strategic industry and for this reason needs to be protected</td>
</tr>
<tr>
<td></td>
<td>Develop a policy of nationalism where the cabotage fleet is built up for prestige and strategic considerations</td>
</tr>
<tr>
<td></td>
<td>Control the quality of vessels employed in the provision of cabotage services</td>
</tr>
<tr>
<td></td>
<td>Protect the national flag, national fleet and national owners</td>
</tr>
<tr>
<td></td>
<td>Support cabotage for reasons of national security/defence purposes</td>
</tr>
<tr>
<td>Legal</td>
<td>Enforce the compliance of national and internationalisation legislation</td>
</tr>
<tr>
<td>Economic</td>
<td>Guarantee that cabotage vessels fulfil with the international and national legislation</td>
</tr>
<tr>
<td></td>
<td>Increase the value of the cabotage contribution to the balance of payments</td>
</tr>
<tr>
<td></td>
<td>Guarantee the viability of national cabotage companies</td>
</tr>
<tr>
<td></td>
<td>Promote the development of the national shipbuilding industry</td>
</tr>
<tr>
<td></td>
<td>Protect an infant cabotage industry until it is sufficiently strong to compete in the international market</td>
</tr>
<tr>
<td></td>
<td>Protect a mature cabotage industry from international competition</td>
</tr>
<tr>
<td></td>
<td>Protect the cabotage industry against dumping (predatory pricing)</td>
</tr>
<tr>
<td></td>
<td>Protect the domestic industry from foreign competition</td>
</tr>
<tr>
<td></td>
<td>Support cargo reservation schemes</td>
</tr>
<tr>
<td></td>
<td>Modernize the cabotage fleet in order to make it more competitive</td>
</tr>
</tbody>
</table>

(continued)
Second, and despite the environmental pressures that the industry has been subject to lower the percentage of gases emissions going into the atmosphere, shipping is still environmentally friendly and in this regard liberalised cabotage policies may allow a better relation between the different modes of transport, particularly a better integration of the sea and road modes. Liberalised cabotage policies will always support maritime logistics, improved port operations, streamlined port procedures that promote both the vessels and ports operational performance.

However, the focus of the policy changes when countries move into protectionist cabotage regimes. Table II lists the reasons for adopting protectionist cabotage policies and indicates that they fall within the scope of six categories (strategic, legal, economic, social, cultural and environmental). An insight into them suggests that, independently of the category, the reasons’ background is of an economic nature as protectionist cabotage policies mainly focus on cost and market control issues. Research and innovation related reasons are non-existent, and in this regard, protectionist cabotage policies target at maintaining the industry’s status-quo. The willingness to develop a competitive cabotage market is very low, as the industry takes for granted some form of “subsidies” to keep it afloat. While it is a fact that such reasons contributed to the flourishing of Malaysian and Indonesian cabotage markets that is not the rule but the exception as both countries are archipelagos and therefore 100 per cent dependent on maritime transport.

To support the above policies, Table list a set of potential policy instruments that decision makers may use when choosing liberalised and protectionist cabotage policies.

In presence of liberalised cabotage trades (Table III), policy instruments fall within the scope of general policy instruments, economic incentives to cabotage companies, port policy and logistics policy instruments as they contribute to foster the competitiveness of the maritime sector. However, a shift occurs in the type of policy instruments used when protectionist policy instruments are used (Table III); apart from the general policy instruments concerning public ownership and flag discrimination instruments, the remaining are of a fiscal and financial nature, which prevents the integration of a country’s economy with the rest of the world. Instead of being a facilitator, cabotage becomes a bottleneck.

However, the information provided in Tables II and III neither indicates which of these reasons influence more the decision makers when they have to choose a cabotage policy to foster the development of their domestic shipping industry nor which policy instruments are more adequate to implement either protectionist or liberalised cabotage policies. Also within

<table>
<thead>
<tr>
<th>Category</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Save hard currency which would be spent if cargo is conveyed in foreign registered ships</td>
</tr>
<tr>
<td>Social</td>
<td>Make cabotage services available to remote areas in a country’s territory, which otherwise would not be commercially viable</td>
</tr>
<tr>
<td>Political</td>
<td>Protect the employment of national crew/preserve maritime jobs</td>
</tr>
<tr>
<td>Cultural</td>
<td>Support cabotage to serve certain trades such as those serving the islands</td>
</tr>
<tr>
<td>Environmental</td>
<td>Secure maritime and shipbuilding know-how</td>
</tr>
<tr>
<td></td>
<td>Develop an environmentally friendly cabotage industry</td>
</tr>
<tr>
<td></td>
<td>Support cabotage for reasons of public safety</td>
</tr>
</tbody>
</table>

Source: Authors  
Table II.
<table>
<thead>
<tr>
<th>Class of instrument</th>
<th>4A: Policy instruments for implementing liberalised cabotage policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>General policy instruments</td>
<td>Enact and enforce legislation towards liberalization of cabotage services</td>
</tr>
<tr>
<td></td>
<td>Enact and enforce national modern systems of law to deal with the cabotage market</td>
</tr>
<tr>
<td></td>
<td>Compliance with the international maritime legislation</td>
</tr>
<tr>
<td></td>
<td>Enforce safety and operating/technical standards on cabotage vessels</td>
</tr>
<tr>
<td></td>
<td>Provide an efficient and widely accepted nautical/maritime education and training for the cabotage market</td>
</tr>
<tr>
<td></td>
<td>Subject to the Maritime Labour Convention establish labour regulations pertaining to conditions of employment, training and certification</td>
</tr>
<tr>
<td></td>
<td>Regulate market entry conditions to ensure a level playing field</td>
</tr>
<tr>
<td></td>
<td>Allow the cabotage market to be run by a range of companies with different organisational structures</td>
</tr>
<tr>
<td></td>
<td>Set up a cabotage observatory/agency to regulate competition and to control monopolistic tendencies</td>
</tr>
<tr>
<td></td>
<td>Promote R&amp;D of maritime economics at different levels including implementing governmental research laboratories, supporting industry R&amp;D, and supporting university R&amp;D</td>
</tr>
<tr>
<td>Economic incentives to cabotage companies</td>
<td>Tonnage tax schemes</td>
</tr>
<tr>
<td></td>
<td>Reduction of crew size</td>
</tr>
<tr>
<td></td>
<td>Offer more attractive employment opportunities to officers and seafarers</td>
</tr>
<tr>
<td>Port policy instruments</td>
<td>Expansion of main and secondary ports</td>
</tr>
<tr>
<td></td>
<td>Provision of dedicated terminals for cabotage services</td>
</tr>
<tr>
<td></td>
<td>Reduce port charges for all cabotage operators</td>
</tr>
<tr>
<td></td>
<td>Implement pilot exemption certificates</td>
</tr>
<tr>
<td>Logistics policies instruments</td>
<td>Establish a well-defined logistics plan supported by a strong economic strategy</td>
</tr>
<tr>
<td></td>
<td>Provide for connectivity between ports and the road/rail network</td>
</tr>
<tr>
<td></td>
<td>Simplify procedures for cabotage services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class of instrument</th>
<th>4B: Policy instruments for implementing protectionist cabotage policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>General policy instruments</td>
<td>Full public ownership of cabotage companies</td>
</tr>
<tr>
<td></td>
<td>Ownership of cabotage companies under public private partnerships</td>
</tr>
<tr>
<td></td>
<td>Flag discrimination policies (allocation of quotas)</td>
</tr>
<tr>
<td></td>
<td>Define foreign participation rules in the cabotage market</td>
</tr>
<tr>
<td>Economic incentives to cabotage companies</td>
<td>Enforce cargo reservation schemes</td>
</tr>
<tr>
<td>Fiscal incentives to cabotage companies</td>
<td>Operating subsidies</td>
</tr>
<tr>
<td></td>
<td>Tax exemptions on the import of new buildings and 2nd hand vessels</td>
</tr>
<tr>
<td></td>
<td>Zero or low corporation tax (i.e. tax exemptions on the income of cabotage companies)</td>
</tr>
<tr>
<td></td>
<td>Exempt customs duties on spares and bunker fuel</td>
</tr>
<tr>
<td></td>
<td>Favourable tax treatment of individuals and partnerships investing into shipping</td>
</tr>
<tr>
<td>Financial incentives to cabotage companies</td>
<td>Accelerated depreciation allowances</td>
</tr>
<tr>
<td></td>
<td>Direct investment grants given to cabotage companies for new and/or second hand ships</td>
</tr>
<tr>
<td></td>
<td>Direct subsidies given to shipyard</td>
</tr>
<tr>
<td></td>
<td>Interest free or low interest loans to shipowners for new tonnage</td>
</tr>
<tr>
<td></td>
<td>Subventions</td>
</tr>
<tr>
<td></td>
<td>Subsidise the national shipbuilding industry in what concerns the construction of cabotage vessels</td>
</tr>
<tr>
<td>Port policy instruments</td>
<td>Public expansion of main and secondary ports</td>
</tr>
<tr>
<td></td>
<td>Public provision of dedicated terminals for cabotage services</td>
</tr>
</tbody>
</table>

**Table III.** Policy instruments for implementing liberalised and protectionist cabotage policies

**Source:** Authors
the scope of the analysis performed and if it is assumed that governments have adopted any of the several existing policy making models (College of the Liberal Arts, 2017), to define their cabotage policies, it is clear from the information gathered that there is no evidence about the policy instruments that governments/public authorities have been using to implement their cabotage policies. A negative issue since it prevents from performing a thorough assessment of the success/failure of the different maritime cabotage policies’ implementation.

7. Conclusions
The paper achieved its objectives. It investigated the analyses, from a geographical perspective, different countries’ cabotage policies and classified them and identified in a systematically way a set of reasons and policy instruments that support each of chosen policies approach. An immediate conclusion to be drawn is that only very few countries promote liberalised cabotage polices; the majority of them, as per the analysis, chose a protectionist regime. The reasons that lead decision makers to support both policy approaches and the policy instruments used in each of the policies have also been listed. Although the lists are comprehensive, they fail to identify which of them are more relevant to decision makers. Therefore, the following questions are valid.

Q1. What reasons influence the decision makers when deciding on a protectionist or liberalised cabotage policy?

Q2. Which policy instruments suit better either the protected or the liberalised cabotage market?

Such information may help policymakers to better sustain the design of new policies and to better promote possible changes in existing policies using the most adequate policy instruments that contribute to the successful implementation of the chosen policies. The limitation of this study falls on the numerous countries that were not addressed because no information was gathered given the limited scope of time to carry out the research and length of the paper.

References
Assembleia Nacional Angolana (2012), Lei No. 27/12 de 28 de Agosto, Lei da Marinha Mercante, portos e Actividades Conexas, Diário da República Ia Série N.º 166, 28 de Agosto 2012, pp. 3870-3908.


Conselho de Ministros de Moçambique (2016), Decreto n. 35/2016 – Autoriza o Registo Especial de Navios no Transporte Marítimo de Cabotagem para permitir que navios estrangeiros possam ser utilizados nesta actividade arvorando a Bandeira Nacional, Boletim da República, 1a Serie, Nº 104, 31 de Agosto de 2016.


Ministério dos Transportes e Comunicações de Angola (1989a), Decreto n° 30/89, Diário da República, 1a Série, N° 26, 8 de Julho de 1989.


Ministérios das Finanças e dos Transportes de Angola (2008), Decreto executivo conjunto n.° 323/08 de 16 de Dezembro, Diário da República, 1a Serie - N.° 236, 16 de Dezembro de 2008.


Further reading


Corresponding author
Ana Cristina Paixão Casaca can be contacted at: anaccasaca@sapo.pt

For instructions on how to order reprints of this article, please visit our website: www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: permissions@emeraldinsight.com
Liner shipping alliances and their impact on shipping connectivity in Southeast Asia
Wei Yim Yap and Seyed Mehdi Zahraei
School of Business, Singapore University of Social Sciences, Singapore

Abstract
Purpose – The liner shipping industry underwent a major round of change between 2014 and 2017 where the concentration ratio of the top ten carriers rose from 64 per cent in 2013 to 82 per cent by 2017. This paper aims to analyze the impact of these developments on the state of shipping connectivity for major container transshipment hubs in Southeast Asia, namely, Port Klang, Singapore and Tanjung Pelepas.

Design/methodology/approach – The developments in shipping services deployed before and after the latest round of reshuffling in the liner shipping industry were analyzed.

Findings – Significant service rationalization took place in the period that saw 38 per cent reduction in the number of shipping services called at the ports. Participation in alliance arrangement was revealed to be important for shipping lines to compete successfully on the Asia–Europe trade route in the new shipping landscape. Terminal operators should expect further rationalization of services should overcapacity persist. Maintaining hub status would require the ability to accommodate the strategic, operational and commercial requirements of the entire alliance rather than just focusing on the key shipping line.

Originality/value – This is the first paper to examine the effects of the latest round of consolidation in the liner shipping industry. In-depth analyses were conducted for shipping services where the service configuration was examined. The case of Southeast Asia and the Asia–Europe trade route was used to illustrate the impact with managerial and policy implications for shipping lines, terminal operators and port authorities.

Keywords Southeast Asia, Shipping alliance, Asia–Europe trade, Shipping connectivity

1. Introduction
The liner shipping industry underwent a major round of shuffle between 2014 and 2017. The period saw the dissolution of the G6 Alliance and CHKYE Alliance as a result of the bankruptcy of Hanjin as well as mergers and acquisitions involving container shipping lines Maersk, CMA CGM, COSCO, China Shipping, OOCL, APL, Hamburg-Süd, CSAV, CCNI and UASC. The result was the formation of three shipping alliances which are the 2M alliance, Ocean Alliance and The Alliance. These developments affected more than 80 per cent of the global container fleet capacity with fourteen out of the top fifteen container shipping lines belonging to an alliance. The concentration ratio of the top ten carriers increased further from 64 per cent in 2013 to reach 82 per cent by 2017 (Alphaliner, 2013, 2017a). A list of events detailing container shipping lines affected is shown in Table I.

The Asia–Europe trade is a major east–west container trade. Container traffic on the trade route is estimated at 23 million TEUs in 2017 (UNCTAD, 2017). The trade route connects major load centers of East Asia with that of Europe and the Mediterranean region. Shipping lines that ply along the trade route also call at key ports in Southeast Asia, South
Asia and the Middle East. It is worth noting that the eighteen busiest container ports in the world are located along the Asia–Europe trade route. Of these, the ports of Singapore, Port Klang and Tanjung Pelepas were ranked 2nd, 12th and 18th, respectively, in 2015 where they accounted for almost 100 per cent of Southeast Asia’s transshipment throughput (Lam and Yap, 2008). The Asia–Europe trade is also an important market for transshipment traffic for the ports of Singapore, Port Klang and Tanjung Pelepas (Yap and Notteboom, 2011). In 2015, the three ports handled 51.6 million TEUs of containers (American Association of Port Authorities, 2017). Of this amount, 80.6 per cent or 41.6 million TEUs consisted of transshipment containers thereby presenting the region as one of the largest container transshipment markets in the world.

Southeast Asia is a major transshipment market in the world with all three shipping alliances having well-developed shipping service connectivity in the ports of Singapore, Port Klang and Tanjung Pelepas (Lam and Yap, 2008). However, the literature has not adequately addressed the issue of connectivity from the perspective of relationships between two ports. This will require investigation into the direction of ship routing as well as frequency of calls for the set of ports involved. Furthermore, network reorganization as a result of consolidation and changes in alliance memberships will trigger new dynamics in the container shipping scene. In view of the aforementioned events which took place in the liner industry, they warrant investigation into the impact these developments have on the container shipping and port landscape. As such, the paper aims to examine the impact of recent developments in alliance membership over the period from 2013 to 2017 on liner connectivity for each of these major container hubs for the Asia–Europe trade route. The paper is organized as follows. In the next section, we cover research efforts devoted to this subject. Section three presents the research methodology. In section four, we discuss the results of our analysis and implications from the managerial and policy perspectives. Section five concludes with recommendations for future research.
2. Literature review

Shipping lines engage in alliances to reap perceived strategic, commercial and operational objectives in a bid to gain an advantage over rival companies. Ryoo and Lee (2002) suggested that cooperative behavior could enhance network reach and frequency of connections compared to competing carriers. The capital intensive and highly competitive nature of container shipping line operations has resulted in a few shipping lines dominating the market (Chao, 2017). Lam (2013) observed from a supply chain perspective that shipping lines integrate their fleet capacity to realize economies linked to a larger cargo volume and lower unit cost of operation. The benefits of shipping alliances also included enhanced operational synergy and efficiency through the form of slot sharing and joint services (Evangelista and Morvillo, 1999; Ryoo and Thanopoulou, 1999), and Slack et al. (2002) noted that wider markets could be accessed through shipping alliances. Wen (2012) also observed that collaborative arrangements served to boost logistics capability and competitive advantage of shipping lines.

Nonetheless, container shipping alliances were found to be inherently unstable having seen structural changes over the years (Das, 2011). Rau and Spinker (2017) observed that the intensity of competition, cost of complexity of the alliance and volatility in freight rate led to alliance instability. Ferrari et al. (2008) highlighted that optimizing shipping networks could aid the success of shipping alliances, and Midoro and Pitto (2000) pointed out that stability and efficiency of shipping alliances could be strengthened with fewer partners with clear differentiating of roles and contributions, and through coordinating marketing and sales. Yang et al. (2011) also observed that the strategy of jointly using mega ships focusing on lowering unit costs for members would aid alliance stability.

On the issue of connectivity, shipping networks offer a practical avenue to determine, quantify and evaluate connectivity based on their origin–destination pairings of specific port nodes. A formal approach to capture parameters associated with connectivity was developed by Tang et al. (2011) which included trade volume, cargo traffic, port calls, port draft, port charges, turnaround time, operating hours and the factor of intermodal transport. Calatayud et al. (2017) emphasized that connectivity should be investigated and measured in relation to alternative routings that are deemed relevant in view of the dynamic nature of global trade movements and the way of response by shipping lines. These effects would determine the position of a port in the context of shipping networks and thereby reveal its connectivity. However, Lam and Yap (2011) found that establishing the presence of connectivity between two ports is not sufficient because it does not reveal the relationship between these ports. The relationship could be one of intense competition or complementarity depending on the nature of the trade network where the ports are intended to serve. Yap and Lam (2013) further highlighted that shipping connectivity is an important issue for countries that rely on shipping networks for direct market access to international trade. Toward this purpose, container ports that serve these countries would be required to have the necessary facilities to accommodate the shipping networks and associated shipping capacity.

The latest developments in the container shipping industry are unprecedented in their scales which affected all the major container trades involving more than 80 per cent of global container fleet capacity (Alphaliner, 2017a). The impact on connectivity as a result of these developments has not been addressed in the literature. As such, this paper attempts to investigate the impact of these developments in the context of the Asia–Europe trade route with a focus on the three container transshipment hubs in Southeast Asia. The investigation will also research into the dynamics of port competition and port complementarity between these ports through developments in shipping connectivity that are provided by shipping
networks. The research will also attempt to shed light on important implications from the perspective of contestability, terminal investments and capacity development for port managers and policy makers.

3. Research methodology
The focus of the research is on the Asia–Europe container trade and the geographical region of Southeast Asia. Container ports selected for our research are the ports of Port Klang, Singapore and Tanjung Pelepas. We begin from the perspective that container shipping services that operate on the Asia–Europe trade route might be deployed to call at different ports, have different order of calls among the three ports and be alliance or non-alliance members. We use $k_{z,q}^m$ to distinguish container shipping services with these different characteristics, where $z$ determines if service $k$ operates under the aegis of any shipping alliances, $q$ denotes the order of calls by service $k$ and $m$ denotes the arrangements of the port-calls by service $k$. $m$, $q$ and $z$ values are determined as follows:

$$z = \begin{cases} 
0 & \text{non-alliance member} \\
1 & \text{alliance member} 
\end{cases}$$

$$q = \begin{cases} 
1 & \text{Westbound only} \\
2 & \text{Eastbound only} \\
3 & \text{Westbound & Eastbound} 
\end{cases}$$

$$m = \begin{cases} 
0 & \text{non of the three ports} \\
1 & \text{only Singapore} \\
2 & \text{only Port Klang} \\
3 & \text{only Tanjung Pelepas} \\
4 & \text{Singapore & Port Klang} \\
5 & \text{Singapore & Tanjung Pelepas} \\
6 & \text{Port Klang & Tanjung Pelepas} \\
7 & \text{all the three ports} 
\end{cases}$$

For instance, if service $k$ is not an alliance member, on the Eastbound only, and calls at only Singapore port among these three ports, the notation will be $k_{0,2}^1$. Empirical analysis of the results shall be made using the Venn diagram depicted in Figure 1. The triple helix distinguishes between the nature of those services identified that called at the selected ports.

Figure 1.
Categorization and analysis of shipping services calling at Singapore, Port Klang and Tanjung Pelepas on the Asia–Europe trade route.
including the port-of-rotation involved in the network as well as whether these were operated by shipping alliances or otherwise.

The proposed research framework is summarized in Figure 2. The research approach considered five differentiating factors to identify those sets of relevant services. The first differentiating factor is to identify those services that are plying on the Asia–Europe trade route. These services are distinguished by their port-of-calls to include a set of ports that are located in East Asia and another set of ports that are located in Europe. Container shipping services that ply on the Asia–Europe trade would include both sets of ports in the same service loop. The second differentiating factor is to determine if those services, that have been identified to operate on the Asia–Europe trade route, have been called at either of the three ports specified in our research. This step is necessary, as there could be shipping services that bypass all of the three ports for the trade route. Our interest is to identify those shipping services that are calling either at Singapore, Port Klang or Tanjung Pelepas. Having identified the relevant data set for the analysis, the third step is to determine the nature of service calls made. These are differentiated by those that consist of exclusive calls, which is for \( m = 1, 2 \) or 3 or those that consist of parallel calls made at two or more of the selected ports where \( m = 4, 5, 6 \) or 7. Analysis into the nature of the port call is important for revealing the dynamics of relationships between the three selected ports. Calls that were made solely at one port and not at any of the other two ports in relation to the shipping network operated by the carrier or members of a shipping alliance could be an indication of hub status for the former. In the case for parallel calls, ports which are included in the port-of-rotation would indicate higher priority in the service network. This information can be obtained by analyzing the ports of rotation for each service.

Having determined the nature of the service call, the fourth differentiating factor is to distinguish whether calls were made on an eastbound journey or a westbound journey or

---

**Figure 2.** Framework to identify the nature of shipping services calling at Singapore, Port Klang and Tanjung Pelepas on the Asia–Europe trade route
being made on both the head haul and back haul legs of the service. Head haul traffic would involve calls made on a westbound voyage (i.e. Asia–Europe) whereas eastbound voyages (i.e. Europe–Asia) would indicate back haul traffic in view of the location of the three container ports with respect to the flow of international trade on the route trade. Looking within the trade, the focus is on the head haul traffic which totaled 15.5 million TEUs in 2017 (UNCTAD, 2017, p. 12). This volume is twice that of the back haul traffic on the eastbound voyage at 7.6 million TEUs. Hence, a port which receives calls for only the westbound voyage could indicate higher priority in the shipping service network compared to a port which receives calls for only the eastbound voyage. Calls that were made on both legs of the service loop are denoted by \( q \) taking the value of “3” and could likely indicate hub status for the port with respect to the organization of the line’s shipping network. Names of the shipping services and shipping lines involved can be determined in the subsequent step. The services can also be differentiated into those that are operated as part of an alliance network which is denoted by \( z \) taking the value of “1” as opposed to those services that are operated independent of alliances which is denoted by \( z \) taking value of “0”. The results are analyzed in the final step which takes into consideration the characteristics of the shipping services identified in the research. Information for container shipping services was sourced from Containerisation International Yearbook 2013 (Informa plc, 2013) and Alphaliner (2017b). The analysis focused on the period lasting from year 2013 to 2017 to capture the recent developments that took place in the liner shipping industry with respect to alliance reshuffles and mergers and acquisitions.

4. Findings and implications

4.1 Discussion of findings

The results were organized into two time periods namely year 2013 which preceded the latest round of merger and acquisition and alliance reshuffle activity and 2017 which represents the more recent situation for the liner industry. Results for our analysis are shown in Figure 3.

![Figure 3. Shipping connectivity by liner services for Singapore, Port Klang and Tanjung Pelepas (2013 and 2017)](source: Authors’ computation)
The situation in year 2013 recorded 50 shipping services on the Asia–Europe trade route that called at either of the three ports. Of these services, 26 were made solely at the port of Singapore. These consisted mostly of services operated by the G6 Alliance, CKYH Alliance and container shipping line MSC. It is worth noting that majority of these services involved Singapore on both the head haul and back haul legs in their port of rotation. Our analysis also found that dedicated calls made solely at either Port Klang or Tanjung Pelepas totaled 11. Those services that called at Port Klang were made mostly by the shipping lines of CMA CGM, China Shipping, UASC and ZIM. As for Tanjung Pelepas, most of the services were operated by Maersk and Evergreen. This development could be traced back to the early 2000s where Maersk, Evergreen, CMA CGM and China Shipping made the move to relocate their hubs in Southeast Asia from Singapore to Tanjung Pelepas (Yap and Notteboom, 2011). The rest of services that called in the region contained 13 services which consisted of parallel calls comprising a combination of at least two of the three ports. Most of these shipping services involved the shipping lines Maersk and CMA CGM. Even though their hubs in the region were respectively at Tanjung Pelepas and Port Klang, both shipping lines chose to deploy a significant proportion of their services to include Singapore in the call. Similarly, MSC while choosing Singapore as their hub in Southeast Asia, deployed two services which jointly operated with CMA CGM to make parallel calls involving Port Klang. Analysis of calls made by shipping alliances found that there were nine services operated by the G6 Alliance and eight by the CKYH Alliance. It is also significant to note that almost all of these services called solely at the port of Singapore. The exception was the Asia–Black Sea Express service which was operated by the CKYH Alliance that made parallel calls at both Singapore and Port Klang.

By 2017, the situation had altered considerably with a new set of shipping alliances in place as well as exiting of long-time major industry players like Hanjin Shipping, China Shipping, APL and UASC which were either went bankrupt or acquired or merged with another shipping line. In the reorganized shipping network, the number of shipping services that called at the three selected ports was significantly reduced to 31. Singapore continued to be the main port of call receiving dedicated calls from 16 shipping services of which 15 were operated by shipping alliances. More significantly, most of these services called at Singapore on both head haul and return legs of the voyage. These included the cargo-heavy westbound legs. By comparison, the number of dedicated services that called at either Port Klang or Tanjung Pelepas was significantly reduced from 11 such services in 2013 to three in 2017. The number of services which made parallel calls involving a combination of at least two of the three ports remained at almost the same number as seen in 2013. However, the new shipping landscape saw the dynamics of network design change to one where Singapore was paired either with Tanjung Pelepas or Port Klang. This could be attributed to the new 2M and Ocean alliances. In the case for the 2M Alliance, the Southeast Asia hub for member shipping lines Maersk and MSC is at Tanjung Pelepas and Singapore, respectively. Hence, the port of Tanjung Pelepas now included calls by MSC in addition to Maersk as the latter’s sister company APM Terminals had a 30 per cent stake in the port since 2000 (Pelabuhan Tanjung Pelepas, 2000). In the case for the Ocean Alliance, Port Klang saw the continuation of calls by CMA CGM and China Shipping (now in the form of COSCO in the merged entity). However as with Tanjung Pelepas, many of these services which used to call solely at Port Klang now include joint calls made at the port of Singapore.

4.2 Discussion of implications
The results have four important implications from the managerial and policy perspectives. First, the results showed significant rationalization of services that called at the three ports
on the Asia–Europe trade although Singapore remained the dominant port of call after the series of mergers and acquisitions and reshuffle in alliance membership. We also observed that the number of vessels involved in the trade fell from 397 in 2013 to 262 in 2017. The behavior of shipping lines in the new operating landscape suggested that there was significant overcapacity in terms of the number of shipping services provided which necessitated rationalization of shipping networks. Should overcapacity persist, terminal operators and port authorities should be cognizant that there could be further rationalization, as shipping lines continue to streamline their service networks in the post-merger and acquisition environment. Specifically, emphasis on commercial bottom lines and pursuit of operational efficiencies could see shipping lines rationalize their networks further with consequences on hubbing strategies followed by the respective shipping alliances. For example, China Shipping used to call only at Port Klang prior to its merger with COSCO. However in the post-merger environment, service rationalization of the merged entity changed from making dedicated calls at Port Klang to now include the port of Singapore. A similar situation was observed for Evergreen which moved away from making dedicated calls at Tanjung Pelepas to now include the port of Singapore. As such, while Singapore continued to be the only major container transshipment hub in the region to receive calls by members of all the three shipping alliances and the Ocean Alliance and 2M alliance continued to call respectively at Port Klang and Tanjung Pelepas, the scenario could be affected by overcapacity in shipping, pending developments in world trade. With reference to Table II, each of the alliances are anchored by a few key players. These are Maersk and MSC for the 2M alliance, CMA CGM and COSCO for the Ocean Alliance and Hapag-Lloyd for The Alliance. Nonetheless, the disparity in fleet capacity and membership composition between the three alliances suggests that the situation is unlikely to remain stable. This could result in another round of merger and acquisition and potential reshuffle in the near term. Specifically, The Alliance was found to lag behind the two leading shipping alliances not only in terms of fleet capacity but also in potentially higher coordination costs with more member lines involved even though Hapag-Lloyd is the largest single contributor by ship capacity. The potential instability could see specific shipping lines in The Alliance being acquired by members of the two leading alliances which results in the container shipping industry being dominated by two mega alliances with each commanding almost 10 million TEUs in shipping capacity. Hence, the evolving situation could necessitate further concentration of service calls in one or two locations in Southeast Asia that offer the best financials and economics especially for those shipping lines who are key drivers behind each of the alliances.

Second, the results appeared to suggest that participation in alliance arrangement is an important strategy for shipping lines to compete successfully on the Asia–Europe trade Table II.

<table>
<thead>
<tr>
<th>2M Alliance</th>
<th>Ocean Alliance</th>
<th>The Alliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maersk (57%)</td>
<td>CMA CGM (42%)</td>
<td>Hapag-Lloyd (43%)</td>
</tr>
<tr>
<td>MSC (43%)</td>
<td>COSCO and OOCL (41%)</td>
<td>Yang Ming (16%)</td>
</tr>
<tr>
<td>Evergreen (17%)</td>
<td></td>
<td>MOL (16%)</td>
</tr>
<tr>
<td>Total fleet capacity</td>
<td>Total fleet capacity</td>
<td>Total fleet capacity</td>
</tr>
<tr>
<td>7.3 million TEUs</td>
<td>6.1 million TEUs</td>
<td>3.6 million TEUs</td>
</tr>
</tbody>
</table>

**Source:** Authors, compiled using data from Alphaliner (2017a)
route. The new shipping landscape in 2017 showed that most of the services were operated in the form of shipping alliances with 10 services operated each by the 2M alliance and Ocean Alliance and seven services operated by The Alliance. If we included the two services which are operated by CMA CGM and the joint consortium of COSCO, Evergreen and OOCL who are all members of the Ocean Alliance, total number of shipping services related to members of the Ocean Alliance would increase further from 10 to 12. By contrast, the situation in 2013 saw shipping services operated under the G6 Alliance or CKYH Alliance to be in the minority. Analysis of the three shipping alliances revealed distinct calling patterns in their network arrangement. Members of The Alliance were found to call solely at the port of Singapore. The development represents the continuation of calling arrangements by member lines Hapag-Lloyd, K Line, MOL, NYK, UASC and Yang Ming while they were members of the G6 Alliance and CKYH Alliance. Analysis of shipping services operated by the Ocean Alliance found the entity to put greater emphasis on Singapore with many of their services calling at the port on both legs of the voyage or the westbound leg. By contrast, many of those services operated by the 2M alliance tended to put greater emphasis on Tanjung Pelepas by calling at the port on the westbound leg and Singapore on the return voyage from Europe to Asia. As a whole, evidence from the revised shipping landscape seemed to show alliance strategy as the way forward for container shipping lines to survive on the intensely competitive Asia–Europe trade route.

Third, dynamics in the new state of port competition in Southeast Asia suggest the need to cater to the needs of the alliance and associated subsidiary regional and feeder lines as opposed to the strategy of anchoring specific shipping lines. Terminal operators and port authorities in the three ports had been focusing on enticing major shipping lines to hub transshipment operations in their respective facilities. This strategy was complemented by efforts to target specific services to boost connectivity to particular regions. These initiatives were supported by a slew of arrangements including joint venture terminals and other forms of preference treatments such as priority berthing and special rates. While these initiatives continue to remain relevant in the new setting, target clientele would have to be extended beyond the key anchor shipping line of the alliance to other members. For example, in the era of the 2M Alliance, PSA in Singapore would need to cater to the operational and commercial requirements not only of MSC but also of Maersk who is also a key member of the shipping alliance. Similarly, terminal operator Westports Malaysia in Port Klang would need to cater to the needs not only of CMA CGM but also to the requirements of COSCO and Evergreen where all three are members of the Ocean Alliance. This involves anticipating and meeting the complexities posed by an expanded shipping network and vessel fleet as well as the dynamics of intra-alliance relationships. Hence, the port that is able to contribute most toward fulfilling the demands of the alliance will emerge as the preferred hub of choice in Southeast Asia.

Fourth, the industry has entered into an era of mega alliances which requires commensurate responses in terms of handling capacity from the port and terminal perspective. This will include aspects covering terminal design, handling technology, channel approach, fairways and anchorages, port draft and terminal capacity among other concerns. With reference to Table III, we note the number of shipping services deployed as part of alliances form the majority in 2017. The number of vessels operated in alliances also rose from 171 to 226 from 2013 to 2017. By contrast, non-alliance shipping services fell from 33 to four and the number of vessels involved also dropped from 226 to 36 in the same time period. We note from the analysis that average vessel size along the Asia–Europe trade route rose considerably by 52 per cent from 9,143 TEUs in 2013 to 13,943 TEUs in 2017. This was attributed to the fact that the trade continued to receive the largest container
vessels, reaching 20,568 TEUs in 2017. The latest of these vessels were deployed in the 2M Alliance. In terms of vessel dimension, these behemoths require drafts of up to 16.5 meters. As such, ports and terminals that strive for hub status have to provide sufficient capabilities in terms of infrastructure, software and human resource to handle these mega container ships. In addition, associated with the mega alliances are their shipping networks and larger container volumes which must be accommodated without compromising the efficient functioning of the alliance as well as the entire port. It is important to note that container handling is just one aspect of the port business. There is competing usage demand from other sectors in the port industry which include non-containerized cargo as well as ship-related ancillary services. These activities are typically located in the same vicinity thereby increasing pressure on space utilization from the landward and seaward perspectives. This might necessitate redesign and relocation of new container handling facilities in new sites to capitalize on the latest advances and frontiers of new technology to accommodate the abovementioned developments.

5. Conclusion and recommendations for future research
This is the first research effort to consider the impact from the recent round of alliance reshuffle which comprised a series of events that took place from year 2014 to 2017. In place of the G6 Alliance and CHKYE Alliance are three new shipping alliances which are the 2M Alliance, Ocean Alliance and The Alliance. The research methodology uses information for shipping services that are deployed on the Asia–Europe trade route and focused on the three major container transshipment hubs in Southeast Asia which are Singapore, Port Klang and Tanjung Pelepas. Results from the shipping scene in 2017 revealed that Singapore continued to be the main port of call. However, the number of dedicated calls at Port Klang and Tanjung Pelepas was significantly reduced. The dynamics of network design was also changed to one where Singapore was paired either with Tanjung Pelepas or Port Klang.

The research highlighted four implications from the managerial and policy perspectives. First, there was significant rationalization of shipping capacity. Should overcapacity persist, emphasis on commercial bottom lines and pursuit of operational efficiencies could see
further rationalization. This development could be aided by structural instabilities especially for The Alliance which lagged considerably behind the 2M and Ocean Alliance in terms of fleet capacity and potentially higher coordination costs among member lines. As a result, the industry could evolve toward being dominated by two mega alliances with consequential rationalization of shipping service networks to one or two locations in Southeast Asia that offer the best financials and economics. Behavior of shipping lines in the new operating landscape also suggested that participation in an alliance arrangement could be an important strategy to compete successfully on the Asia–Europe trade route. Although majority of shipping services deployed on the Asia–Europe trade in 2013 that called at the three ports did not belong to any specific alliances, the situation in 2017 saw a reverse with 27 out of 31 services belonging to an alliance. Including two shipping services operated separately by different members of the Ocean Alliance would bring the total number of alliance-related services to 29. Hence, evidence from the research seemed to point toward alliance strategy as the way forward for container shipping lines to survive on the intensely competitive Asia–Europe trade route.

The results also revealed that terminal operators and port authorities will need to cater to the needs of the alliance and their associated subsidiary regional and feeder lines unlike the strategy of targeting specific lines or shipping service to anchor at the port. Hence, retaining the hub status would necessitate being useful especially to key members of an alliance to entrench the entities’ network in the port. This is made even more critical with most shipping lines and services operating under the aegis of shipping alliances. As a result, there will be implications for port managers and terminal operators in their berth allocation policies, policies for priority berthing and even policies involving selection of partners to enter into joint ventures. In the case for Singapore, its status as a hub for Ocean Alliance was strengthened by CMA CGM jointly investing with PSA to operate four container berths with an annual capacity of 4 million TEUs at the new Pasir Panjang Terminal (Woo, 2017). CMA CGM which used to hub at Port Klang, announced its commitment to hub at Singapore with more service calls following the acquisition of APL (Woo, 2015). In addition, PSA and COSCO announced a new joint venture agreement to replace the original two berths at Pasir Panjang Terminal 1 with three larger berths at the new Pasir Panjang Terminal 5 (The Straits Times, 2017b). The three berths will have an annual capacity of 3 million TEUs. More significantly, both joint venture terminals by PSA with CMA CGM and COSCO are located at the same terminal which is Pasir Panjang Terminal 5. By doing so, PSA could better cater to the needs of two key players of the Ocean Alliance and capitalize on efficiencies afforded by terminal operations in a single location. Similarly, while Maersk continued to call at its hub in Southeast Asia which is located at Tanjung Pelepas, the carrier dedicated a significant proportion of its calls in the region to include Singapore together with its alliance partner MSC. As such, there is the need to not only cater to the needs of MSC which has a joint venture terminal in Pasir Panjang Terminal 2 but also being able to handle services that are operated by the shipping line’s alliance partner Maersk. The analysis further notes that catering to the needs of mega alliances will require appropriate responses from the supply side and that the container-handling business is just one aspect the port needs to accommodate. There is competing usage demand from other sectors in the port industry. As such, the situation might necessitate redesign and relocation of container-handling facilities to account for the abovementioned developments. As a result, there will be implications for port managers and terminal operators in their berth allocation policies, policies for priority berthing and even policies involving selection of partners to enter into joint ventures.
The research addresses the gap in literature concerning the recent alliance reshuffle and its impact on the state of shipping connectivity using the case of the Asia–Europe trade route pertaining to key transshipment hubs in Southeast Asia. Because the research approach adopted considered the supply perspective through shipping services deployed at the various ports, future research could address perspectives drawn from other key trade routes and geographical regions as well as supply chain effects to provide a comprehensive understanding on the network dynamics in the new shipping landscape.

References


**Corresponding author**
Wei Yim Yap can be contacted at: wyyap@suss.edu.sg
Modeling the determinants of dry bulk FFA trading volume from a cross-market perspective of spot and forward

Shiyuan Zheng and Shun Chen
School of Transportation, Shanghai Maritime University, Shanghai, China

Abstract

Purpose – This study aims to propose a theoretical model to characterize the optimal forward freight agreement (FFA) procurement strategies and investigate the determinants of FFA trading activities from a new cross-market perspective.

Findings – A two-step model specification is used to empirically test the theoretical results for the Capesize, Panamax and Supramax sectors. It is found that spot demand has a positive relation with FFA trading volume for all three sectors. Moreover, spot demand volatility has a negative relation, while the correlation between spot demand and spot rate has a positive relation with FFA trading volume for the Capesize and Panamax sectors.

Originality/value – The results show that the expected spot demand is scaled by a “quantity premium,” which is the product of a demand covariance term, a demand riskiness term and a demand volatility term. This can be used by the traders in the FFA market to construct their hedging strategies.

Keywords Trading volume, DCC-GARCH model, Dry bulk, FFA, Fixture demand, Spot price

Paper type Research paper

1. Introduction

Since the past 20 years, the forward freight market has experienced a dramatic change. After reaching a historical peak in 2007, its trading volume sharply decreased in 2008 and 2009, then maintained at a relatively stable level around one million lots in the recent six years (except 2012, see Figure 1). As an important hedging tool, the forward freight agreement (FFA) plays a significant role in risk management in the dry bulk and tanker markets. An FFA is defined as a cash-settled contract between two counterparties to settle a freight rate for a specified quantity of cargo or hire rate type of vessel in one or a basket of the major shipping routes in the dry bulk and tanker shipping sectors at a certain date in the future (Alizadeh et al., 2015a). Because of its remarkable value for the shipping theory and the industrial practice, FFA draws much attention in the academic field. However, the FFA market has long been dominated by financial institutions such as hedge funds and investment banks, which treat the FFA as a speculation tool. In this paper, we aim to investigate the hedging function of FFA and the determinants of the FFA trading volume for the dry bulk shipping sector from a cross-market perspective (the spot market and the future market). Through this study, we examine whether the FFA can play a hedging and risk management role or only as a speculation tool.

© Pacific Star Group Education Foundation. Licensed re-use rights only.

This work was supported in part by the National Science Foundation of China (No. 71402095).
There are lots of studies on the dynamics of the FFA market, the relationship between spot rates and FFA prices and risk management issues related to FFA. Kavussanos and Visvikis (2006) make a survey for the literature on shipping derivatives including FFA. For the issue of the dynamics of the FFA market, most studies investigate the volatility of FFA prices or returns and their influencing factors. Koekbakker and Adland (2004) use the weekly time charter rates of a Panamax 65,000 dwt bulk carrier as a sample to investigate the factors governing the dynamics of the forward freight rate curve. Batchelor et al. (2005) explore the interrelationships between the bid-ask spreads and the FFA price volatility. Kavussanos et al. (2010) examine the cross-market linkages and spillover effects between FFAs and futures contracts on the commodities carried by Panamax vessels. Kavussanos et al. (2014) investigate the economic spillovers between the freight derivatives markets of the dry bulk shipping sectors and the derivatives of the commodities carried by the dry bulk vessels.

For the issue of relations between spot rates and FFA prices, Kavssanos and Nomikos (1999) examine the relationship between the futures prices and the realized spot prices in the Baltic International Freight Futures Exchange (BIFFEX) market. Kavssanos and Nomikos (2003) examine the causal relationship between futures and spot prices in the freight futures market. Kavssanos and Visvikis (2004) use the vector error correction model (VECM)-generalized autoregressive conditional heteroskedasticity (GARCH)-X model to examine the lead–lag relationship in both returns and volatilities between spot and FFA prices for four Panamax routes. Kavssanos et al. (2004a) investigate impacts of the introduction of the FFA trading on the spot price volatility. Kavssanos et al. (2004b) use the same four routes as a sample to investigate whether the FFA prices (one, two and three months before maturity) are the unbiased predictors of spot rates. Batchelor et al. (2007) compared the performance of vector auto regression (VAR), VECM and autoregressive integrated moving average models in forecasting spot and FFA rates. The results indicate that FFA prices can improve the forecasting performance of spot rates, but not vice versa. Tezuka et al. (2012) establish an equilibrium price model to derive the spot price and future price formulae. Moreover, they obtain an optimal hedge ratio based on their model. Zhang et al. (2014) explore the lead–lag relationships in freight rates between spot and forward markets. Li et al. (2014) use dynamic conditional correlation (DCC)-GARCH model to investigate the spillover effects and dynamic correlations between spot and forward tanker freight rates returns.

For the issue of FFA hedging and risk management, Tvedt (1998) derives an analytical pricing formula for European futures options in the BIFFEX market. Kavssanos and
Nomikos (2000a, 2000b) investigate the hedging ratios and hedging efficiency in the BIFFEX market. Dinwoodie and Morris (2003) utilize the questionnaires to study the attitudes of tanker shipowners and charterers toward freight hedging and their risk perceptions of FFAs. Koekebakker et al. (2007) establish theoretical models to value the Asian-style options traded in the freight derivatives market. Nomikos and Doctor (2013) carry out a comprehensive study on the quantitative trading strategies in the FFA market for various contracts and maturities with different trading rules. Alizadeh et al. (2015a) investigate the impact of liquidity risk on FFA returns. Alizadeh et al. (2015b) examine the effectiveness of alternative hedging methods in managing tanker freight rate risk based on Tanker FFAs.

Although there are many studies concerning different aspects of the FFA market, there are very little research examining the relationship between the FFA trading volume and its determinants from a cross-market perspective. Here, we focus our attention on the work of Alizadeh (2013), who investigate the relationship between the FFA trading volume and FFA price volatilities for Capesize, Panamax and Supramax sectors. In our paper, we aim to explore the hedging function of FFA and the determinants of the FFA trading volume from a different cross-market perspective. Although we work on a similar topic, there are still some differences as follows:

- **Different perspectives**: Alizadeh (2013) explores the relation between the FFA trading volume and its price volatility in the FFA market, while we investigate the impacts of the spot demand volatility and the covariance between the spot rate and the spot demand, or the covariance between the earning and the spot demand, on the FFA trading volume. In other words, we mainly focus on the FFA hedging from a cross-market perspective, while Alizadeh (2013) examines the speculation or arbitrage of FFA. To be consistent with the fact that many players in the practice trade FFA for the purposes of speculation or arbitrage, we add the consideration of the speculation or arbitrage function of FFA in our empirical studies. Still, we find that the demand volatility in the spot market has a negative impact on the FFA trading volume, while the covariance between the spot demand and the spot rate can influence positively the FFA trading volume for the Capesize and Panamax sectors.

- **Different theoretical basis**: Alizadeh (2013) uses the theory of the mixture of distribution of Clark (1973) to explain the contemporaneous relationship between volatility and trading activity, while we establish a model on the inventory theory to characterize the equilibrium of the FFA trading activity and its determinants.

- **Different models to estimate the volatility**: Alizadeh (2013) uses the EGARCH-X model to estimate the FFA price volatilities, while we use the DCC-GARCH to estimate the time-dependent spot demand volatility and the covariance between the spot demand and the earning, as well as the covariance between the spot demand and the spot rate. In the DCC-GARCH model, asymmetries are incorporated in a broader fashion than in other types of multivariate GARCH models, i.e. the DCC-MGARCH model does not assume constant correlation coefficients over the sample period. Specifically, it allows for series-specific news shocks and smoothing parameters and takes into account conditional asymmetries in correlation dynamics and corrects for heteroskedasticity directly by using standardized residuals in the estimation of correlation coefficients (Tsoukndis, 2016). Therefore, the dynamic variance and covariance needed to verify our theoretical statements can be better estimated.

Our work contributes to the literature in the following ways.
Theoretically, we investigate the FFA hedging function and the determinants of dry bulk FFA trading activities from a new cross-market perspective. Some existing literature explores the determinants of FFA trading volume from the freight forward market itself, e.g. FFA price volatility and FFA trading volume (Alizadeh, 2013). Others discuss the relationship between prices in the spot and forward markets (Kavussanos and Visvikis, 2004; Kavussanos et al., 2004a, 2004b; Batchelor et al., 2007; Tezuka et al., 2012; Zhang et al., 2014), or the volatility spillovers (Kavussanos et al., 2014; Tsouknidis, 2016), from a cross-market perspective. In our paper, we propose a theoretical model to characterize the optimal FFA procurement strategies to indicate the FFA hedging function. We prove that the optimal FFA procurement quantity is the expected spot demand scaled by a “quantity premium,” which is the product of a demand covariance term, a demand riskiness term and a demand volatility term, from the perspective of hedging. We argue that besides FFA prices, some factors in the spot market, e.g. spot rates, spot demand, spot demand volatility and the covariance between the spot demand and spot rate, have impacts on the FFA trading volume.

Empirically, we link our study with the existing literature which mostly examines the dynamic of the FFA prices. Considering both the hedging and the speculation functions of FFA in the empirical studies, our theoretical conclusions are tested and most of them are verified in the Capesize and Panamax sectors. The empirical study results indicate that our investigation on the FFA hedging from a cross-market perspective is valid. Moreover, our empirical studies illustrate the procedure to obtain the parameters needed to determine the optimal FFA procurement quantity when using the FFA hedging function. The empirical equations between the FFA trading volume and its determinants can be used for the possible applications of the FFA hedging.

The rest of the paper is organized as follows: Section 2 establishes a theoretical model to characterize the optimal FFA procurement strategies for a buyer. Section 3 uses a two-step model specification to empirically test the theoretical statements derived from Section 2. Conclusions and possible directions for future research are summarized in Section 4.

2. Theoretical model

In this section, we establish a theoretical model to analyze the shipping capacity procurement problem when a buyer faces uncertainties in the spot demand, spot rates and shipping revenues. It is worthy pointing out that our theoretical model focuses on the hedging function of FFA[1]. It is well known that shipping capacities cannot be stored. Thus, procurement of shipping supply in the spot and forward markets for delivery on the usage date is important in matching a buyer’s uncertain demand. Our model can characterize the optimal FFA procurement strategies for a buyer. In our model, a buyer is an agent who uses the shipping services, e.g. a shipper. To hedge the risk of the spot rate fluctuation and the uncertain demand in the future, he procures some shipping capacities now by a forward contract with delivery at a future time (of course, in any time before its delivery, he can sell them in the market if it is profitable to do so. This can be considered as the speculation or arbitrage function of FFA). Because the international dry bulk shipping is a perfect competition industry (Pirrong, 1992), the sum of all buyers’ optimal FFA procurement quantities is the market equilibrium volume. Therefore, we can investigate the determinants and their impacts on the FFA trading volume by our model.

We consider a shipping capacity procurement problem in a finite horizon \([0, T]\). To satisfy a shipping demand at time \(T\), the buyer decides to procure \(q\) units of shipping capacity at time 0 in a forward contract with delivery at time \(T\). It could be argued that FFAs are cash-settled instruments without any obligation whatsoever to deliver a transport...
service. However, if we consider a FFA’s hedging function, we could relate the FFA’s trade with the transport service. According to the definition of FFA, it settles a freight rate for a specified quantity of cargo at a certain date in the future. That means that the FFA’s trader tries to avoid the future fluctuation of the freight rate using the FFA contract. When he sells the FFA contract, the buyer implicitly undertakes the transfer of the transport services. The FFA contract price is \( F \) at time 0. The shipping demand \( D \) is a random variable at any time before time \( T \), and it becomes known at time \( T \). The spot shipping price \( f \) and the buyer’s marginal revenue \( r \) to fulfill the shipping business at time \( T \) are random variables too. Thus, the buyer faces the following optimization problem:

\[
\max_q \pi = E[r_{\min}(q, D) + f(q - D)^+ - Fq]
\]  

(1)

where \((\cdot)^+ = \max(\cdot, 0)\), \( \pi \) is the buyer’s profit and \( E \) is the mathematical expectation.

The first and the second terms in equation (1) are the buyer’s expected revenue from shipping and selling the excess capacity on the spot market, respectively. The third term in equation (1) is the buyer’s forward procurement cost. Therefore, the buyer faces a stochastic optimization problem to determine his best procurement quantity in the forward market. Similar models can be found in the trade of future commodity, e.g. natural gas (Secomandi and Kekre, 2014).

Note that \( F \) is known by the buyer and \( D, f \) and \( r \) are unknown to the buyer when he makes the procurement decision. To solve equation (1), we assume the demand \( D \), the buyer’s marginal revenue \( r \) and the chartering price \( f \) to follow the joint lognormal distribution[2]:

\[
\begin{pmatrix}
\log D \\
\log r \\
\log f
\end{pmatrix} \sim N\left[
\begin{pmatrix}
\log M_D - S^2_D/2 \\
\log M_r - S^2_r/2 \\
\log M_f - S^2_f/2
\end{pmatrix},
\begin{pmatrix}
S^2_D & \rho_D S_D S_r & \rho_D S_D S_f \\
\rho_D S_D S_r & S^2_r & \rho_f S_f S_f \\
\rho_D S_D S_f & \rho_f S_f S_f & S^2_f
\end{pmatrix}\right]
\]  

(2)

where \( M_D \), \( M_r \) and \( M_f \) and \( S_D \), \( S_r \) and \( S_f \) are the mean values and standard deviations of \( D, r \) and \( f \), respectively. \( \rho_D \) and \( \rho_f \) are the correlation coefficients between \( D \) and \( r \) and \( D \) and \( f \), respectively. \( \begin{pmatrix}
\log M_D - S^2_D/2 \\
\log M_r - S^2_r/2 \\
\log M_f - S^2_f/2
\end{pmatrix} \) is the mean vector, and

\[
\begin{pmatrix}
S^2_D & \rho_D S_D S_r & \rho_D S_D S_f \\
\rho_D S_D S_r & S^2_r & \rho_f S_f S_f \\
\rho_D S_D S_f & \rho_f S_f S_f & S^2_f
\end{pmatrix}
\]

is the covariance matrix for \( \begin{pmatrix}
\log D \\
\log r \\
\log f
\end{pmatrix} \).

Solving equation (1), we obtain the optimal procurement quantity \( q \), which can be implicitly expressed as follows. The detailed proofs are shown in Appendix A.

\[
M_r \Phi\left(\frac{\log q - \log M_D + S^2_D/2 - \rho_D S_D S_r}{S_D}\right) = M_f \Phi\left(\frac{\log q - \log M_D + S^2_D/2 - \rho_f S_f S_f}{S_D}\right) - F
\]  

(3)

where \( \Phi(\cdot) \) is the standard normal distribution function.
Next, we explain the optimal condition equation (3) for the buyer’s procurement problem. If the buyer procures too much shipping capacity in the forward market, he will have to sell it in the spot market with the expected price \( M_f \) and obtain the expected net marginal revenue \( M_f - M_r \). Because the revenue and spot price are uncertain, the expected net marginal revenue should be adjusted by their weights, which are related to the variance of the demand, the correlations between the demand and the spot price, as well as the correlations between the demand and the marginal revenue. The LHS of equation (3) is the buyer’s weighted expected marginal overage revenues. On the other hand, if the buyer does not procure enough shipping capacity in the forward market, his expected net marginal revenue is \( M_r/C_0 \), which is the RHS of equation (3). Therefore, the economic insight of equation (3) is that the buyer’s optimal FFA procurement quantity is to equal the weighted expected marginal overage revenues and the expected marginal underage revenues.

Furthermore, if \( \rho_{D_rS_D} \approx \rho_{D_fS_D}S_f \), i.e. \( \text{cov}(D, r) \approx \text{cov}(D, f) \), equation (3) can be simplified as:

\[
\log q = \log M_D - S_D^2/2 + \rho_{D_fS_D}S_f + S_D \Phi^{-1}(z) \text{ or (4)}
\]

where \( z = \frac{M_r - F}{M_f - M_r} \) and \( \Phi^{-1}(\cdot) \) is the inverse function of the standard normal distribution[3].

From equation (4) and (5), we know that the FFA trading volume \( q \) is related to the expected spot demand \( M_D \), the variance of the spot demand \( S_D^2 \), the covariance between the demand and the spot rate \( \rho_{D_fS_D} \) or the covariance between the demand and the earning \( \rho_{D_rS_D} \), as well as the critical ratio \( z \). Exponentializing the both sides of equations (4) or (5), we obtain:

\[
q = M_D \exp\left(-S_D^2/2\right) \exp(\rho_{D_fS_D}S_f) \exp[S_D \Phi^{-1}(z)] \quad (6)
\]

or

\[
q = M_D \exp\left(-S_D^2/2\right) \exp(\rho_{D_rS_D}) \exp[S_D \Phi^{-1}(z)] \quad (7)
\]

From equations (6) and (7), we can summarize a buyer’s optimal FFA procurement strategy as follows. The optimal FFA procurement quantity is the expected spot demand scaled by the demand covariance term \( \exp(\rho_{D_fS_D}S_f) \) and the demand riskiness term \( \exp[S_D \Phi^{-1}(z)] \) and descaled by the demand volatility term \( \exp(-S_D^2/2) \). The latter three terms consist of a “quantity premium.” Investigating the impacts of these determinants to the optimal trading volume, we can obtain the following properties. The detailed proofs are shown in Appendix A:

- A positive relationship exists between the FFA volume and the expected spot demand.
- A positive relationship exists between the FFA volume and the expected earnings.
- A positive relationship exists between the FFA volume and the expected spot rates.
- A negative relationship exists between the FFA volume and FFA prices.
- A positive relationship exists between the FFA volume and the covariance between the spot demand and the spot rates (or the spot demand and the earnings).
- If the volatility of the spot demand is large, there is a negative relationship between the FFA volume and the volatility of the spot demand; otherwise, there is a positive relationship between the FFA volume and the volatility of the spot demand.
From equations (4) or (5), we know that the impacts of the spot demand volatility to the FFA trading volume come from two sources: the demand riskiness term $S_D\Phi^{-1}(z)$, which has a positive impact, and the demand volatility term $-S_D^2/2$, which has a negative impact. The higher spot demand volatility can bring the possible higher revenue, but at the same time the possible over-procurement and profit loss. The final impacts depend on their interactions. Note that the demand volatility term is a quadratic function of $S_D$, while the demand riskiness term is a linear function of $S_D$. Therefore, when the spot demand volatility is large (or small), the demand volatility term dominates (or is dominated by) the demand riskiness term, which causes the negative (or positive) impact to the FFA trading volume finally.

In the next section, we will empirically test these statements.

### 3. Empirical tests

In this section, we use a two-step model specification. The first step is to measure the variance of the spot demand, the covariance between the spot demand and the earnings and the covariance between the spot demand and the spot rates. The DCC-GARCH (multivariate) model is developed to make the estimation. In the second step, the items derived from the DCC-GARCH model are used to analyze the relationship between the FFA trading volume and the various factors by regressions. Finally, our theoretical statements are examined for the three dry bulk shipping markets: Capesize, Panamax and Supramax. Similar two-step estimation procedure can be found in other studies, e.g. Xu et al. (2011).

#### 3.1 Data

The data set in this study consists of weekly FFA prices (FFA), total trading volume (VOL), spot rate indices (SR), fixture demand (FIX) and the earnings (EARNING) for three dry bulk sectors, namely, Capesize, Panamax and Supramax, over the period of July 2009 to February 2016. The FFA prices and trading volume are from the Baltic Exchange. Here, the trading volume series are the total [cleared and over the counter (OTC)] trading activities for all maturity contracts, which are not specific trading activities for first, second, third and fourth nearest quarter FFAs. Weekly FFA prices for first, second, third and fourth nearest quarter (FFA-Q1, FFA-Q2, FFA-Q3, FFA-Q4) are Thursday’s prices. We choose these four data series because they are considered as the most liquid contracts in the dry FFA market (Alizadeh, 2013). The weekly spot rate indices and the earnings are directly from the Clarkson SIN. The fixture demand is used to represent the spot market demand. The fixture information is obtained from both the Clarkson SIN (2013-2016) and the Baltic Exchange (2009-2012). After filtering the missing values and unusable information, a total of 10,687, 16,872 and 10,050 fixture observations are available for Capesize, Panamax and Supramax dry bulk ships, respectively. Based on these data, we obtained the weekly fixture demand by summing the corresponding “Dwt” or “Quantity” for the three bulk ships. The descriptive statistics of these variables are shown in Table I.

From Table I, we find that the FFA trade volume and the spot demand of the Supramax sector is much smaller than the other two sectors. Meanwhile, the standard deviations of these two variables in the Supramax sector are smaller than the other two sectors. These indicate that the Supramax market has low trading activities and liquidity. Moreover, all variables seem to be normally distributed, and the Supramax FFA trade volume and spot demand have higher skewness and kurtosis. Except these two variables, the others seem to be nonstationary according to the PP test for all sectors.
3.2 Methodology
3.2.1 Dynamic conditional correlation–GARCH models. To test the theoretical statements in Section 2, we need to investigate the time-varying variance of the fixture demand, the time-varying covariance between the fixture demand and the earning and the time-varying covariance between the fixture demand and the spot rate. The DCC-GARCH models, proposed by Engle (2002), are used to characterize the time-dependent conditional covariance of the error terms. These models can detect possible changes in conditional correlations over time, thus allowing for dynamic shocks in response to information. Moreover, the DCC-GARCH model accounts for heteroscedasticity directly by estimating correlation coefficients of the standardized residuals (Tsouknidis, 2016). Therefore, we use the DCC-GARCH(1,1) model in this section.

In our study, the VAR representation is used as the mean equations, which are shown as follows:

\[ \ln(ERN_t) = d_1 + \sum_{i=1}^{n} a_{1i} \ln(ERN_{t-i}) + \sum_{i=1}^{n} b_{1i} \ln(SR_{t-i}) + \sum_{i=1}^{n} c_{1i} \ln(FIX_{t-i}) + \varepsilon_{1,t} \]  

Table I. Descriptive statistics of FFA prices, trading volume, fixture demand, spot rates and earnings for different dry bulk sectors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Std. dev.</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Jarque-Bera p-Val</th>
<th>PP Stat</th>
<th>p-Val</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capesize</td>
<td>VOL</td>
<td>10,752.000</td>
<td>10,002.000</td>
<td>4,548.472</td>
<td>0.838</td>
<td>3.902</td>
<td>47.401</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FIX</td>
<td>6,523,324.000</td>
<td>5,704,875.000</td>
<td>3,001,588.000</td>
<td>0.856</td>
<td>3.229</td>
<td>39.073</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>SR</td>
<td>2,204.716</td>
<td>1,838.100</td>
<td>1,315,736</td>
<td>1.120</td>
<td>4.309</td>
<td>88.064</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>EARNING</td>
<td>18,227.300</td>
<td>12,333.340</td>
<td>14,747,610</td>
<td>5.064</td>
<td>4.235</td>
<td>120.980</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q1</td>
<td>14,751.02</td>
<td>1,175,000</td>
<td>9,287.83</td>
<td>1.397</td>
<td>4.235</td>
<td>120.980</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q2</td>
<td>15,420.22</td>
<td>13,000.00</td>
<td>8,551.11</td>
<td>1.102</td>
<td>3.355</td>
<td>64.555</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q3</td>
<td>15,818.01</td>
<td>13,000.00</td>
<td>8,350.24</td>
<td>1.398</td>
<td>5.217</td>
<td>164.971</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q4</td>
<td>19,019.05</td>
<td>15,000.00</td>
<td>8,745.35</td>
<td>0.800</td>
<td>2.602</td>
<td>35.199</td>
<td>0.000</td>
</tr>
<tr>
<td>Panamax</td>
<td>VOL</td>
<td>8,161.975</td>
<td>7,740.000</td>
<td>2,994.957</td>
<td>1.262</td>
<td>5.855</td>
<td>190.554</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FIX</td>
<td>3,821,475.000</td>
<td>3,783,616.000</td>
<td>932,392.800</td>
<td>0.404</td>
<td>3.736</td>
<td>15.699</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>SR</td>
<td>1,449,577</td>
<td>1,080.200</td>
<td>926,528</td>
<td>1.310</td>
<td>4.112</td>
<td>106.383</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>EARNING</td>
<td>10,045.110</td>
<td>8,334.274</td>
<td>5,740.809</td>
<td>1.425</td>
<td>4.590</td>
<td>139.821</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q1</td>
<td>11,091.21</td>
<td>9,175.000</td>
<td>5,739.18</td>
<td>1.233</td>
<td>3.763</td>
<td>86.311</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q2</td>
<td>12,332.50</td>
<td>10,625.00</td>
<td>5,825.21</td>
<td>1.322</td>
<td>4.242</td>
<td>110.576</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q3</td>
<td>10,857.76</td>
<td>9,200.000</td>
<td>5,318.81</td>
<td>1.319</td>
<td>3.955</td>
<td>102.004</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q4</td>
<td>11,920.40</td>
<td>10,400.00</td>
<td>5,447.57</td>
<td>1.060</td>
<td>3.232</td>
<td>58.954</td>
<td>0.000</td>
</tr>
<tr>
<td>Supramax</td>
<td>VOL</td>
<td>2,286.521</td>
<td>2,065.500</td>
<td>1,134,552</td>
<td>1.610</td>
<td>7.492</td>
<td>427.646</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FIX</td>
<td>1,635,444.000</td>
<td>1,618,028.000</td>
<td>686,253,800</td>
<td>0.190</td>
<td>3.736</td>
<td>15.699</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>SR</td>
<td>1,211.996</td>
<td>1,011.633</td>
<td>580,352</td>
<td>1.656</td>
<td>3.605</td>
<td>67.545</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>EARNING</td>
<td>13,901.770</td>
<td>13,151.980</td>
<td>6,275.077</td>
<td>0.924</td>
<td>3.546</td>
<td>51.985</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q1</td>
<td>11,408.15</td>
<td>10,387.50</td>
<td>4,288.96</td>
<td>0.878</td>
<td>3.091</td>
<td>41.478</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q2</td>
<td>12,131.75</td>
<td>11,125.00</td>
<td>4,486.66</td>
<td>1.156</td>
<td>4.186</td>
<td>90.599</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q3</td>
<td>11,207.03</td>
<td>10,087.50</td>
<td>4,134.54</td>
<td>1.004</td>
<td>3.591</td>
<td>58.835</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>FFA-Q4</td>
<td>12,383.51</td>
<td>11,250.00</td>
<td>4,487.99</td>
<td>1.214</td>
<td>4.347</td>
<td>103.477</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Notes: The unit of measurement of VOL is lot. The unit of measurement of FIX is ton. The unit of measurement of EARNING is $/day. The unit of measurement of EARNING is $/day. Jarque-Bera is the Jarque and Bera test for normality. PP Stat is Phillips and Perron test for unit root.
\[
\ln(SR_t) = d_2 + \sum_{i=1}^{n} a_{2i}\ln(ERN_{t-i}) + \sum_{i=1}^{n} b_{2i}\ln(SR_{t-i}) + \sum_{i=1}^{n} c_{2i}\ln(FIX_{t-i}) + \varepsilon_{2,t} \quad (8b)
\]
\[
\ln(FIX_t) = d_3 + \sum_{i=1}^{n} a_{3i}\ln(ERN_{t-i}) + \sum_{i=1}^{n} b_{3i}\ln(SR_{t-i}) + \sum_{i=1}^{n} c_{3i}\ln(FIX_{t-i}) + \varepsilon_{3,t} \quad (8c)
\]

where \(\varepsilon_{i,t}\) is the error term of the conditional mean equation and the error vector conditional covariance matrix of the vector \([\ln(ERN_t), \ln(SR_t), \ln(FIX_t)]^T\) is determined by the Schwarz information criterion (SC).

The conditional covariance matrix \(H_t\) can be expressed as:
\[
H_t = D_t R_t D_t \quad (8d)
\]
where \(D_t = diag\left(h_{11,t}^{1/2}, h_{22,t}^{1/2}, h_{33,t}^{1/2}\right)\) indicates a diagonal matrix with time-varying standard deviation on the diagonal. Here \(h_{ii,t}\) can be defined as a univariate GARCH(1,1) process:
\[
h_{ii,t} = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{ii,t-1}, \forall i = 1, 2, 3 \quad (8e)
\]

where \(\alpha_i\) and \(\beta_i\) are non-negative scalars satisfying \(\alpha_i + \beta_i < 1\). In addition, the conditional correlation matrix \(R_t\) can be specified as:
\[
R_t = \text{diag}\left(q_{11,t}^{-1/2}, q_{22,t}^{-1/2}, q_{33,t}^{-1/2}\right)Q_tD_t \text{diag}\left(q_{11,t}^{1/2}, q_{22,t}^{1/2}, q_{33,t}^{1/2}\right) \quad (8f)
\]
where \(Q_t = (1 - \theta_1 - \theta_2)Q^- + \theta_1 z_{t-1} z_{t-1}' + \theta_2 Q_{t-1}\) (8g) with \(Q^-\) being the unconditional variance matrix of the standardized residuals filtered by the univariate GARCH process (8e) and the non-negative scalar \(\theta_1\) and \(\theta_2\) satisfying \(\theta_1 + \theta_2 < 1\).

### 3.2.2 Linear regression models

After obtaining the variance of the fixture demand (VARF), the covariance between the fixture demand and the earning (COVFE) and the covariance between the fixture demand and the spot rate (COVFS), we establish the regression models for the three dry bulk shipping markets as follows:
\[
\ln(VOL) = A_0 + A_1\ln(FFA) + A_2\ln(FIX) + A_3\ln(ERN) + A_4\ln(SR)
+ A_5\text{COVFS} + A_6\text{COVFE} + A_7\text{VARF} + A_8 FV \quad (9)
\]

Here for each sector, the variable \(FFA\) is represented by the weekly average of the FFA daily prices for first, second, third and fourth nearest quarter contracts, i.e. FFA-Q1, FFA-Q2, FFA-Q3 and FFA-Q4, respectively. To investigate the speculation or arbitrage function of FFA and their impacts on the FFA trading volume at the same time, in equation (9), we add the term \(FV\), which is the volatilities of the returns of FFA. Here, the return of FFA is defined as \(RT_t = \ln(FFA_t) - \ln(FFA_{t-1})\). According to the method proposed by Alizadeh (2013), we use the GARCH model to calculate \(FV\). The estimation results of the GARCH model for the Capsize, Panamax and Supramax sector are presented in Appendix B.

By equation (9), we can investigate the relations between the FFA trading volume and the corresponding factors to verify our theoretical statements in Section 2.
3.3 Empirical results

The estimation results of the DCC-GARCH models for the different dry bulk shipping markets are presented in Table II. The estimated time-varying conditional demand variances and correlations generated from the DCC-GARCH model are illustrated in Figures 2-4. Their descriptive statistics are summarized in Table III. From the results, we can observe that the Capesize sector has the larger volatility of its spot demand and stronger covariance.

<table>
<thead>
<tr>
<th>Mean equation</th>
<th>Capesize</th>
<th>Panamax</th>
<th>Supramax</th>
</tr>
</thead>
<tbody>
<tr>
<td>$d_1$</td>
<td>-1.785***</td>
<td>-0.378 (1.202)</td>
<td>0.218 (1.600)</td>
</tr>
<tr>
<td>$d_2$</td>
<td>-0.567 (2.011)</td>
<td>-0.353 (1.126)</td>
<td>0.075 (0.719)</td>
</tr>
<tr>
<td>$d_3$</td>
<td>8.457*** (6.551)</td>
<td>10.400*** (6.692)</td>
<td>3.955*** (5.971)</td>
</tr>
<tr>
<td>$a_1$</td>
<td>0.611*** (11.540)</td>
<td>0.839*** (25.004)</td>
<td>0.803*** (24.392)</td>
</tr>
<tr>
<td>$a_2$</td>
<td>-0.179*** (-5.852)</td>
<td>-0.105*** (-3.469)</td>
<td>-0.075*** (-2.897)</td>
</tr>
<tr>
<td>$a_3$</td>
<td>0.100 (1.155)</td>
<td>0.017 (0.261)</td>
<td>0.394 (2.822)</td>
</tr>
<tr>
<td>$b_1$</td>
<td>0.474*** (6.639)</td>
<td>0.117*** (4.417)</td>
<td>0.182*** (5.681)</td>
</tr>
<tr>
<td>$b_2$</td>
<td>1.204*** (27.086)</td>
<td>1.065*** (43.107)</td>
<td>1.605*** (38.483)</td>
</tr>
<tr>
<td>$b_3$</td>
<td>-0.241*** (-2.270)</td>
<td>0.113 (1.583)</td>
<td>-0.183*** (-1.468)</td>
</tr>
<tr>
<td>$c_1$</td>
<td>0.123*** (4.222)</td>
<td>0.066*** (3.195)</td>
<td>0.026*** (2.985)</td>
</tr>
<tr>
<td>$c_2$</td>
<td>0.047*** (2.922)</td>
<td>0.055*** (2.678)</td>
<td>0.012* (1.810)</td>
</tr>
<tr>
<td>$c_3$</td>
<td>0.512*** (6.389)</td>
<td>0.249 (1.894)</td>
<td>0.549*** (9.926)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variance equation</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\omega_1$</td>
<td>0.000 (0.296)</td>
<td>0.004 (1.648)</td>
<td>0.002*** (4.025)</td>
</tr>
<tr>
<td>$\alpha_1$</td>
<td>0.011*** (57.011)</td>
<td>0.329* (2.002)</td>
<td>0.241*** (3.007)</td>
</tr>
<tr>
<td>$\beta_1$</td>
<td>0.989*** (105.582)</td>
<td>0.335 (1.041)</td>
<td>0.381*** (3.322)</td>
</tr>
<tr>
<td>$\omega_2$</td>
<td>0.000 (1.478)</td>
<td>0.002* (2.519)</td>
<td>0.001*** (2.801)</td>
</tr>
<tr>
<td>$\alpha_2$</td>
<td>0.129*** (2.530)</td>
<td>0.222*** (3.353)</td>
<td>0.615*** (5.748)</td>
</tr>
<tr>
<td>$\beta_2$</td>
<td>0.850*** (16.814)</td>
<td>0.562*** (5.113)</td>
<td>0.299*** (2.350)</td>
</tr>
<tr>
<td>$\omega_3$</td>
<td>0.098*** (3.572)</td>
<td>0.045* (7.700)</td>
<td>0.003 (0.760)</td>
</tr>
<tr>
<td>$\alpha_3$</td>
<td>0.277*** (1.501)</td>
<td>0.325 (1.597)</td>
<td>0.050* (1.737)</td>
</tr>
<tr>
<td>$\beta_3$</td>
<td>0.064 (0.482)</td>
<td>0.000*** (2.923)</td>
<td>0.928*** (17.174)</td>
</tr>
<tr>
<td>$\theta_1$</td>
<td>0.031*** (67.534)</td>
<td>0.002 (1.000)</td>
<td>0.048 (1.644)</td>
</tr>
<tr>
<td>$\theta_2$</td>
<td>0.831*** (61.394)</td>
<td>0.980*** (75.399)</td>
<td>0.759*** (5.370)</td>
</tr>
</tbody>
</table>

**Diagnostics**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Mean</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>LogL</td>
<td>278.725</td>
<td>755.850</td>
<td>877.219</td>
</tr>
<tr>
<td>AIC</td>
<td>0.434</td>
<td>0.507</td>
<td>0.544</td>
</tr>
<tr>
<td>SC</td>
<td>0.427</td>
<td>0.487</td>
<td>0.514</td>
</tr>
<tr>
<td>ARCH(12) of ERN</td>
<td>0.253 (0.995)</td>
<td>0.314 (0.987)</td>
<td>0.262 (0.820)</td>
</tr>
<tr>
<td>ARCH(12) of SR</td>
<td>0.606 (0.837)</td>
<td>0.384 (0.969)</td>
<td>0.121 (0.998)</td>
</tr>
<tr>
<td>ARCH(12) of FIX</td>
<td>0.575 (0.862)</td>
<td>0.976 (0.861)</td>
<td>0.483 (0.924)</td>
</tr>
</tbody>
</table>

**Notes:** ***,** and *mean statistically significant at 1%, 5% and 10%, respectively. The t-statistics is reported in the parenthesis. LogL is the log-likelihood. AIC is the Akaike information criterion. SC is the Schwarz information criterion. ARCH(12) is Engle’s F-test for ARCH effects. Figures in the brackets under the ARCH(12) estimates indicate the significance levels.

**Table II.**

The estimates of DCC-GARCH models for different dry bulk sectors.
between its spot demand and spot rate (or earning) than the Panamax and Supramax sectors. Meanwhile, the descriptive statistics of the volatilities of the FFA returns for different sectors are summarized in Table III too. It can also be found that the Capesize sector has the larger volatility of the FFA returns than the other two sectors. The larger volatilities of these variables in the Capsize sector can be explained as follows. The main cargoes carried by the Capesize carriers are iron ore and coal, while the Panamax and Supramax carriers can operate more versatile and transport more types of dry bulk cargoes, such as grain, sulfur and fertilizers (Kavussanos et al., 2014). As the world economy is deeply stuck in recession since 2008, the demand for iron ore and coal slumped in recent years. It is easy to understand that the volatility of the spot demand for the Capesize carriers is larger than other carriers. On
the other side, the Capesize carriers have more volatile spot rates than other two carriers (Alizadeh and Talley, 2011). Higher volatilities of both spot demand and freight rate mean that the Capesize carriers’ demand is more price elastic and they have stronger covariance between their spot demand and spot rates. Meanwhile, the speculation is more active in the Capesize sector (which can be reflected by the larger volatility of the FFA returns) than the other two because of the higher market demand.

The regression results of equation (9) are presented in Table IV, where Q1, Q2, Q3 and Q4 mean the cases that the weekly FFA prices for first, second, third and fourth nearest quarter (FFA-Q1, FFA-Q2, FFA-Q3, FFA-Q4) are used to represent the values of the variable FFA in equation (9), respectively. The columns of Q1, Q2, Q3 and Q4 show the corresponding values of the estimated parameters when the FFA prices in the regression are represented by FFA-Q1, FFA-Q2, FFA-Q3, FFA-Q4, respectively. From Table IV, we can obtain the following observations:

- The spot demand is positively related with the FFA trading volume for all three sectors. This is consistent with our theoretical analysis of Statement (i).
- The spot rate has the positive relation with the FFA trading volume for the Capesize and Supramax sectors. This is consistent with our theoretical analysis of Statement (iii). The reason is obvious that the rising expected spot rate brings more benefits if buyers procure more transport capacity by the FFA trading.

### Table III. Descriptive statistics of the variance of the fixture demand, the covariance between the fixture demand and the spot rate, the covariance between the fixture demand and the earning and the volatilities of the FFA return for different dry bulk sectors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Normality</th>
<th>PP Test</th>
<th>PP Stat</th>
<th>p-Val</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsize</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COVFEC</td>
<td>0.019</td>
<td>0.018</td>
<td>0.0035</td>
<td>3.247</td>
<td>19.908</td>
<td>4606.23</td>
<td>0.000</td>
<td>−14.0535</td>
<td>0.000</td>
</tr>
<tr>
<td>COVFSC</td>
<td>0.014</td>
<td>0.013</td>
<td>0.0062</td>
<td>1.198</td>
<td>4.557</td>
<td>114.57</td>
<td>0.000</td>
<td>−6.092</td>
<td>0.000</td>
</tr>
<tr>
<td>VARFC</td>
<td>0.144</td>
<td>0.122</td>
<td>0.072</td>
<td>5.917</td>
<td>52.284</td>
<td>36072.2</td>
<td>0.000</td>
<td>−15.033</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q1</td>
<td>0.0055</td>
<td>0.0042</td>
<td>0.0038</td>
<td>4.207</td>
<td>30.100</td>
<td>10501.49</td>
<td>0.000</td>
<td>−6.705</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q2</td>
<td>0.0089</td>
<td>0.0042</td>
<td>0.0171</td>
<td>6.240</td>
<td>50.168</td>
<td>31344.16</td>
<td>0.000</td>
<td>−9.855</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q3</td>
<td>0.0062</td>
<td>0.0036</td>
<td>0.0112</td>
<td>6.646</td>
<td>53.613</td>
<td>35598.95</td>
<td>0.000</td>
<td>−6.992</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q4</td>
<td>0.0106</td>
<td>0.0077</td>
<td>0.0179</td>
<td>9.185</td>
<td>90.362</td>
<td>102939.8</td>
<td>0.000</td>
<td>−13.069</td>
<td>0.000</td>
</tr>
<tr>
<td>Panamax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COVFEP</td>
<td>0.00196</td>
<td>0.00179</td>
<td>0.0007</td>
<td>1.37</td>
<td>6.093</td>
<td>239.850</td>
<td>0.000</td>
<td>−10.306</td>
<td>0.000</td>
</tr>
<tr>
<td>COVFSP</td>
<td>0.0056</td>
<td>0.0051</td>
<td>0.0117</td>
<td>1.973</td>
<td>7.758</td>
<td>536.497</td>
<td>0.000</td>
<td>−11.679</td>
<td>0.000</td>
</tr>
<tr>
<td>VARGP</td>
<td>0.063</td>
<td>0.051</td>
<td>0.033</td>
<td>5.286</td>
<td>40.651</td>
<td>21474.770</td>
<td>0.000</td>
<td>−17.140</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q1</td>
<td>0.0028</td>
<td>0.0020</td>
<td>0.0026</td>
<td>4.547</td>
<td>33.353</td>
<td>13093.91</td>
<td>0.000</td>
<td>−3.524</td>
<td>0.008</td>
</tr>
<tr>
<td>FV-Q2</td>
<td>0.0038</td>
<td>0.0024</td>
<td>0.0055</td>
<td>5.989</td>
<td>47.174</td>
<td>27581.10</td>
<td>0.000</td>
<td>−5.615</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q3</td>
<td>0.0033</td>
<td>0.0020</td>
<td>0.0051</td>
<td>5.026</td>
<td>33.710</td>
<td>13576.15</td>
<td>0.000</td>
<td>−5.435</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q4</td>
<td>0.006</td>
<td>0.005</td>
<td>0.0067</td>
<td>11.845</td>
<td>148.212</td>
<td>279615.0</td>
<td>0.000</td>
<td>−10.644</td>
<td>0.000</td>
</tr>
<tr>
<td>Supramax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COVFES</td>
<td>0.0007</td>
<td>0.0005</td>
<td>0.0021</td>
<td>0.909</td>
<td>8.738</td>
<td>508.740</td>
<td>0.000</td>
<td>−7.3116</td>
<td>0.000</td>
</tr>
<tr>
<td>COVFSS</td>
<td>0.0023</td>
<td>0.0018</td>
<td>0.0021</td>
<td>1.703</td>
<td>9.907</td>
<td>832.675</td>
<td>0.000</td>
<td>−8.132</td>
<td>0.000</td>
</tr>
<tr>
<td>VARGS</td>
<td>0.135</td>
<td>0.116</td>
<td>0.054</td>
<td>5.157</td>
<td>5.482</td>
<td>225.426</td>
<td>0.000</td>
<td>−2.263</td>
<td>0.185</td>
</tr>
<tr>
<td>FV-Q1</td>
<td>0.0022</td>
<td>0.0015</td>
<td>0.0029</td>
<td>6.540</td>
<td>55.808</td>
<td>41190.3</td>
<td>0.000</td>
<td>−5.483</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q2</td>
<td>0.0021</td>
<td>0.0016</td>
<td>0.0017</td>
<td>4.621</td>
<td>28.697</td>
<td>10347.53</td>
<td>0.000</td>
<td>−4.289</td>
<td>0.001</td>
</tr>
<tr>
<td>FV-Q3</td>
<td>0.0020</td>
<td>0.0013</td>
<td>0.0033</td>
<td>7.443</td>
<td>66.907</td>
<td>57585.75</td>
<td>0.000</td>
<td>−10.660</td>
<td>0.000</td>
</tr>
<tr>
<td>FV-Q4</td>
<td>0.0018</td>
<td>0.0012</td>
<td>0.0024</td>
<td>5.231</td>
<td>32.896</td>
<td>13961.42</td>
<td>0.000</td>
<td>−9.626</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: Jarque-Bera is the Jarque and Bera test for normality. PP Stat is the Phillips and Perron test for unit root.
### Table IV.
The estimates of the regression models for different dry bulk sectors

<table>
<thead>
<tr>
<th></th>
<th>Capesize</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A_0)</td>
<td>2.457**</td>
<td>0.887(0.894)</td>
<td>0.977(1.010)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_1)</td>
<td>-0.335***</td>
<td>-0.168**</td>
<td>-0.195**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_2)</td>
<td>0.387***</td>
<td>0.456**</td>
<td>0.468**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_4)</td>
<td>0.495***</td>
<td>0.366**</td>
<td>0.362**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_5)</td>
<td>13.844***</td>
<td>13.086**</td>
<td>12.712**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_7)</td>
<td>-0.979***</td>
<td>-0.734**</td>
<td>-0.560*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A_8)</td>
<td>17.630***</td>
<td></td>
<td>2.724**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Diagnostics**

<table>
<thead>
<tr>
<th></th>
<th>Adjusted (R^2)</th>
<th>LogL</th>
<th>F Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>DW Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A_0)</td>
<td>0.326</td>
<td>-133.199</td>
<td>26.076</td>
<td>0.898</td>
<td>0.983</td>
<td>1.520</td>
</tr>
<tr>
<td>(A_1)</td>
<td>0.320</td>
<td>-137.005</td>
<td>29.240</td>
<td>0.902</td>
<td>0.991</td>
<td>1.478</td>
</tr>
<tr>
<td>(A_2)</td>
<td>0.319</td>
<td>-137.873</td>
<td>28.713</td>
<td>0.919</td>
<td>0.986</td>
<td>1.492</td>
</tr>
<tr>
<td>(A_3)</td>
<td>0.298</td>
<td>-132.71</td>
<td>22.891</td>
<td>0.901</td>
<td></td>
<td>1.550</td>
</tr>
</tbody>
</table>

**Panamax**

<table>
<thead>
<tr>
<th></th>
<th>Adjusted (R^2)</th>
<th>LogL</th>
<th>F Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>DW Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A_0)</td>
<td>0.080</td>
<td>-105.640</td>
<td>6.297</td>
<td>0.785</td>
<td>0.820</td>
<td>1.351</td>
</tr>
<tr>
<td>(A_1)</td>
<td>0.076</td>
<td>-104.826</td>
<td>28.417</td>
<td>0.737</td>
<td>0.770</td>
<td>1.353</td>
</tr>
<tr>
<td>(A_2)</td>
<td>0.108</td>
<td>-100.777</td>
<td>7.262</td>
<td>0.702</td>
<td></td>
<td>1.373</td>
</tr>
<tr>
<td>(A_3)</td>
<td>0.074</td>
<td>-91.926</td>
<td>4.845</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Supramax**

<table>
<thead>
<tr>
<th></th>
<th>Adjusted (R^2)</th>
<th>LogL</th>
<th>F Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>DW Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A_0)</td>
<td>0.010</td>
<td>-215.643</td>
<td>11.163</td>
<td>1.325</td>
<td>1.382</td>
<td>1.658</td>
</tr>
<tr>
<td>(A_1)</td>
<td>0.117</td>
<td>-208.757</td>
<td>13.677</td>
<td>1.332</td>
<td></td>
<td>1.680</td>
</tr>
<tr>
<td>(A_2)</td>
<td>0.111</td>
<td>-217.721</td>
<td>13.789</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** ***, ** and * mean statistically significant at 1%, 5% and 10%, respectively. The t-statistics is reported in the parenthesis. The variables with insignificant estimates are deleted from the regression equations. LogL is the log-likelihood. AIC is the Akaike information criterion. SC is the Schwarz information criterion. ARCH(12) is Engle’s F-test for ARCH effects. Figures in the brackets under the ARCH(12) estimates indicate the significance levels. \(ln(VOL_t) = A_0 + A_1ln(FFA_t) + A_2ln(FIX_{t-1}) + A_3ln(ERN_t) + A_4ln(SR_t) + A_5COVS_t + A_6COVFE_t + A_7VARF_t + A_8FV_t\).
The spot demand volatility has the negative relationship with the FFA trading volume for the Capesize and Panamax sectors. For the Capsize sector, this result is consistent with our theoretical statements because the spot demand volatility of the Capsize sector is the highest among the three sectors. The main cargoes carried by the Capsize carriers, e.g., iron ore and coal, have higher demand volatilities[6], which means higher risk for procuring more capacity in the forward market. Therefore, buyers are more cautious about the FFA trading, especially when the volatility of the spot demand is higher. This can restrain the FFA trading volume. One possible explanation for the inconsistence of Statement (vi) in the Supramax sector is its relative lower trading activities (Figure 5). The similar phenomenon and explanations can be found in the relationship between the FFA price change and trading volume in the work of Alizadeh (2013).

The covariance between the spot demand and the spot rate displays a positive relationship with the FFA trading volume in the Capesize and Panamax sectors. This is consistent with our theoretical analysis of Statement (v). Higher covariance between the spot demand and the spot rate means that buyers have more chances to sell the excess capacity and obtain more revenues in the spot market. This can encourage their trading enthusiasm in the forward market. Because of its lower trading activities, this Statement is not significant for the Supramax sector either.

FFA prices have a negative impact on the FFA trading volume only for the Capesize sector, which occupies more than 50 per cent of the freight forward market (Figure 5)[7]. This is consistent with our theoretical analysis of Statement (iv).

In the half of all scenarios, the volatilities of FFA returns have significant and positive impacts on the FFA trading volume, which indicates the speculation or arbitrage exist in most players when they trade FFA. This result is consistent with the literature addressing the speculation or arbitrage activities in FFA trade (Alizadeh, 2013).

In summary, we find that in the Capsize sector, we obtain the most reliable results consistent with our theoretical statements. This is mainly due to its more active trading and better liquidity. The reliable results of the empirical studies in the Capsize sector not only partially verify our theoretical statements, but also supply the traders in the FFA market a possible way to construct their hedging strategies. From equations (6) or (7), we know that a buyer’s optimal FFA procurement quantity is the expected spot demand multiplied by the quantity premium, which is determined by the demand covariance term, the demand riskiness term and the demand volatility term. Using the approach proposed by our empirical studies, one can estimate the parameters in equations (6) or (7) and then construct the feasible hedging strategies.

![Figure 5. The FFA trading volume percentages of the Capsize, Panamax and Supramax sectors](image)
strategy in practice. Moreover, our study indicates the impacts of the spot demand volatility and the covariance between the spot demand and the spot rate to the FFA trading activities. These impacts are not displayed by the other literature and can supply new insights to FFA traders.

4. Conclusions

In this paper, we analyze the determinants on the FFA trading volume from a cross-market perspective. We establish a theoretical model to characterize the determinants and their impacts on the FFA trading volume in the market equilibrium. Then we use a two-step model specification to empirically test our theoretical statements for the Capesize, Panamax and Supramax sectors. The results indicate that the most reliable results consistent with our theoretical statements are presented in the Capsize sector. Our empirical studies can supply the traders in the FFA market a possible way to construct their hedging strategies: the buyer’s optimal FFA procurement quantity is the expected spot demand multiplied by the quantity premium, which is determined by the demand covariance term, the demand riskiness term and the demand volatility term. In addition, our study indicates the impacts of the spot demand volatility and the covariance between the spot demand and the spot rate to the FFA trading activities. These impacts can also supply new insights to FFA traders.

Some possible extensions could be considered in future research. One could consider adding some constraints, e.g. the budget constraint, for the procurement in the forward freight market in the theoretical model, and investigate their impacts on the FFA trading volume. This can be implemented by adding a constraint in the buyer’s optimization problem. Moreover, cross-market linkages can be reflected from another angle: between forward freight markets and the derivatives markets of the commodities carried by the dry bulk vessels (Kavussanos et al., 2014). Therefore, one can seek other determinants of the FFA trading volume from these derivative markets of the commodities. For instance, the trading volumes and the volatilities of the derivative prices in the derivative markets of the commodities can be included in our model to reveal their impacts on the FFA trading activities.

Notes

1. Here, we isolate the hedging impacts of the FFA on its trading volume by our theoretical model. In the empirical studies, we will add the impacts of the speculation or arbitrage of FFA in the regression equations.

2. There are many empirical studies to demonstrate that the shipping demand and freight rate follow the lognormal distributions, e.g. Berg-Andreassen (1997); Kavssanos and Nomikos (1999).

3. In equation (4) and equation (5), it does not matter what base is used in the log function. The base can be the natural base e, or other bases. In the empirical studies, we use the natural log function.

4. Here, FFA prices are actually BFA (Baltic Forward Assessment) prices from the Baltic Exchange.

5. According to (Alizadeh et al. 2015a), Thursday’s FFA prices are used to represent the weekly prices to avoid the possible bias due to the weekend effects.

6. We use the sample provided by Stopford (2009, p.422, Table 11.2) to justify this statement. By calculating the coefficients of variation (CVs), which equals to the standard deviation divided by the mean of the maritime transport volumes for different dry bulk cargoes, we know that the CVs of iron ore, coal, grain, agribulks, sugar, fertilizer, Metals and minerals, and steel and forest
products are 0.32, 0.40, 0.17, 0.29, 0.21, 0.08,0.24 and 0.10, respectively. It can be easily found that the iron ore and coal have higher demand volatilities than other dry bulk cargoes.

7. In Figure 5, the FFA trading volume percentage of the Capsize (or Panamax or Supramax) means the percentage of the FFA trading volume of the Capsize (or Panamax or Supramax) sector to the total FFA trading volume.

References


Further reading


Corresponding author

Shun Chen can be contacted at: shunchen@shmtu.edu.cn
Appendix A. Proof of the theoretical statements

Here we use the framework proposed by Secomandi and Kekre (2014) to make the proofs. It is obvious that \( \min(q, D) = q - (q - D)^+ \). Therefore, the buyer’s profit function can be expressed as follows:

\[
\pi = E[rq + (f - r)(q - D)^+ - Fq]
\]

Then we can obtain the first order condition as follows:

\[
\frac{\partial \pi}{\partial q} = E(r) + E[f \cdot 1(q - D)] - E[r \cdot 1(q - D)] - F = 0
\]

where \( 1(\cdot) \) is the indicator function, i.e.:

\[
1(q - D) = \begin{cases} q - D & \text{if } q \geq D \\ 0 & \text{if } q < D \end{cases}
\]

From the property of multivariate normal distribution, we know that:

\[
E[\log r | \log D] = \log M_r - \frac{S_r^2}{2} + \rho_{Dr}^2 S_r S_D \left( \log D - \log M_D + \frac{S_D^2}{2} \right)
\]

\[
\text{var}(\log r | \log D) = \left( 1 - \rho_{Dr}^2 \right) S_r^2
\]

\[
E(r | D) = \exp \left[ E[\log r | \log D] + \frac{1}{2} \text{var}(\log r | \log D) \right]
\]

\[
= M_r \left( \frac{D}{M_D} \right)^{\rho_{D_S} S_r / S_D} \exp \left( \frac{\rho_{D_D} S_D S_r - \rho_{D_r}^2 S_r^2}{2} \right)
\]

Therefore, we have:

\[
E[1(q - D)] \cdot E(r | D) = M_r M_D^{-\rho_{D_S} S_r / S_D} \exp \left( \frac{\rho_{D_D} S_D S_r - \rho_{D_r}^2 S_r^2}{2} \right) E[D^{\rho_{D_S} S_r / S_D} \cdot 1(q - D)]
\]

(15)

From Secomandi and Kekre (2014)’s Lemma 1, we know that:

\[
E[D^{\rho_{D_S} S_r / S_D} \cdot 1(q - D)] = \exp \left( \frac{\rho_{D_D}^2 S_D^2 - \rho_{D_D} S_D S_r}{2} \right) M_D^{\rho_{D_S} S_r / S_D} \Phi \times \left( \frac{\log q - \log M_D + S_D^2 / 2 - \rho_{D_D} S_D S_r}{S_D} \right)
\]

(16)
Substituting equation (16) into equation (15), we have

\[ E[r \cdot 1(q - D)] = E[1(q - D)] \cdot E(r|D) = M_r \Phi \left( \frac{\log q - \log M_D + S_D^2/2 - \rho_{Dr}S_D S_f}{S_D} \right) \]

(17)

Using the same logic, we obtain that:

\[ E[f \cdot 1(q - D)] = M_f \Phi \left( \frac{\log q - \log M_D + S_D^2/2 - \rho_{Dr}S_D S_f}{S_D} \right) \]

(18)

Substituting equations (18) and (17) into equation (11), we can obtain equation (3).

Making the derivations directly based on equations (4) and (5), we can easily obtain:

\[ \frac{\partial \log q}{\partial M_D} > 0, \]
\[ \frac{\partial \log q}{\partial M_r} > 0, \]
\[ \frac{\partial \log q}{\partial M_f} > 0, \]
\[ \frac{\partial \log q}{\partial F} < 0, \]
\[ \frac{\partial \log q}{\partial (\rho_{Dr} S_D S_f)} < 0, \]
\[ \frac{\partial \log q}{\partial (\rho_{Dr} S_D S_f)} < 0. \]

Moreover, \( \frac{\partial \log q}{\partial S_D} = \frac{\rho_{Dr} S_D S_f - S_D^2}{S_D^2} \). If \( \rho_{Dr} S_D S_f < S_D^2 \), i.e. \( \text{Var}(D) < \text{cov}(D,f) \), \( \frac{\partial \log q}{\partial S_D} > 0 \), otherwise, \( \frac{\partial \log q}{\partial S_D} < 0 \).

The same logic can be applied to the case when considering the covariance between the demand and the earning \( \text{cov}(D, r) \).
Appendix B. The estimates of the GARCH models to calculate the volatilities of the FFA returns

<table>
<thead>
<tr>
<th>Capsize</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C0</td>
<td>C1</td>
<td>ω</td>
<td>α</td>
</tr>
<tr>
<td></td>
<td>-0.00463 (−1.053)</td>
<td>-0.0043 (−1.139)</td>
<td>-0.0037 (−1.004)</td>
<td>-0.010 (−1.556)</td>
</tr>
<tr>
<td></td>
<td>0.276*** (3.990)</td>
<td>0.307*** (4.768)</td>
<td>0.327*** (4.857)</td>
<td>0.179*** (2.558)</td>
</tr>
<tr>
<td></td>
<td>0.0009*** (2.804)</td>
<td>0.0012*** (4.343)</td>
<td>0.0005*** (4.246)</td>
<td>0.0078*** (8.386)</td>
</tr>
<tr>
<td></td>
<td>0.184*** (3.055)</td>
<td>0.654*** (6.086)</td>
<td>0.191*** (3.962)</td>
<td>0.324*** (5.610)</td>
</tr>
<tr>
<td></td>
<td>0.668*** (8.004)</td>
<td>0.368*** (5.490)</td>
<td>0.692*** (14.650)</td>
<td>0.062 (−0.561)</td>
</tr>
</tbody>
</table>

### Diagnostics

<table>
<thead>
<tr>
<th></th>
<th>Adjusted $R^2$</th>
<th>Log-likelihood</th>
<th>DW Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>ARCH(12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.061</td>
<td>389.53</td>
<td>2.014</td>
<td>-2.457</td>
<td>-2.397</td>
<td>0.512 (0.907)</td>
</tr>
<tr>
<td></td>
<td>0.026</td>
<td>378.10</td>
<td>2.127</td>
<td>-2.361</td>
<td>-2.302</td>
<td>0.499 (0.915)</td>
</tr>
<tr>
<td></td>
<td>0.014</td>
<td>406.262</td>
<td>2.210</td>
<td>-2.572</td>
<td>-2.512</td>
<td>0.409 (0.960)</td>
</tr>
<tr>
<td></td>
<td>0.004</td>
<td>296.04</td>
<td>2.332</td>
<td>0.006</td>
<td>0.014</td>
<td>0.072 (1.000)</td>
</tr>
</tbody>
</table>

### Panamax

<table>
<thead>
<tr>
<th></th>
<th>C0</th>
<th>C1</th>
<th>ω</th>
<th>α</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.0034 (−1.371)</td>
<td>-0.0031 (−1.006)</td>
<td>-0.0043 (−1.777)</td>
<td>0.003 (0.518)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.185*** (3.356)</td>
<td>0.102 (1.593)</td>
<td>0.230*** (3.742)</td>
<td>0.044 (0.465)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0002*** (2.081)</td>
<td>0.0001*** (1.886)</td>
<td>0.0001*** (2.516)</td>
<td>0.005*** (14.225)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.243*** (2.716)</td>
<td>0.209*** (5.027)</td>
<td>0.201*** (4.257)</td>
<td>0.177** (2.784)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.701*** (8.619)</td>
<td>0.806*** (27.55)</td>
<td>0.751*** (16.681)</td>
<td>0.059 (−1.434)</td>
<td></td>
</tr>
</tbody>
</table>

### Diagnostics

<table>
<thead>
<tr>
<th></th>
<th>Adjusted $R^2$</th>
<th>Log-likelihood</th>
<th>DW Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>ARCH(12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.030</td>
<td>512.508</td>
<td>1.986</td>
<td>-3.243</td>
<td>-3.183</td>
<td>1.572 (0.099)</td>
</tr>
<tr>
<td></td>
<td>0.010</td>
<td>485.79</td>
<td>1.982</td>
<td>-3.043</td>
<td>-2.984</td>
<td>0.221 (0.997)</td>
</tr>
<tr>
<td></td>
<td>0.006</td>
<td>511.05</td>
<td>2.151</td>
<td>-3.244</td>
<td>-3.184</td>
<td>0.266 (0.994)</td>
</tr>
<tr>
<td></td>
<td>0.032</td>
<td>401.53</td>
<td>2.472</td>
<td>0.006</td>
<td>0.010</td>
<td>1.099 (0.361)</td>
</tr>
</tbody>
</table>

### Supramax

<table>
<thead>
<tr>
<th></th>
<th>C0</th>
<th>C1</th>
<th>ω</th>
<th>α</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.0034 (−1.507)</td>
<td>-0.0051*** (−2.186)</td>
<td>-0.004*** (−1.916)</td>
<td>-0.003 (−1.625)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.187*** (2.974)</td>
<td>0.087 (1.206)</td>
<td>0.214*** (3.252)</td>
<td>0.189 (26.440)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.000*** (2.175)</td>
<td>0.000*** (2.703)</td>
<td>0.0002*** (3.03)</td>
<td>0.000 (5.433)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.193*** (4.212)</td>
<td>0.080*** (3.904)</td>
<td>0.210*** (4.343)</td>
<td>-0.039 (−9.983)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.787*** (20.13)</td>
<td>0.881*** (37.543)</td>
<td>0.639*** (7.358)</td>
<td>1.013 (124.376)</td>
<td></td>
</tr>
</tbody>
</table>

### Diagnostics

<table>
<thead>
<tr>
<th></th>
<th>Adjusted $R^2$</th>
<th>Log-likelihood</th>
<th>DW Statistics</th>
<th>AIC</th>
<th>SC</th>
<th>ARCH(12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.014</td>
<td>598.51</td>
<td>2.050</td>
<td>-3.554</td>
<td>-3.497</td>
<td>1.198 (0.284)</td>
</tr>
<tr>
<td></td>
<td>-0.0068</td>
<td>579.43</td>
<td>2.092</td>
<td>-3.450</td>
<td>-3.393</td>
<td>0.068 (1.000)</td>
</tr>
<tr>
<td></td>
<td>0.017</td>
<td>591.43</td>
<td>1.89</td>
<td>-3.654</td>
<td>-3.595</td>
<td>1.187 (0.291)</td>
</tr>
<tr>
<td></td>
<td>0.009</td>
<td>628.91</td>
<td>2.141</td>
<td>0.017</td>
<td>0.0088</td>
<td>1.594 (0.092)</td>
</tr>
</tbody>
</table>

Notes: ***, ** and * mean statistically significant at 1%, 5% and 10%, respectively. The t-statistics is reported in the parenthesis. LogL is the log-likelihood. AIC is the Akaike information criterion. SC is the Schwarz criterion. DW statistics is the Durbin–Watson statistics. ARCH(12) is Engle’s F-test for ARCH effects. Figures in the brackets under the ARCH(12) estimates indicate the significance levels. $\text{RT}_t = \text{C}_0 + \text{C}_1 \cdot \text{RT}_{t-1} + \epsilon_t, \epsilon_t \sim (0, h_t), h_t = \omega + \alpha \epsilon_{t-1}^2 + \beta h_{t-1}$.
An empirical analysis of service quality factors pertaining to ocean freight forwarding services

S. Subhashini and S. Preetha
Department of Management, Vels University, Tamil Nadu, India

Abstract

Purpose – The service sector is the key driver of a country’s economic growth. The quality of service is more important for the survival of any organization. It is the interactive process by which the organization understands the customer and satisfies their needs. The main purpose of this study is to identify the factors influencing service quality in ocean freight forwarding and to study the association between the factors.

Design/methodology/approach – This research uses a deductive approach, which understands the theory first and collects the data. A questionnaire is designed to collect the data. The sampling technique used is two-stage sampling. First, the freight forwarders are selected and then the customers, importers and exporters are selected randomly. Likert scales are used to measure quality factors such as tangibility, reliability, responsibility, value, empathy and assurance. The association of factors is empirically evaluated. The SPSS tool is used for the correlation analysis.

Findings – An extensive review of the literature has been done to study and identify these service quality factors influencing customer satisfaction and loyalty. The result of this extensive literature review revealed that tangibility, responsiveness, reliability, trust, empathy and value are the service quality. It has been proved that there exists a significant association between the service quality factors and is positively related to the customer satisfaction.

Originality/value – Some studies have examined the freight forwarders’ service quality, but not specifically related to any dimension. This study attempts to bring together the five dimensions of SERVQUAL scale and the value dimension evaluating the cost, freight charges, safety and security criteria in the industry and examines the association between the quality factors and customer satisfaction.

Keywords Customer satisfaction, Value, Service quality, Freight forwarder

Paper type Research paper

1. Introduction

Nowadays shippers outsource their shipping activities to freight forwarders. Freight forwarders perform operation and activities needed for the smooth flow of goods from the place of origin to the destination. A freight forwarder is a third-party logistics (3PL) service provider who links the buyers and the sellers by delivering the products to the customer in an efficient manner. Freight forwarding companies are getting diversified into fast-growing logistics business and changing from traditional activities to adapt into a very new avatar. Transport intelligence (Global Freight Forwarding report, 2016), a market research firm, estimated that the global freight forwarding in 2016 was US $141.9bn, which indicates a growth of 2.7 per cent, and cargo volume growth is estimated at 2.6 per cent when compared to 2015, with 2.1 per cent growth in value/revenue and 2.0 per cent growth in cargo volume. Sixty per cent of global freight market is controlled by

© Pacific Star Group Education Foundation. Licensed re-use rights only.
the top 20 forwarders. Other forwarders almost cover 40.5 per cent of the market share. The activities of freight forwarders include preparing shipping documents, booking space from the carrier, preparing customs clearance, advising customers on import/export regulations, etc. They also provide some value-added services to both importers and exporters such as packing and labelling, proving own transport, warehousing, providing distribution services. For the shipments leaving or entering India, the freight forwarders act as an interface with all the government agencies and companies involved in making the cargo available at the destination. The shippers select the forwarders if they are the better service provider with a better deal. The freight forwarders also provide good planning to ensure a cost-effective method of moving the cargo to the destination country at the required time. Providing the shippers with good quality of service increases their loyalty. The quality of service determines the shippers’ satisfaction and loyalty. The shippers perceive the quality of service of the service provider in three ways: high quality, where the shippers’ perceived quality of service is greater than the expected service; acceptable quality, where the perceived quality of service is equal to the expected service; and bad quality, where the perceived quality of service is much lower than the expected service.

It becomes necessary to study the service quality factors in ocean freight forwarding to check if the perceived service quality is less than the expected service. Therefore, the objectives of this study is to identify the crucial service quality factors pertaining to ocean freight forwarding services based on the SERVQUAL scale and examine the associations between the factors.

2. Review of literature on SERVQUAL scale
Parasuraman (1985) revealed ten dimensions consumers use to frame the expectations and the perceived services. It has also been identified that there exist five key gaps with regards to the quality of services from the service provider side which are affecting the service quality perceived by the consumers. The five key gaps from the study of Parasuraman et al. (1991) indicated that gaps exist between consumer expectation and management perception, management perception and service quality specifications, service quality specifications and service delivery, service delivery and external communication, as well as expected service and perceived service.

Lovelock (1994) identified the sixth gap which is the gap between perceived service and service delivery. The service quality was measured with the service performance scale which was to measure the perceived service. The initial ten dimensions identified by Parasuraman et al. (1991) have been reduced to five dimensions, namely, tangibility, reliability, responsibility, assurance and empathy (Table I). It has also been stated that the cost and price factors can be taken into a separate dimension to study service quality. This SERVQUAL is more widely used in different service sectors to evaluate the service quality. It has also been stated that the cost dimension must be taken separately apart from the five dimensions. Chowdhary and Prakash (2007) revealed that the value dimension is more important while evaluating the service quality.

2.1 Literature on ocean freight forwarding service quality
Apart from the SERVQUAL dimensions, Shin et al. (2011) stated that speed and accuracy are essential to evaluate the service quality in ocean freight forwarding. Yuen and Thai (2015) addressed that speed and value are crucial factors in the shipping industry. The transit time of the transportation services, frequency, accuracy and those factors that contribute to the speed of shipment are evaluated under speed dimension. The total cost, freight charges and
safety and security of shipments are evaluated under the value dimension. Lin and Liang (2011) observed four dimensions such as convenience of operation process, aggregated service, excellent transit handling and rationalization of freight rate while exploring the service quality of freight forwarders in Taiwan market. Results revealed five priority items, such as EDI, cargo tracing service, availability of cargo space, competence of emergency handling and the ability of claims handling and freight rate that influence the shippers’ satisfaction. Arif (2015) identified that price, individual attention, on time delivery, tracking and tracing would improve the service quality and would boost the financial performance of the shipping company. Reliability, accuracy, safety, speed, protection of shipments, delivery time, politeness of employees, qualification of employees, technical condition and appearance of the vehicle, communication, credibility, flexibility are the criteria necessary in freight forwarding industry (Simkova et al., 2013).

2.2 Service quality under SERVQUAL dimension

2.2.1 Tangibility. Parusuraman et al. (1985) identified a well-furnished office as a tangible dimension. It has been stated that the SERVQUAL dimension can be modified accordingly with respect to the service sector under study. Thus, SERVQUAL needs to be refined so that it fits the context. Lu (2003) proposed five service attributes such as availability of cargo space, low cargo damage, accurate documentation, reliability of schedule, courtesy on inquiry. Premeaux et al. (2002) indicated that the containers must be seaworthy so that there is low cargo damage. It is one of the important attributes for influencing the perceived service quality.

O’Neill and Palmer (2003) and Zeithaml et al. (2006) stated tangibles as physical cues that are part of the service delivery process. The assets of outsource company comprise physical facilities and information technology and software systems. Liang et al. (2006) addressed that computer EDI, cargo tracing ability also influence the service quality. Wen and Huang (2007) and Wong et al. (2008) showed that the condition of containers influences the service quality perceived by the shipper. Availability of special equipment includes reefer and flats, container availability, etc. Wong et al. (2008) identified computer hardware and software facilities, internet connection and shipment tracking facility play a vital roles in enhancing service quality.

Tansakul and Kulsomsiri (2013) suggested that tangibles are of two types, physical facilities and information technology facilities, such as tracking devices, software systems, etc., which facilitate the service. The appearance of physical facilities, staff sufficiency, availability and utilization of resources, IT system and capabilities are all evaluated under the tangibility dimension.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibility</td>
<td>Ability to provide physical facilities, equipment and appearance</td>
</tr>
<tr>
<td>Reliability</td>
<td>Ability to perform the promised service dependably and accurately</td>
</tr>
<tr>
<td>Assurance</td>
<td>Ability to inspire trust and confidence</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Willingness to help customers and provide prompt service</td>
</tr>
<tr>
<td>Empathy</td>
<td>Caring and individualized attention to customers</td>
</tr>
<tr>
<td>Value</td>
<td>Cost and price flexibility aspects</td>
</tr>
<tr>
<td>Safety</td>
<td>Safety of the cargo</td>
</tr>
</tbody>
</table>

Table I.
Service quality dimensions

Source: Parusuraman et al. (1985)
2.2.2 Reliability. Reliability is defined as the ability of the service provider in providing the service accurately and dependably. Honouring work schedules, error-free records, customers feeling safe during transactions, informing exactly when services will be performed are the factors identified by reviewing the study done by the authors pertaining to ocean freight forwarding to measure reliability. (Sirisoponsilp and Wonginta, 2003) Adherence to commit sailing schedule (Lu, 2003) error-free documentation, accepting requests for diversion or re-consignment of cargo (Wen and Huang, 2007), transit time reliability and consistency are considered as the evaluation criteria.

2.2.3 Responsibility. Responsibility was defined by Parusuraman et al. (1988), as the service provided providing prompt services. Lu (2003) suggested that sales people’s regular visits to customers play a vital role in improving the service quality. Kannan et al. (2010) identified that the on-time issuance of the arrival and delay notices, the on-time release of B/L, freight invoices were considered crucial from the shipper’s point of view. Wen and Huang (2007) identified that safe transportation of cargo is a measure of service quality. Wong et al. (2008) indicated that on-time pickup and delivery of cargo are service quality criteria in the shipping industry. Emergency situations need extra attention and care from the service provider for smooth movement of cargo to the destination. Competence in emergency handling, prompt service and flexibility are classified under the dimension of responsibility (Lin and Liang, 2011; Wenyong, 2010).

2.2.4 Assurance. Assurance is defined as the ability of the service provider to instil trust and confidence (Zeithmal et al., 2006; Buttle, 1996). The interaction between the freight forwarder and the shipper must enhances a degree of confidence and trust (Sirisoponsilp and Wonginta, 2003). Politeness and courtesy of employees, knowledge and competence of employees, honouring promise, communicating effectively and consistently being courteous are some of the service quality criteria under the assurance dimension (Wen and Huang, 2007). On-time and proper communication about shipment matters are perceived as an essential criterion from the shippers’ perspective (Wen and Huang, 2007).

2.2.5 Empathy. Parusuraman and Zeithmal (1988) stated empathy as personal attention given to an individual customer, employees’ willingness to help, listening to customer complaints and providing a prompt response, understanding customer needs and keeping the best interest of customers at heart.

2.2.6 Value. Yuen and Thai (2015) evaluated the liner service quality identifies that freight cost, safety and security are also criteria influencing shippers’ satisfaction. Simkova and Knoecnny’s (2013) study on the service quality of the ocean freight forwarders found 12 service quality factors including safety and protection of shipments that were perceived as important by the shippers. Wen and Huang (2007) analysed that the safe transportation of cargo, willingness to negotiate rates, extending credit facilities to shippers are criteria that can be classified under the value dimension (Kannan et al., 2010; Wenyong, 2008).

2.2.7 Service quality and customer satisfaction. Perceived service quality and customer satisfaction relationships, direct and indirect influence of service quality on customer satisfaction and customer loyalty have been empirically examined in service literature. The construct customer satisfaction has been the most important element of research for over years. It is defined as “customer’s fulfilment response to a consumption experience or some part of it”. It is the customer’s pleasurable fulfilment response. Oliver (1993) stated that service quality should be given priority to enhance customer satisfaction. Anderson and Fornell (1994) and Brown and Swartz (1989) indicated that the quality of service positively correlates with customer satisfaction and service quality strongly influences satisfaction (Cronin and Taylor, 1992). Improvement of quality should be based on the needs of customer which would result in enhanced customer satisfaction (Anderson et al., 1994).
Customer satisfaction plays a vital role in determining customer loyalty. Dick and Basu (1994) revealed that satisfaction has a significant positive effect on loyalty, and there is a positive linear association among the service quality variables. Iacobucci et al. (1995) suggested the difference between the service quality and customer satisfaction is that quality relates to the management's service delivery and satisfaction refers to a customer's expectation with the service. There happens to be very little research on studies related to the improvement of freight forwarding services. This study uses an exploratory factor analysis to examine the criteria of ocean freight forwarders' service quality in Chennai on the basis of SERVQUAL dimensions.

Sureshchandar et al. (2002) pointed out that there exists a crucial relationship between service quality and satisfaction. Caruana (2002) concluded that customer satisfaction plays a mediating role between the service quality and customer loyalty. The results of this research concluded that service quality is an important gateway to customer satisfaction and explains variance of 53 per cent. Othman and Owen (2001) framed a model called CARTER, consisting of 34 attributes related to dimension complaint, assurance, reliability, tangibility, empathy and responsiveness.

Liang and Zhang (2009) indicated that customer satisfaction lead to positive customer behavioural intentions. Senic and Marinkovic (2014) proved that customers who are satisfied exhibit loyalty to the service provider by recommending the services to others which would positively influence the financial performance of the firm (Lam et al., 2004). Mowen and Chakraborty (1995) used 12 dimensions instead of 5 basic SERVQUAL dimensions to study the quality of services pertaining to medical services. Yoon and Suh (2004) promoted the traditional five dimensions into six dimensions, namely, reliability, empathy, assurance, responsiveness, process and education, which best adapted to the study about IT consultancy services. Wenyong et al. (2010) developed a system of quality evaluation for freight forwarding through SERVQUAL with 5 dimensions and 17 items and proved that reliability is the most important dimension. Liang (2006) identified the service requirements for international freight forwarders and found that the key attributes were the provision of door-to-door delivery, operation efficiency and transport cost and stated that empathy and responsiveness are the bottleneck problems and even though reliability and assurance are satisfied, but they are still key for improvement. According to the knowledge of the authors, there exists relatively very little research on service quality pertaining to freight forwarding. Ding and Tsai (2012) studied the basis criteria of evaluating the service quality of freight forwarding services in Taiwan which includes 57 criteria under dimensions such as freight and shipping schedule, supportive transport items, contingency handling ability, company reputation and internal management. The study induced 24 criteria from 57 criteria, and the first 5 important criteria include freight cost, transport time, sailing frequency, convenience of service and service scope and location.

An in-depth study of the literature revealed that most studies focused on finding the SERVQUAL factors to measure the quality of service pertaining to service providers (Table II). Many studies have been conducted to compare the expected and perceived service quality among 3PL service providers. There exist very few studies on the perceived service quality related to freight forwarding services. Hence, this study focuses on shippers' perceived service quality and analysing the factors and its association with customer satisfaction.

3. Methodology
3.1 Research hypothesis
Many empirical studies have stated the link between the service quality factors and customer satisfaction in different service sectors (Cronin and Taylor, 1992;
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Items</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical facilities</td>
<td>Corporate website, well-furnished office, telecommunications equipment, computers, printers, fax machines, internet facilities, sufficient staff, sufficient number of agents</td>
<td>Wong et al. (2008), Parasuraman and Zeithmal (1988)</td>
</tr>
<tr>
<td>ICT</td>
<td>Online shipment tracking, e-booking</td>
<td>Liang et al. (2006), Lu (2002)</td>
</tr>
<tr>
<td>Committed schedules</td>
<td>Adherence to committed schedules</td>
<td>Siriponsilp and Wonginta (2003)</td>
</tr>
<tr>
<td>Documentation quality</td>
<td>Error-free documentation</td>
<td>Lu (2003)</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Accepts request for re-consignment of cargo</td>
<td>Premeaux (2002), Siriponsilp and Wonginta (2003)</td>
</tr>
<tr>
<td>Time reliability</td>
<td>Provides transit time reliability and consistency</td>
<td>Wen and Huang (2007), Wong (2008)</td>
</tr>
<tr>
<td>Equipment availability</td>
<td>Availability of cargo space</td>
<td>Wen and Huang (2007), Siriponsilp and Wonginta (2003), Lin and Liang (2011)</td>
</tr>
<tr>
<td>Sales call regularity</td>
<td>Sales people regular visits</td>
<td>Ding and Tsai (2012), Lu (2003), Premeaux (2002)</td>
</tr>
<tr>
<td>On-time release of documents</td>
<td>On-time release of B/L, freight invoices</td>
<td>Kannan et al. (2010)</td>
</tr>
<tr>
<td>Safety</td>
<td>Safe transportation of cargo</td>
<td>Wen and Huang (2007)</td>
</tr>
<tr>
<td>On-time pick-up and delivery</td>
<td>On-time pick-up and delivery of cargo</td>
<td>Wong et al. (2008)</td>
</tr>
<tr>
<td>Handling emergency</td>
<td>Competency in emergency handling</td>
<td>Lin and Liang (2011)</td>
</tr>
<tr>
<td>Information</td>
<td>Informing exactly when service will be performed</td>
<td>Parasuraman and Zeithmal (1988), Parasuraman and Zeithmal (1988)</td>
</tr>
<tr>
<td>Claim Settlement</td>
<td>Speed and ease of claims</td>
<td>Wenyong (2010)</td>
</tr>
<tr>
<td>Value and Counselling service</td>
<td>Route plan that enables fast delivery at a reasonable cost</td>
<td>Yuen (2015), Ding and Tsai (2012)</td>
</tr>
<tr>
<td>Credit facility</td>
<td>Extending credit facilities to customers</td>
<td>Kannan et al. (2010)</td>
</tr>
<tr>
<td>Pricing facilities</td>
<td>Willingness to negotiate rates to match customers</td>
<td>Wong et al. (2008), Lu (2003)</td>
</tr>
<tr>
<td>Competence of employees</td>
<td>Knowledge and competence of employees</td>
<td>Parasuraman and Zeithmal (1988), Lu (2003), Wen and Huang (2007)</td>
</tr>
<tr>
<td>Communication</td>
<td>On-time and proper communication about shipment matters</td>
<td>Wen and Huang (2007)</td>
</tr>
<tr>
<td>Assurance</td>
<td>Honouring promises</td>
<td>Parasuraman and Zeithmal (1988)</td>
</tr>
<tr>
<td>Trust</td>
<td>Feeling safe in transactions</td>
<td>Lu (2003), Sirisoponsilp and Wonginta (2003)</td>
</tr>
<tr>
<td>Complaint handling</td>
<td>Listening to complaints and showing sincere interest in solving problem</td>
<td>Lu (2003), Parasuraman and Zeithmal (1988)</td>
</tr>
<tr>
<td>Personal attention and understanding the customer</td>
<td>Understanding customer specific needs and assessing customer future needs</td>
<td>Parasuraman and Zeithmal (1988)</td>
</tr>
</tbody>
</table>
Anderson, 1994). Anderson (1994) studied the link between the perceived performance and customer satisfaction and proved that perceived performance has a significant impact on satisfaction. The expectation disconfirmation theory by Oliver (1993) explained that the customer satisfaction resulted from a comparison between the expectation of customer and outcome performance. The outcome of the performance of the service provider influences the customer satisfaction and that customer satisfaction increases by increasing the perceived performance. Cronin and Taylor (1992) suggested that service quality can be evaluated by the performance of the service provider. Teas (1993) stated that an individual evaluates the service quality of the service provider by the performance. The main aim of the study is to investigate the association between service quality factors and the influence of tangibility, responsibility, reliability and value on customer satisfaction in freight forwarding. Through an extensive review of the literature, the following hypothesis has been framed:

\[ H1. \] There is an association between the service quality factors.

\[ H2. \] Service quality in terms of tangibility, reliability, responsibility and value positively influences customer satisfaction in ocean freight forwarding services.

### 3.2 Sampling technique

The sampling method applied is sub-sampling. It is a two-stage sampling. First, the freight forwarders are selected randomly from the list provided by *EXIM Shipping Times*, one of newspapers in Chennai. Then the importers and exporters are selected randomly from the freight forwarders list. Information was drawn from a mail survey of 135 randomly selected importers and exporters. Most of the respondents were presidents, CEOs and owners. The number of responses returned were 100. The respondents have a history of using freight forwarding services and so they possess knowledge and familiarity on the quality of service. Sixty responses were from importers and 40 from exporters. The questionnaire was divided into two sections. The first part consists of the demographic questions related to the type of business, designation, size of company and years of experience. The second part has 31 questions on the factors of service quality and 6 questions based on customer satisfaction. A five-point Likert scale from strongly agree to strongly disagree has been adapted to measure the service quality factors and customer satisfaction. Customer satisfaction is measured using six statements such as:

1. Compared to other freight forwarders, I know my freight forwarder gives me high quality service.
2. I am completely satisfied with the services delivered by my freight forwarder.
3. I feel absolutely delighted with my freight forwarder services.
4. I feel relaxed clearing goods with my freight forwarder.
5. Overall, I feel happy about the shipping experience.
6. My freight forwarder makes all processes known to me, and I am happy with that.

Service quality statements are as given below in service quality statements:

- My freight forwarder has an informational corporate website.
- My freight forwarder has well-furnished office with communication equipment.
- My freight forwarder has sufficient staff to handle my work.
- My freight forwarder has online shipment tracking facility.
Service quality factors

- My freight forwarder has e-booking facility.
- My freight forwarder has a sufficient network of agents.
- Employees of my freight forwarder are polite and courteous
- My freight forwarder provides route plan that enables fast delivery at reasonable cost.
- My freight forwarder informs exactly when services will be performed.
- My freight forwarder’s employees are knowledgeable and competent enough.
- My freight forwarder offers low freight rates.
- My freight forwarder extends credit facilities.
- My freight forwarder has the willingness to negotiate rates.
- My freight forwarder’s employees have the willingness to help.
- My freight forwarder accepts requests for re-consignment of cargo.
- My freight forwarder provides transit-time reliability and consistency.
- My freight forwarder listens to complaints and shows interest in solving problem.
- I feel safe in transactions.
- My freight forwarder assesses my future needs.
- My freight forwarder honours promises made.
- My freight forwarder provides on-time and proper communication on shipment matters.
- Speed of service process and ease of claims.
- Safe transportation of cargo.
- On-time release of B/L, freight invoices.
- On-time issuance of arrival and delay notices.
- On-time pick-up and delivery of cargo.
- Provides error-free documentation.
- Competency in emergency handling.
- My freight forwarder adheres to committed schedule.
- Availability of cargo space.
- My freight forwarder’s sales people regularly visit me.

3.3 Statistical analysis
Statistical Package for Social Sciences (SPSS) is used for analysis. Factor analysis is used to verify the construction of scale. Pearson correlation is used to analyse the association between the service quality factors – tangibility, reliability, responsibility, value, assurance, empathy, customer satisfaction. Multiple regression has been analysed to find the relationship between tangibility, reliability, responsibility, value and customer satisfaction. Cronbach’s analysis has been done to examine the reliability of the questionnaire, as the reliability increases, the fraction of error decreases (Tavakol and Dennick, 2011). Reliability is 0.884 for the 37 items, which suggests that the questionnaire is reliable.
4. Results of analyses

Factor analysis is performed using SPSS 21. Factor analysis is a method to verify the construction of scale and construct indices. It could also be used to justify dropping of questions. Principal component was the extraction method used, and after the extraction of factors, varimax rotation method was used, which is an orthogonal rotation that produce factor loading that may be high or low and makes it easier to match each item with a factor.

The appropriateness of the collected data is checked through Kaiser–Meyer–Olkin measure of sampling adequacy and Bartlett’s test of sphericity. A KMO index greater than 0.5 is accepted (Kaiser, 1974), and the test is significant if the p value is less than 0.05 and (Field, 2005), it states the appropriateness of the analysis. The KMO value is 0.578 and is above the accepted limit of 0.5. In addition, the high chi-square value of 2669.8 and 0.001 significance levels proves that the data collected are appropriate.

MacCaullum et al. (2001) suggested that all items should have communalities of more than 0.60 to justify the analysis with a small sample size, and hence, factor loadings above 0.6 are considered and other statements which had factor loadings less than 0.6 are omitted. The total number of statements from 31 has been reduced to 28. Seven factors induced from this analysis are, namely: reliability, responsibility, tangibility, value, assurance, empathy and safety. Table III shows that the total cumulative variance is above 60 per cent which is considered acceptable in social sciences. The first five principal components have fulfilled the actual requirement of the 60 per cent limit and above. The percentage of cumulative eigenvalue is raised to 72.547 when considering two more components, and therefore, seven components are retained to study the service quality of ocean freight forwarders in Chennai.

The Pearson correlation test is used to determine the associations between the factors (Table IV). The analysis shows that there exists significant correlation between the service quality factors, and the correlation is significant at the 0.01 level. The correlation coefficient between reliability and tangibility is 0.862 which indicates a positive relationship between reliability and tangibility, and the percentage of relationship is 74 per cent. The percentage of relationship between value and responsibility is 72.2 per cent, assurance and responsibility is 68.8 per cent, empathy and responsibility is 44 per cent and safety and reliability is 23.5 per cent. The above results also state that there is no correlation between safety and empathy, as safety is a precautionary measure and employees’ willingness to listen to complaints and employees’ willingness to help have no association with safety. Accordingly, the results support H1. There exists an association between the service quality factors.

Table IV explains that the partial regression coefficients of responsibility, reliability, value and tangibility are 0.275, 0.521, 0.213 and 0.081, respectively; the R-value is 0.980, and the R-square value is 0.961. The above regression equation states that for each unit increase in the factors such as responsibility, reliability, value and tangibility, customer satisfaction increases by 0.275, 0.521, 0.213 and 0.081, respectively. This clearly states that the above factors play a significant role in enhancing customer satisfaction. Among the seven factors discussed earlier, reliability, responsibility, value and tangibility play a key role in influencing customer satisfaction. Hence, H2 was partially supported. There exists a significant and positive influence of tangibility, reliability, responsibility and value on customer satisfaction (Table V).

5. Conclusions

To enhance service quality in freight forwarding, managers should know the service attributes that must be improved based on the expectations of the shippers. This study has revealed through an extensive literature review and exploratory factor analysis that well-
### Table III. Factor analysis results

<table>
<thead>
<tr>
<th>Factors</th>
<th>Statement</th>
<th>Cronbach’s α</th>
<th>Factor loading</th>
<th>Eigenvalue</th>
<th>Percentage of variance</th>
<th>Cumulative percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Availability of cargo space</td>
<td>0.937</td>
<td>6.809</td>
<td>21.963</td>
<td>21.963</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder adheres to committed schedule</td>
<td>0.899</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder provides transit-time reliability and consistency</td>
<td>0.848</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feeling safe in transactions</td>
<td>0.849</td>
<td>0.842</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder provides on-time and proper communication on shipment matters</td>
<td>0.818</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assesses my future needs</td>
<td>0.791</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder accepts requests for re-consignment of cargo</td>
<td>0.750</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder provides error-free documentation</td>
<td>0.646</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>On-time pick-up and delivery of cargo</td>
<td>0.813</td>
<td>4.000</td>
<td>12.904</td>
<td>34.864</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On-time release of B/L, freight invoices</td>
<td>0.734</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarders’ sales people regularly visit me</td>
<td>0.722</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>On-time issuance of arrival and delay notices</td>
<td>0.836</td>
<td>0.699</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competency in emergency handling</td>
<td>0.637</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Speed of service process and ease of claims</td>
<td>0.615</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tangibility</td>
<td>My freight forwarder has online shipment tracking facility</td>
<td>0.773</td>
<td>3.392</td>
<td>10.942</td>
<td>45.808</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has sufficient staff to handle my work</td>
<td>0.738</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has e-booking facility</td>
<td>0.732</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has well-furnished office with communication equipment</td>
<td>0.721</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has a sufficient network of agents</td>
<td>0.821</td>
<td>0.692</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>My freight forwarder extends credit facilities</td>
<td>0.806</td>
<td>2.968</td>
<td>9.574</td>
<td>55.382</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has willingness to negotiate rates</td>
<td>0.774</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder provides route plan that enables fast delivery at reasonable cost</td>
<td>0.747</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>My freight forwarder has willingness to negotiate rates</td>
<td>0.837</td>
<td>0.735</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assurance</td>
<td>My freight forwarder’s employees are knowledgeable and competent enough</td>
<td>0.827</td>
<td>1.979</td>
<td>6.385</td>
<td>61.767</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employees of my freight forwarder are polite and courteous</td>
<td>0.818</td>
<td>0.797</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empathy</td>
<td>Listens to complaints and shows interest in solving problem</td>
<td>0.811</td>
<td>0.773</td>
<td>1.783</td>
<td>5.752</td>
<td>67.520</td>
</tr>
<tr>
<td></td>
<td>Employees have the willingness to help</td>
<td>0.717</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Safe transportation of cargo</td>
<td>0.833</td>
<td>0.786</td>
<td>1.558</td>
<td>5.027</td>
<td>72.547</td>
</tr>
</tbody>
</table>
equipped office, sufficient staff, online booking, shipment tracking, good network of agents (tangibles), committed schedule, error-free documentation, accepting requests for re-consignment of cargo, transit time reliability and consistency, cargo space availability, on-time communication, feeling safe in transactions (reliability), sales people regular visit, on-time issuance of B/L, arrival and delay notices, pick-up and delivery of cargo, competence in emergency handling, speed and ease of claims (responsibility), route plan, freight rates, credit facilities, willingness to negotiate rates (value), knowledge and politeness of employees (assurance), willingness to help, sincere interest in solving problems (empathy) and safe transportation of cargo are the 28 attributes of service quality pertaining to freight forwarding services in Chennai. The study has identified the association between factors and influence of reliability, responsibility, value and tangibility factors on the satisfaction of shippers. To effectively compete in the market, freight forwarders should provide dedicated service and should provide differentiated service to satisfy customer needs. Moreover, the study enables future researchers to frame service quality models to further evaluate the relationship between service quality factors customer satisfaction. The study has highlighted the importance of the service quality factors that are more important for enhancement of freight forwarding business. Moreover, sea freight in India contributes more than 70 per cent of international trade through sea ports. The performance in the logistics industry in international trade is very important to the economic growth of a country. This sector is now recognised as one of the core pillars that shapes the economy of a country. Freight forwarding companies should focus on improving the quality of factors to improve customer satisfaction which in turn would increase the number of loyal customers leading to an increase in the overall profit.

The present study examined the association between the tangibility, responsibility, reliability, value, assurance, empathy and its influence on customer satisfaction pertaining

<table>
<thead>
<tr>
<th>Service quality factors</th>
<th>Reliability</th>
<th>Value</th>
<th>Assurance</th>
<th>Empathy</th>
<th>Tangibility</th>
<th>Responsibility</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>0.660**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assurance</td>
<td>0.750**</td>
<td>0.712**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empathy</td>
<td>0.329**</td>
<td>0.457**</td>
<td>0.522**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tangibility</td>
<td>0.862**</td>
<td>0.575**</td>
<td>0.585**</td>
<td>0.452**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibility</td>
<td>0.731**</td>
<td>0.854**</td>
<td>0.835**</td>
<td>0.678**</td>
<td>0.690**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>0.485**</td>
<td>0.268**</td>
<td>0.267**</td>
<td>0.091</td>
<td>0.475**</td>
<td>0.368**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note:** **Correlation is significant at the 0.01 level**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized coefficients</th>
<th>Standardized coefficients</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.662</td>
<td></td>
<td>0.004</td>
</tr>
<tr>
<td>Responsibility (X1)</td>
<td>1.850</td>
<td>0.275</td>
<td>0.001</td>
</tr>
<tr>
<td>Reliability (X2)</td>
<td>2.337</td>
<td>0.512</td>
<td>0.001</td>
</tr>
<tr>
<td>Value (X3)</td>
<td>1.039</td>
<td>0.213</td>
<td>0.001</td>
</tr>
<tr>
<td>Tangibility (X4)</td>
<td>0.593</td>
<td>0.081</td>
<td>0.003</td>
</tr>
</tbody>
</table>

**Note:** $Y = 0.275X1 + 0.512X2 + 0.213X3 + 0.081X4$
to freight forwarding services in Chennai. Moreover, service failure and service recovery factors were not considered in this study. Future research could be conducted on identifying failure and recovery factors and its influence on customer satisfaction and loyalty pertaining to freight forwarding services.

References


Further reading


Corresponding author
S. Subhashini can be contacted at: pavanaarush@gmail.com
Strategic maritime management as a new emerging field in maritime studies

Ping Wang and Joan Mileski
Department of Maritime Administration, Texas A&M University, Galveston Campus, Texas, USA

Abstract

Purpose – This study aims to promote strategic maritime management as a new emerging discipline to foster research in strategic maritime issues.

Design/methodology/approach – An existing academic discipline maturity model is adapted by including four phases of dynamic evolutionary paths to evaluate the phase of maturity of a research discipline. The model is validated by means of two matured disciplines: strategic management and maritime economics.

Findings – It is found that the current research of strategic maritime management is at a phase of emergence of discipline and ready to move to the maturity phase. It is also found that the evolution of the path of strategic maritime management resembles the early evolution path of strategic management but lags 30 years behind. Future research directions of strategic maritime management can be referred to the research streams in the maturity phase of strategic management.

Research limitations/implications – The adapted academic discipline maturity model brings in the longitudinal and dynamic perspectives of the evolution of an academic discipline, which helps maritime strategists identify gaps and opportunities and evaluate the appropriateness of applying a strategic management paradigm to a specific research topic.

Originality/value – The adapted academic discipline maturity model brings in the longitudinal and dynamic perspective of the evolution of an academic discipline, which helps maritime strategists define the gaps and opportunities in strategic maritime management research.

Keywords Dynamic capability, Discipline maturity, Internal governance structure, Maritime business strategy, Networked maritime stakeholder, Paradigm evolution

Paper type Research paper

1. Introduction

Most research studies in maritime administration have historically been rooted in economics (Hayuth, 1981; Wang, 1998; Notteboom and Rodrigue, 2005; Woo et al., 2011). One primary research theme for maritime scholars is to adopt the language and logic of economics to investigate economic impacts of the maritime industry (Woo et al., 2011). There are abundant publications in leading maritime journals that explored how a country’s or region’s maritime infrastructure, including shipping lines, seaports, foreland and hinterland, affects the country or region economic growth or employment (Benito et al., 2003; Langen, 2002; Pallis et al., 2010).

The past two decades have witnessed a significant revolution in the maritime industry, research and writing. The maritime logistics industry has evolved from its traditional role of
facilitating loading and discharging operations to the new role of coordinator, facilitator and integrator in port clusters and global (physical goods) supply chains (Estache and Trujillo, 2009; Verhoeven, 2010; Parola et al., 2015; Notteboom et al., 2017). Facing fierce competition and low-profit margins, maritime logistics firms are prompted to adopt complex corporate or business strategies aiming at improving profitability and survivability (Midoro et al., 2005; Lorange, 2009; Parola et al., 2015; Yuen et al., 2016). In the meanwhile, maritime scholars have started to “borrow” or “reformulate” tools or theories from management disciplines (Woo et al., 2011; Panayides and Song, 2013). By following the unique set of research objectives, theoretical paradigms and theories and frameworks from each management discipline, maritime scholars attempt to understand the impacts of the intrinsic maritime transport market structure on managerial behaviors (Woo et al., 2011; Cariou et al., 2015).

Among the management disciplines that have been followed by maritime scholars, two management disciplines stand out. One is business logistics and supply chain management (Panayides, 2006; Panayides and Song, 2013; Lam and Bai, 2016). Panayides and Song (2013) proposed maritime logistics as an emerging discipline, following the definitions of logistics and supply chain management offered by the Council of Supply Chain Management Professionals (CSCMP) and Liles et al.’s (1995) criterion to define a matured academic discipline[1]. In their view, the emergence of maritime logistics discipline is due to the internal and external environmental changes. Panayides and Song (2013) subtly defined maritime logistics as a discipline that:

[...] would encompass the management of the physical maritime transport flows, the management of information flows, as well as the management of the interfaces between the various actors in the maritime supply chain from manufacturers to the end consumer[...]. (and) should aim at improving performance[...], improving quality[...], improving the spectrum of operations and processes and enhancing environmental performance, growth and corporate responsibility. (p. 296)

Another one is strategic management (Hawkins, 1997; Cariou et al., 2015; van der Lugt et al., 2013, 2017; Hollen et al., 2013; Notteboom et al., 2017; Satta and Persico, 2015; Pallis and Parola, 2018). For instance, Parola et al. (2015) investigated the impact of corporate strategies on the profitability of maritime firms by applying a generic theoretical framework of “strategy performance” in the context of maritime logistics firms. Satta and Persico (2015) and Pallis and Parola (2018), through the theoretical lens of international business (IB) and strategic management, explored the market entry strategies for international (container) terminal operators and private cruise terminal operators, respectively. van der Lugt et al. (2014) and Notteboom et al. (2017) investigated the co-evolution strategies and port choices within a maritime network or strategic alliance. Lu (2007), Progoulaki and Theotokas (2010), Davarzani et al. (2016) and Yuen et al. (2018) applied the resource-based view (RBV) theory from strategic management to investigate a variety of resource and capability issues in the context of the maritime logistics industry.

The school of maritime scholars favorable to strategic management has produced prolific research findings. Yet, it is still unclear whether the research stream on strategic issues in the maritime logistics industry is ready to be called as an academic discipline or simply an application of existing strategic management theories and constructs in maritime. This study was set out to clarify this concern. We agree with the statement made by Cariou et al. (2015) that:

[...] the uniqueness of this (maritime) industry provides a fruitful empirical groundwork that invites scholars to more advanced research objective. Future outcomes should reach beyond the
We extend this line of the statement by proposing strategic maritime management – the field of research on the management of strategic issues in maritime – as an emerging academic discipline.

A community of scholars represents an academic discipline that shares a common identity and language (Kuhn, 1962) and is strongly influenced by the community members’ specialties and norms (Shapin, 1995). Our primary premise is that research in strategic maritime management shares the consensus of strategic management in general but is contingent on the context of the maritime industry. Referring to the definition of the field of strategic management by Nag et al. (2007, p. 944), we define strategic maritime management as:

The field of strategic maritime management deals with the major intended and emergent initiatives taken by general managers on behalf of both owners and stakeholders, involving utilization of resources, to enhance the performance of maritime organizations in the global maritime environment.

Our objective in this study is to argue for the legitimacy of strategic maritime management as an academic discipline. We have two specific research questions:

**RQ1.** How to determine the research stream of strategic maritime management as an emerging academic discipline?

**RQ2.** Where does the discipline of strategic maritime management come from and where will it go?

One approach to determine the maturity of a research stream is to use a *static* set of evaluation criteria, as what has been done in Panayides and Song (2013). However, this static approach cannot capture the dynamic longitudinal information concerning where the research comes from and where it will go. We thus take a different approach and develop an academic discipline maturity model (ADMM) that incorporates both the *static* and *dynamic* stances.

The dynamic stance of ADMM can be traced to Kuhn’s (1962) seminal book, *The Structure of Scientific Revolutions*, one of the 100 most influential books published after the Second World War selected by TLS (*The Times Literary Supplement*). The philosophy of Kuhn’s paradigm revolution has been well applied in evaluating the levels of maturity of management disciplines emerged after the 1970s, such as the management information system (MIS) (Culnan, 1986), strategic management (Teece *et al.*, 1997; Nag *et al.*, 2007), logistics (Stentoft Arlbjørn and Halldorsson, 2002) and service marketing (Anderson, 1983; Lovelock and Gummesson, 2004). We adapt the static set of criteria from Barney’s comments on the maturity of the strategic management discipline (Barney, 2002), which includes the research objective, unit of analysis, (prescriptive) theoretical paradigm and (predictive) theoretical frameworks. Barney’s four criteria are more “quantifiable” than the criteria developed by Liles *et al.* (1995) and the “active research agenda” criterion used by Panayides and Song (2013). We use the four criteria to describe the four phases of the evolution path to be discussed below.

We validate the maturity model with the evolution paths of both strategic management (Barney, 2002; Teece *et al.*, 1997; Teece, 2007) and maritime economics (Heaver, 1995, 2006; Woo *et al.*, 2011). A phase-by-phase comparison justifies the model’s validity. We apply this
model to verify if each phase of strategic maritime management satisfies the model requirement and if its path shares the commonalities that both strategic management and maritime economics mutually have. Path-pattern comparison helps us gain a deeper understanding of where the strategic maritime management comes from and where it will go. We find that the strategic maritime management satisfies the criteria to be a mature discipline, and its evolution path matches with the paths that both strategic management and maritime economics had experienced.

The paper is organized as follows. In Section 2, we discuss the development of the maturity model for academic discipline. Then, we validate this model with our review of the evolution paths of strategic management and maritime economics in Section 3. We use this model as the organizing theme to review the literature of research in maritime strategic management in Section 4. Finally, we discuss the results of the comparison between strategic maritime management and the two matured disciplines in Section 5 and make suggestions for future research directions in Section 6.

2. Method: the maturity model approach
This study is basically a qualitative evaluation research (Patton, 1990) in which the development, validation and application of an evaluation scheme are the critical steps. The maturity model approach is deemed appropriate to analyze the current stage of the research in strategic management issues in the context of maritime. A maturity model is a conceptual multistage model that describes typical path-patterns in the development of capabilities in a specific social–economic context (Benbasat et al., 1980; de Bruin and Rosemann, 2005). It usually depicts a sequence of stages that together form an anticipated, desired or logical path from an initial to a target maturity state, either for individual entities or regarding a complete set of institutional capabilities (Poepplbuss et al., 2011). Scholars have applied the maturity model approach to many academic areas or disciplines such as Total Quality Management (TQM), project management, MIS (MIS), business process management (BPM) and knowledge management. In each discipline, scholars evaluate either a specific management framework or the entire knowledge advancement with a customized maturity model. In this section, we will briefly review the literature, discussing the stage of maturity concerning the accumulated knowledge base for a particular discipline.

2.1 Perspectives on academic maturity
There are two perspectives on determining whether an active research area is mature enough to be an academic discipline: the static view and the dynamic view. The static view examines the characteristics of the “snapshot” of a research area status quo, while the dynamic perspective takes the longitudinal view by looking at the historical evolution of a research area. Liles et al.’s (1995) approach represents the static perspective. When they argued Enterprise Engineering as an academic discipline, they referred to six characteristics including the “focus of study “worldview,” “reference disciplines,” “principles and practices,” “active research agenda” and “education and professionalism” (for a detailed discussion, see Liles et al., 1995, p. 5). Panayides and Song (2013) chose one criterion, an active research agenda, to define the maturity level of maritime logistics as an (emerging) academic discipline. They operationalized the criterion of active research agenda with three indicators: the research topic stands the test of time, the research topic is complex and substantial enough to be subdivided into different research directions and multiple fundamental questions/approaches are raised and formulated to guide research in the area (p. 303). Barney (2002) used the “focus of study” to describe the maturity of the discipline of strategic management. He operationalized the criterion of focus of study with four
Barney’s perspective of defining the emergent of strategic management reflects the school of arguments that an emerging academic discipline is a self-sustained research paradigm (Furrer et al., 2008). Such a paradigm is ready to shift from descriptive research to prescriptive research (Doz and Prahalad, 1991).

The dynamic view identifies critical phases that the research area has historically experienced. In the domain of management, many studies with the longitudinal perspective reveal four distinct phases that a research area has to go through and becomes an emerging and then a mature academic discipline. The four phases are the early creative thoughts, convergence of objectives, descriptive and prescriptive. In the “early creative thoughts” phase, research topics are scattered around with little consensus about research objectives. The “convergence of objectives” phase characterizes a period in which the diversified objectives of many studies start to converge to a single one. In the “descriptive” phase, researchers either empirically describe management practices or conceptually develop management frameworks from the lens of an established discipline (e.g. early management and social research use economics as the theoretical lens). This stage signals the emergent of an academic discipline. The “prescriptive” phase represents the period that many researchers start to utilize multidisciplinary angles to generalize findings that come to develop a research paradigm with a commonly accepted theoretical framework. This phase marks the maturity of an academic discipline. We will discuss these four phases with examples in the following literature review section.

The static criteria can be viewed as the “gatekeepers” between phases. These criteria represent the accumulated outcomes (or knowledge) along the evolution of a research stream. Liles et al.’s (1995) six characteristics of an emerging discipline are the outcomes of the historical evolvement of a research area (enterprise engineering). Panayides and Song’s (2013) criterion, “stands for a long time”, emphasizes the historical advances of an emerging research discipline. Barney’s (2002) four criteria on the emergent and maturity of strategic management operationalize the indicators for stages. These criteria provide a set of measurable indicators to evaluate the status of a research area. The dynamic perspective helps make an analogy between matured disciplines and an emerging one. By comparing the theoretical advances across evolutionary phases of a matured discipline, researchers can make predictions of the future for the emerging discipline. Also, the operationalized indicators of the criteria to define an emerging discipline help researchers to concentrate their efforts on the key areas to evaluate. To take advantages from both perspectives, we develop an organizing scheme of literature to discuss the emergent of strategic maritime management as an academic discipline.

2.2 Academic discipline maturity model

Based on the previous discussion, we proposed an academic discipline maturity model (ADMM) from the dynamic perspective. The model is composed of two dimensions. One dimension uses Barney’s four criteria to define the maturity of an academic discipline in the case of strategic management and another dimension depicts the four phases of the dynamic evolvement of the academic discipline, as shown in Figure 1. The non-dotted cells define the scope of our selected literature. The dotted cells, on the other hand, represent literature that falls outside the scope of this study.

Specifically, we searched literature in two steps. First, we searched the literature on strategic management and maritime economics from leading academic journals in each field and extended to all journals where such papers were published (Woo et al., 2011). The
leading journals for strategic management include the Strategic Management Journal, Academy of Management Journal, Academy of Management Review and Administrative Science Quarterly (Nag et al., 2007), and that for maritime economics are Maritime Policy and Management and Maritime Economics and Logistics (Woo et al., 2011). We used keywords such as “maritime”, “economics”, “strategy”, “policy”, “management”, “administration”, “history”, “longitudinal”, “evolution”, “competitiveness” and “productivity.” The keywords “seaport”, “shipping”, “hinterland and “water transport” were later used to substitute the keyword “maritime” to find more papers on the subjects of interest. We also searched the internet and digital databases such as Google Scholar, Business Source Premier and ABI/Inform Complete (Business) with these keywords being contained in titles or abstracts.

Second, we differentiated papers on strategic maritime management from maritime economics based on five research contents identified by Nag et al. (2007)[2] in their survey of the consensual definition of the field of strategic management. The five content areas that are implicitly agreed upon by many strategic management scholars include “strategic initiatives”, “top management”, “resources and capabilities”, “performance and competitiveness” and “firm and organization” (Nag et al., 2007, pp. 942-943). These five research contents reflect the fundamental differences between strategic management and economics (Nag et al., 2007). Readers who are interested in the arguments about the differences between strategic management and economics are referred to Barney (1990, 2002), Rumelt et al. (1991) and Nag et al. (2007).

Because there is no academic journal dedicated to strategic maritime management, we looked at both maritime and logistics/transportation journals (e.g. International Journal of Logistics Research and Applications, Transportation Research: Parts A-E). We also traced the publications of some maritime scholars who are active in the research of strategic issues in maritime (e.g. Mary Brooks, Trevor Heaver, Theo Notteboom, Photis Panayides, Dong-Wook Song, Roy van den Berg, Larissa van der Lugt, Francesco Parola and Kum Fai Yuen).
While our review of the literature is not exhaustive, these sampled publications are representative of the phases in ADMM to be discussed in Sections 3 and 4.

3. Model validation

In this section, we validate the ADMM with strategic management and maritime economics, the two disciplines highly relevant to the strategic maritime management, and propose it to be an emerging discipline. We overview the literature along the evolution paths of both disciplines and positioned relevant seminal work in each phase in the ADMM.

3.1 Evolution of strategic management

The discipline of strategic management has evolved through all four phases. Phase 1 is represented by papers published during the Second World War and 1950s. During this period, many scholars brought up their creative thoughts regarding how to develop and implement policies to cope with business challenges faced by managers at that time. Scholars and managers used the term *policy*, but later replaced it with the term *strategy*. In this phase, scholars developed concepts of strategy (von Neumann and Morgenstern, 1947; Drucker, 1954), but their strategic objectives varied regarding the need for the abilities to anticipate change, to take advantage of new opportunities and to take timely actions to avoid threats to firms (Bracker, 1980). The differences among their objectives reflect their different needs for the breadth of strategy, the component of the strategy and the process of strategy formation. The unit of analysis used during Phase 1 spans from industry to individual. Most studies were narrative and descriptive based on the observations of individual industries or firms. There was no effort to explain management endeavors from any theoretical lens.

Phase 2 happened in the 1960s, as exemplified by the following three works: *Strategy and Structure* (Chandler, 1962), *Corporate Strategy* (Ansoff, 1965) and *Business Policy: Text and Cases* (Learned et al., 1965, the textbook of Harvard Business School). The latter was rewritten in another book, *The Concept of Corporate Strategy* (Andrews 1971, c.f. Bracker, 1980). Diversified objectives that emerged in Phase 1 converged into specific objectives such as: how a company handles a management problem and what the best practice is to handle a problem in the industry. Scholars developed a research stream on strategic choice, meaning that management deterministically picked up a strategy that they thought it would be the best. The unit of analysis is either corporate or industry. Findings mainly come from in-depth case studies of single firms or industries, and the results of these studies are hardly generalizable (Hoskisson et al., 1999). By the end of Phase 2, researchers started to shift from a deterministic one-best-way approach to a contingent perspective where organizations need to adapt to their external environments, as discussed below for Phase 3.

Phase 3 represents the period in the 1970s, in which the majority of studies emphasized the issues of generalizability of case study-based theories with common or similar objectives. One of the research objectives – the relationship between the external environment and the industry where a firm should operate – stood out as the primary research objective for most scholars in the area of strategic management (Barney and Hansen, 1994). Two different research streams based on very different ontological and epistemological perspectives emerged and developed during this phase. One stream pursued a “process” approach, which consisted essentially of descriptive studies on how strategies were formed and implemented. This research stream resembled a theoretical paradigm of behavioral theory and contributed to more realistic conceptions of the strategy-formation and or strategy-implementation process by observations of actual organizational decision-making and action-taking (Quinn, 1980; Mintzberg and Waters, 1985). At the same time,
another stream pursued a “strategy-performance” approach. Strategic scholars later acknowledged this approach as the (industry) structure–conduct–performance (S-C-P) theoretical paradigm that had been dominant in the literature of industrial organization (IO) economics (Porter, 1980; Barney, 2002). The objectives of this stream extended to incorporate the stakeholders’ perspective, in addition to the equity-holders’ perspective dominant in previous phases. There were some other creative thoughts developed in Phase 3, but they did not evolve as independent research streams. For instance, the contingency theory (Hofer, 1975) had gained significant development during this period, but it did not grow into a prolific research stream (Van de Ven et al., 2013).

Phase 4 represents studies conducted in the 1980s. In this phase, strategy research developed into two different directions. One direction kept the focus on industry (i.e. industry structure) as a unit of analysis, represented by Porter’s (1980) book Competitive Strategy. The primary objective of this research direction is to determine how a firm can position itself in the industry to gain competitive advantages (Barney, 2002). The primary theoretical paradigm that supports this stream of research is still IO economics. This research stream later became the “competitive-advantage” theoretical paradigm. The other direction used firm as the unit of analysis, and drawn theoretical paradigm(s) from economics or organizational theory, or both (Barney, 1991). This stream later evolved to the “resource based view (RBV)” theoretical paradigm. The main objective of this stream of research is to determine how a firm can develop and deploy resources to gain competitiveness. Three sub-streams with the RBV perspective were emerged later, each emphasizing one of the three different aspects of a firm, namely internal structure, resources and capabilities.

3.2 Evolution of maritime economics
In this section, we follow the discussion by Heaver (2006), “the evolution of the study of shipping and ports reflects the history of the maritime industry (p. 11).” We will limit our literature review on the international shipping and seaport industries.

Phase 1 represents maritime studies published between the 1950s and 1960s, which is a gestation period of maritime economics (Metaxas, 1983). After the Second World War, three publications laid down the foundation on maritime studies, including Shipping Economics (Svendsen 1950s, cited from Heaver, 2006); Essays on Maritime Economics (Gross, 1968, c.f. Metaxas, 1983); and Supply and Demand of Water Transport (Thorburn, 1960, c.f. Metaxas, 1983). In these two decades, research objectives and topics were dispersed, covering issues such as economics, politics, sociology, management, strategy and operations (Metaxas, 1983). Research methods also varied. Some studies applied tools of economic analysis to the maritime sector (Robbins, 1975), while others tried to optimally allocate scarce resources within the maritime sector and between the maritime sector and other sectors (e.g. total cost minimization, Thorburn, 1960).

Regarding to the unit of analysis, most studies used the ocean shipping industry (Svendsen 1950s), whereas a few studies used the relationship between shipping and seaports (Thorburn, 1960). Meanwhile, Svendsen’s objective was the relationships between various inputs/outputs for shipping and the throughput for ports. On the contrary, Thorburn’s objective was the relationship between the supply and demand for water transport by viewing ocean shipping and ports as an integral (maritime) industry. While these publications chose different research methodologies and took different objectives, their theoretical paradigm was economics, specifically transportation economics (Metaxas, 1983). Thorburn’s argument on the relationship between cost (i.e. port investment) and benefit (e.g. to better serve the shipping industry) was later acknowledged as the first
theoretical framework of maritime studies (Goss, 1967). The cost–benefit argument led to research objectives on strategic issues such as whether to invest, how to invest, when to invest and where to invest (Goss, 1967).

Phase 2 represents the studies published in the 1970s. Influenced by the container revolution in the 1960s, many studies in the 1970s focused on cargo containerization and shipping, and the impacts on ports (re)construction for new container ships (Author D. Little Ltd., 1970; Heaver, 2006). The unit of analysis remained at the industry level but at the level of sub-sectors (bulk shipping, container shipping, general cargo port, and specialized port, etc.) There were three sub-streams with different research objectives. One sub-stream focused on the relationship between the external environment and maritime structure, bringing more perspectives from IO economics (Goss, 2002). Scholars in this stream had the objectives of choosing a strategy to gain the best cost–benefit tradeoff (Metaxas, 1983). The second sub-stream continued to focus on the relationship between the costs of shipping and their impacts on port investment. The primary research objectives were the choice of ship (i.e. between bulk and containerized), the likely evolution of ship itineraries (i.e. the change of ship routing due to containerization) and aspects of container terminal operations (i.e. the changes on the port layout, equipment to be used and interfaces with carriers) (Gilman et al., 1977). The third sub-stream focused on the effect of geographical locations of ports on the global logistics service network (Bird, 1971). The objective of this school of research was to understand how changes in both shipping and freight handling in shipping and seaport would change the competitive dynamics of trade volume within the network of hinterlands and ports (Bird, 1971). The theoretical paradigm was transportation economics.

Phase 3 is the 1980s and 1990s, representing the emergence of the discipline of maritime economics. In this phase, researchers started to apply a variety of theories derived from transportation economics or IO economics to explain specific management phenomenon in the maritime sector. The primary objectives further converged to the policy and management for port and international shipping (Heaver, 1995). They focused on defining what maritime economics (e.g. the arbitrary nature of port economics) is and how to develop it (e.g. the important role of institutions and individuals in the development of port economics). In this phase, the unit of analysis and research objectives was affected by the research methodologies (descriptive vs prescriptive) and the dynamics of the external environment (e.g. the maritime market worldwide) and internal environment (e.g. the reforms of organizational structures of shipping and ports). Later on, researchers’ objectives were shifted to develop “new, relevant, and correct hypotheses concerning the exogenous and endogenous factors which regulate the functioning of the main maritime markets and the world shipping industry.” (Metaxas, 1983, p. 147) More studies tended to use an individual maritime organization or a specific relationship as the unit of analysis and both descriptive and prescriptive research methodologies were used in this phase. For instance, Jansson and Shneerson (1982) described the functions of seaport as the results of evolutions of a variety of port activities, and prescriptively applied production theory on port services and queuing theory on the cost of congestion.

In Phase 4 (during the 2000s and 2010s), research on maritime economics became mature. Its maturity is characterized by both the concentrations of research on a few unique sets of objectives and the research efforts in developing context-dependent theories that are originated to maritime (e.g. how PAs’ multiple faces affect their roles of management). Both industry leaders and scholars realized that they need to develop new skills and knowledge with multidisciplinary perspectives to deeply appreciate societal needs, understand the true base of company productivity and collaborate across profit and non-profit boundaries (van der Lugt et al., 2013). In this phase, the unit of analysis used in most of the maritime studies
has completely shifted to the level of individual organization or individual interface. Research objectives were concentrated more on efficiency and competitiveness, which are mostly influenced by the angles of theoretical paradigms that researchers take. More maritime research adopted a multidisciplinary research approach since 2000 (Woo et al., 2011).

Literature shows multidisciplinary impacts on maritime studies (Midoro et al., 2005; Martin and Thomas, 2001; Panayides, 2006) because maritime scholars have referred to concepts and theoretical constructs from matured management areas such as strategic management, organization studies and logistics and supply chain management (Panayides and Song, 2013). Also, researchers who follow a specific discipline channel their studies to a direction different from researchers following other disciplines. For instance, port reforms make maritime organizations more “business-like.” Consequently, maritime scholars reexamined the “governance-performance” relationship from the perspective of strategic management (Brooks and Pallis, 2008), reevaluated the networked organizational structure in line with organizational studies (Rodrigue and Notteboom, 2009) and redefined the logistical relationship roles of the port from the lens of logistics and supply chain management (Song and Panayides, 2008). While these researchers’ research objectives were all motivated by the same environmental change and their units of analysis were all focused on individual organizations or processes, they are different from each other in terms of the underlying theoretical paradigms and proposed theoretical frameworks.

As maritime economics gets mature, three research areas are emerging as discernible research streams, including maritime logistics (as proposed by Panayides and Song, 2013), strategic maritime management (as proposed by this study) and operations management in the maritime industry (a potential future research topic). The first research stream of maritime logistics has evolved faster than the other two streams, partially due to the nature of the maritime (transportation) industry. The maritime industry offers a rich research environment in which many strategic logistics issues can be better explored through the lens of strategic logistics management, a matured academic discipline. The second research stream represents studies in the recognition and exploration of the strategic issues in maritime studies (Woo et al., 2011; van der Lugt et al., 2013, 2017). Many issues are relevant to management, such as business models (e-market), strategic positioning, competitive advantages, co-opetition strategies, agility (flexibility), leanness, service quality and social responsibility (Woo et al., 2011). The third research stream consists of the studies of strategic or tactical issues of operations management in maritime. In general, operations management concerns “decisions and plans involving the developing, positioning and aligning managerial policies and needed resources so that they are consistent with the overall business strategy” (Boyer et al., 2005), and tactical planning or operational control (Anthony, 1965). Some maritime studies have their primary objectives falling within the scope of operations management we just mentioned. As the maritime studies in operations management are beyond our research scope, we leave the review and discussion of the research on maritime operations management to others.

In summary, our proposed ADMM is valid regarding its content, criterion and construct validities. The way we classify an evolution path into four evolution stages present four mutually exclusive stages. The criteria used to determine the level of maturity represent different aspects of a research stream. While both the evolvement phase dimension (a construct of the ADMM) and the maturity criteria dimension are arguably correlated, the combination of both provides a vivid picture of the origin of a research stream, the path it evolves and the future it will go.
4. Evaluating the maturity of strategic maritime management with ADMM

Phase 1. Phase 1 of maritime strategic management represents publications of the management of strategic issues in the maritime industry in the 1980s. In 1982, the Inter-Governmental Maritime Consultative Organization (IMCO) was renamed as the International Maritime Organization (IMO). This event was the result of the changes in the maritime environment, such as international maritime traffic, load lines and the carriage of dangerous and shifting maritime attention from governmental collaboration to IB. The post-war growth of international trade had made it clear that the port industry had become the bottleneck of international trade and the ship/port interface posed a significant challenge for the entire maritime industry.

Maritime scholars’ response to the market dynamics was to study how to balance the demand with supply in the maritime industry. They chose policy and strategy as their key research objectives. Most studies used industry as the unit of analysis. For instance, some researchers applied IO economics theories such as the productivity function to analyze the structure of the port (Kim and Sachish, 1986). Kim and Sachish’s objectives were to understand the impact of an individual port’s pricing on both the port-choice decision by a shipping line and the investment decision by the port authority, a research topic raised by Bennathan and Walters (1979). The majority of maritime research studies in this stream chose the unit of analysis at the industrial level. Although in this period the strategic management discipline had evolved into Phase 3 as an emerging discipline, maritime scholars did not choose their research objectives as competitiveness (the research objectives of strategic management in Phases 3 and 4). As noted by Goss (1979), in the late 1970s, most principle seaports worldwide were government entities. Therefore, maritime scholars preferred to analyze most strategic and administrative issues at the macro level, through the lens of shipping or port economics. A variety of creative thoughts were delivered in this phase, such as the port structure (Goss, 1979), separation of ownership and executive team (Suykens, 1985) and efficiency and productivity (Kim and Sachish, 1986). However, in line with the shipping literature on strategy, Harvey (1987, c.f. Hawkins, 1997) found only two papers citing shipping strategies and practices. Moreover, we found only one paper that emphasized the use of firm as the unit of analysis in exploring key strategic issues in strategic planning and the planning process (Frankel 1989).

Phase 2. Publications of strategic research on maritime issues in the 1990s can better represent Phase 2 of strategic maritime management. Globalization triggered unprecedented capacity expansions by major shipping lines, resulting in a trend of mergers and acquisitions and fierce price competition on the shipping market (Brooks and Ritchie, 2006). Port reforms had changed the way port authorities used to run their port business (Goss, 1990; Baird, 1995). Topics related to competitive advantages had converged as the key research objectives in this strategic research stream (Haezendonck et al., 2000; Panayides and Gray, 1999). Such convergence can be explained as the impact of the matured strategic management on maritime scholars’ thinking (Sletmo and Holste 1993; Fleming and Baird, 1999).

In this phase, description is the primary research methodology. For instance, Goss (1990) described five frontiers of completion in the port industry worldwide and proposed a typology consisting of four maritime strategies. He suggested port authorities should make the “right choice” of strategy in response to industrial competitiveness. Brooks et al. applied descriptive research methodology to analyze the associations between (maritime) environment and (maritime) strategy and the association between strategy and performance (Brooks, 1998; Brooks and Button, 1996). Other maritime strategists descriptively explored the process of how strategy is formed and executed in the maritime setting (Coeck et al., 1997). The common usage of descriptive research methodologies marked those studies as...
the representatives of Phase 2. The unit of analysis started to shift from the industry level to a mix of industry and organization.

It is worth mentioning that Jeffery Edward Hawkins (1997) is one of the first maritime scholars who systematically reviewed the field of strategic management and its applications in the different industries. In his dissertation, *A Strategic Choice Model for Asia-Pacific Shipping*, he mentioned that while there were calls for more strategic research into ports and shipping (Holste, 1993), the writing on maritime strategy research had been “fragmented and dispersed, with no coherent base, which severely limits widespread use (of the approach of strategic management (Hawkins, 1997, p. 63).” Based on his holistic review of the two prevailing theoretical paradigms in strategy management in that time – content and process[3] – Hawkins recommended three directions for future research in maritime strategy research: the content of strategy, the link between content and process and a more eclectic, interdisciplinary approach for theory building and research (p. 88).

**Phase 3.** Phase 3 of strategic maritime management started in the 2000s. In this phase, the critical research objectives in this stream of research remained to be competitiveness, but most maritime scholars chose a strategic theoretical paradigm to buttress their arguments. Two theoretical paradigms emerged as the primary theoretical lens that most maritime strategists used, the S-C-P paradigm and the RBV paradigm. Each strategic theoretical paradigm leads to an independent research stream. The S-C-P stream viewed the maritime (sub) industry as the unit of analysis and emphasized external impacts and resources. This stream followed Goss’s (1990) reasoning on competition and introduced new frontiers of competition to maritime administration, such as the competition between shipping lines and stevedoring companies (Midoro *et al.*, 2005), competitions between port authorities and terminal operators (Song, 2003) and competition between shipping lines and ports (Heaver *et al.*, 2000).

The RBV stream of strategic maritime management, on the contrary, used an individual firm or organization as the unit of analysis, and it focused more on the perspective of internal structure or resources, which followed the “strategy-structure-performance” theoretical paradigm (Brooks and Pallis, 2008; Jenssen, 2003; Lu, 2007; Yang *et al.*, 2009a). In this phase, maritime scholars identified and acknowledged new sources of competence in maritime along key managerial functions (Lu, 2007) or organizational processes. For instance, human resource management has been recognized as a key capability for the maritime industry for success and to survive (Lu, 2007; Theotokas and Progoulaki, 2007). Innovation and knowledge management are the critical organizational routines, treated as internal resources, to develop competitive capabilities (Yang *et al.*, 2009b).

Most studies in both research streams still descriptively explained the strategic maritime management phenomenon, but some scholars started to develop predictive theories in the context of the maritime setting. For instance, Jenssen (2003) and Jenssen and Randøy (2006) tested the generic theory on the link between innovation and firm performance in the context of Norway shipping industry. They found that the core capabilities are human skill, networking and strategic assets. Human skill and networking can be viewed as a maritime organization’s internal and external capabilities, respectively. They concluded that both internal and external capabilities must be played together with strategic assets to create “a competitive profile” and an innovation-friendly culture and structure seem to be a necessity to “develop and maintain distinctive capabilities and strategic assets (p. 101)”.

**Phase 4.** Phase 4 represents the status of strategic maritime management in the 2010s. The research objectives remain to be competitiveness but shift to individual competitive priorities. The governance (i.e. internal structure) theoretical paradigm continues to be used as a theoretical paradigm, but some studies choose the “resource and capabilities”
theoretical paradigm to develop new theories and frameworks (Brooks and Pallis, 2012; Song and Parola, 2015). On the one hand, new theoretical constructs are introduced to classical theoretical frameworks to verify or prescribe managerial behaviors in the maritime context. For instance, Yang (2012) proposed the moderating effect of the innovation capability on the link between logistics capability and firm performance for ocean freight forwarders.

On the other hand, existing constructs are modified with the inclusion of maritime-specific contents. Axarloglou et al. (2013), for instance, added the time dimension to the construct of flexibility and explored the interplay between time-varying flexibility and resource allocation. Mason and Nair (2013) extended the generic flexibility construct by developing a typology specific to a carrier’s internal supply-side flexibility, including speed flexibility, capacity flexibility, communication flexibility and ownership flexibility. Other competitive dimensions such as safety, reliability and security (Yang et al., 2013; Talley, 2013), as well as corporate social responsibility, sustainability and resilience (Yuen et al., 2017; Justice et al., 2016), are evolving rapidly in Phase 4 as new research streams of maritime management capabilities.

As the outcomes of maritime strategists’ scientific endeavours, a few context-specific theoretical frameworks emerge, including maritime cluster evolution theory (Zhang and Lam, 2013), hub-spoke (hinterland) institutional network theory (van den Berg and De Langen, 2011; Lam, 2016), conflict theory in seaports (Parola and Maugeri, 2013) and networked stakeholder theory (Notteboom et al., 2015). These new theoretical propositions are developed surrounding the intrinsic maritime market structure which is unique to the maritime context. We argue that the (mid-range) theories have the potentials to continue to evolve as the general theories to contribute to the stream of internal organizational relationship (IOR) in the field of strategic management.

It is worth noting that two emerging areas might become future research streams. One is the process-oriented strategic maritime management research (Robinson, 2015; Borch and Batalden, 2015). A typical business process has three elements – input, process and output. The process-oriented research helps remedy the impact of complexity on a maritime service environment. For instance, Dinwoodie et al. (2012) recognized strategic, tactical and operational processes in their study of the sustainable development of maritime operations in ports. Notteboom et al. (2017) extended the “port of choice” research stream from the process perspective by exploring how changes of organizational routines (i.e. alliance formation and vertical integration) will affect the port of choice in intercontinental shipping networks.

Another area is the interface between maritime corporate (business) strategy and operations (functional) strategy (Schwarze and Voß, 2015; Wang et al., 2017; Ng et al., 2018). There has been a growing interest in theorizing the interface between corporate strategies and operations strategies in the 2000s and 2010s (Song and Parola, 2015). Coopetition, a new competition frontier in the port and shipping industries, represents well the simultaneous pursuit of competition at the strategic level and collaborate at the operational level (Song et al., 2015). The intertwined corporate and operations strategies provide new challenges and opportunities to researchers and practitioners to redesign their organizational and operations processes to align with corporate strategies (Dinwoodie et al., 2012; Wang et al., 2017). Research on developing innovation and knowledge management capabilities across maritime supply chains also represents the scientific endeavor in understanding the interface between organizational routines (e.g. the strategy formation and implementation) and operations processes (e.g. the execution of operations strategy).
In summary, by the evaluation results, we conclude that strategic maritime management has evolved as an academic discipline. Literature reveals that extant research in strategic maritime management meets the criteria to be an emerging academic discipline. Maritime strategists root their research to the strategic theoretical paradigms and develop new theories and frameworks contingent on the maritime context, making strategic maritime management to be more mature.

5. Findings and discussions
Figure 2 summarizes the evolution paths for the three academic disciplines, strategic management, maritime economics and maritime strategic management. Each phase is denoted as an “S” curve, simply to reflect an accumulated learning experience of a given academic community in a phase. The S-curve is derived on the basis of the arguments on scientific revolution (Kuhn, 1962) and can be viewed as the product of the number of “primary” or “hot” research topics and the number of publications per topic in a given time. The low end of an S-curve indicates a small number of emerging hot issues with fewer publications on each issue. The middle section of an S-curve indicates that a few research topics become the main research streams and the number of publications per each stream becomes proliferated (in a given time unit). The high end of an S-curve means that researchers’ interest in a research stream is diminishing so that the productivity on the research stream is slowing down. The interaction between two adjacent curves indicates that the discipline is transitioning from a lower phase to a higher one. Phase 4 of strategic maritime management is depicted as a dotted curve, indicating that this discipline is still evolving at this stage.

There are three commonalities among their evolutionary paths. First, the (internal or external) environment dynamics drive a discipline to update phases. New business realities always challenge scholars to look at new ways to explain and predict management behaviors. Second, all three disciplines start to change their dominant theoretical paradigms during Phase 3. Literature indicates that the new paradigm adapted during Phase 3 is more effective to nurture new research directions. These new directions have high potentials to

![Figure 2. Three evolution paths](image)
become new outstanding research streams. Third, it takes about 20 years or so for a research topic to become an outstanding research stream or a prominent theoretical paradigm. For instance, it takes about 20 years for the topic of competition to be the competitive advantage theory (Porter, 1980), resource to be the resource-based theory (Barney, 1991), capability to be the dynamic capability theory (Teece et al., 1997), cost-benefit (Thorburn 1960) to be the productivity theory (Jansson and Shneerson 1987), regional port network (Van Klink, 1998) to be the maritime cluster evolution theory (Zhang and Lam, 2013) and multiple stakeholders in ports to be the networked stakeholder theory (Notteboom et al., 2015). Such a long cycle reflects the notion that an active research agenda stands for time.

From Figure 2 we have three interesting observations. First, strategic maritime management resembles the evolution path of strategic management in both shape and slope but lags 30 years behind. Maritime scholars’ research methodologies mirror the paradigm shift in strategic management. For instance, Brooks et al.’s early studies on port governance structure took the IO paradigm, but in their later publications, they switched to the internal structure paradigm (a branch of RBV). The paradigm switch indicates that the latest knowledge advancement in strategic management has a positive influence on maritime strategists.

Second, the first three phases of strategic maritime management show hyper-similarities with that of strategic management. In other words, strategic management has predominantly influenced the trajectory of the evolvement of strategic maritime management. Phase 4 of strategic maritime management shows the tendency of adopting prominent theoretical paradigms or adapting the theoretical frameworks from strategic management. It is expected to see more prescriptive theoretical research to be done in Phase 4. However, we are also expecting the adaptation rate to slow down, similar to the stagnated evolvement rate of maritime economics in its fourth stage.

Third, most of the high-impact publications in strategic maritime management are conducted and led by a limited number of seasoned maritime strategists. The small body of maritime strategists may hinder the adoption speed of the latest theoretical advances carried out by strategic scholars and restrict the potentials of generating new prescriptive management theories to the maritime research community and the entire strategic management community. It is the time for maritime scholars to consider how to develop the strategic maritime research community. High educational institutions should take the lead to develop doctoral programs with the concentration on strategic maritime management. A new generation of maritime strategists is crucial to the future of strategic maritime management.

There are two potential areas for future research. One is to continue the internal (governance) structure research stream with more emphasis on the network perspective. A few theoretical frameworks have been developed to prescribe the governance structure at different levels of maritime networks and their relationships with external stakeholders (Mclaughlin and Fearon, 2013). The network of maritime stakeholder is multi-tiered. It spans from a territorial seaport (e.g. the Port of Houston) and a regional cluster to an extended network consisting of both a focal seaport and its hinterland network (e.g. the Port of Rotterdam). The network can also be a group of extended hub-hinterland networks that run by the same port operator (e.g. DP World) and shipping line (e.g. Maersk). The tiered network structure in maritime is unique, offering abundant opportunities for maritime strategists to conduct theoretical research.

Another future research direction is how to develop strategic capabilities for (networked) maritime organizations to support long-term competitiveness (Yang, 2010; Yuen et al., 2016). A few maritime scholars have made remarkable efforts to investigate a variety of strategic
capabilities. These strategic capabilities include innovation (Jenssen, 2003; Yang et al., 2009a, 2009b; Yang, 2012), flexibilities (Mason and Nair, 2013; Mileski and Honeycutt, 2013), process management (Borch and Batalden, 2015), quality (Thai, 2008; Yuen and Thai, 2015; Pantouvakis and Psomas, 2016), knowledge management (Lee and Song, 2010; Lambrou, 2016) and integration (Panayides and Song, 2009; Lam and Zhang, 2014). These studies highlight the potentials that the capability research stream can have to advance strategic maritime studies. It is undoubtedly that the long-term strategic competitiveness and sustainability of a maritime ecosystem depends on how well it develops and deploys its resources and how fast and appropriate it can respond to the market dynamics with insurmountable strategic capabilities.

6. Conclusion
In this study, we propose that the research stream in strategic maritime management has matured to be an emerging academic discipline. The maritime industry has become more “business-like”, and the industry is expecting maritime-specific strategic theories and frameworks. However, our academic community is not ready to provide a reality-based yet theoretically robust curriculum to meet the industry’s demand. This study aims to make the first effort to promote strategic maritime management as an emerging discipline to foster research in strategic maritime issues.

To evaluate the level of maturity of the research in strategic maritime issues, we developed an academic discipline maturity model. This model encompasses two dimensions. One is a set of maturity criteria, and the other consists of four evolution phases. Both dimensions are theoretically grounded in the literature. The four distinct phases describe the evolution path that an academic discipline will experience to become mature: creative thoughts, convergence of thoughts, emergence of discipline and maturity of discipline. The set of maturity criteria includes the (scope of) research objectives, unit of analysis, theoretical paradigms and theoretical frameworks. We first validated the model with the evolution paths of strategic management and maritime economics. Then we applied the model to evaluate the maturity level of the research in strategic maritime issues. Literature shows that strategic maritime management is qualified to be an emerging discipline, and it is still evolving in its maturity phase.

Research in strategic maritime management reflects how maritime scholars respond to the external forces of globalization and technological advancements, and internal changes of port reforms and shipping line mergers and acquisitions. We found that strategic maritime management resembles the evolution path of strategic management very well, yet with a lag of 30 years. Concerning the evolutionary trajectory of strategic maritime management, we propose two future research opportunities. Both follow the RBV theoretical paradigm, with is one following its internal structure stream and the other one following the stream of strategic capabilities. Some pioneering works have illustrated the prosperity of adapting the RBV theoretical paradigm in the maritime industry. For instance, with the recognition and justification of key resources and capabilities in the shipping (Lu, 2007) and port industries (Notteboom and Winkelmans, 2001), researchers can either continue to introduce new dimensions to existing theoretical constructs in strategic capabilities or develop new context-specific or generalizable constructs and theoretical frameworks.

We contribute to the maritime research community in four ways. First, this paper presents an approach to evaluate the levels of maturity of other research streams in the field
of maritime studies, such as the research rooted in management science/operations management, MISs and marketing. We outline how dominant theoretical paradigms in strategic management affect the evolvement of strategic management and how the outstanding research streams and theoretical frameworks emerge. The roadmap of strategy management we outlined in the paper provides a guideline for maritime strategists to choose their research methodologies.

Second, the academic discipline maturity model we developed provides a systematic and structured approach to guide literature review and facilitate analysis. It can be applied to evaluate not only an entire academic discipline but also a research stream that has been evolving for years (say, about 20 years). It can also be used to determine if a strategic theoretical paradigm (say, competitive advantage paradigm and agency theory) is appropriate to a specific strategic maritime research project. A maritime scholar can check if the unit of analysis she uses complies with the unit of analysis required by the theoretical paradigm.

Third, this study reveals that two RBV-based research areas, internal structure and strategic capability, in the context of maritime industry, have higher potentials to spin out as independent research streams. Moreover, it is promising to see that the research on maritime networking takes the RBV perspective to investigate how a maritime cluster or network utilizes resources within a maritime network and develop strategic capabilities to compete with other maritime networks. This potential area of study may refer to the latest theories and concepts from the research stream of inter-organizational relationship in strategic management or organizational studies.

Last, but not least, we recognized two potential research streams in the field of strategic maritime management – process-oriented management and the interface between maritime (business) strategy and maritime operations management. The interface between maritime strategy and operations represents the new frontier of completion because the industry structure and primary markets for demand and supply are not differentiable in many aspects. The maritime industry is dominated by a limited number of players in each sub-industry such as shipping, port operators and technology and equipment suppliers. Critical competitive advantages may only come from the effective perspective: how a maritime organization or network can run their business at low operating cost and high service quality. Process-oriented research, in general, has been viewed as an emerging management paradigm, in contrast to the function-oriented management paradigm (as in the disciplines offered by business schools). As maritime is basically characterized as a service-process-oriented industry, we recommend developing new doctoral programs in maritime business administration to explore new research contents, constructs, theories and paradigms.

Notes

1. According to Liles et al. (1995), the existence of an active research agenda is revealed if there exist three main characteristics: it stands the test of time; it is complex and substantial enough to be subdivided into different research directions; and multiple fundamental questions/approaches are raised and formulated to guide research in the area.

2. Nag et al. (2007) identified six content areas. The sixth content area is the context of external environment, which is the maritime industry in our study.

3. Since the mid-1990s, the debate between the two strategy management research paradigms have given the way to the debate between the IO economics and RBV.
References


MABR 3,3


Further reading


About the authors

Ping Wang is an Assistant Professor of Maritime Operations and Logistics Management at Texas A&M University at Galveston. Dr Wang received PhD in Business Administration from The Ohio State University, an ME from MIT and an ME from Chinese Academy of Science. Dr Wang developed a five-course package for Lean Six Sigma Black Belt Certification in Maritime. Dr Wang’s research interests focus on the interface between strategic maritime management and operations management, Lean culture development and Lean transformation in maritime, the impacts of high uncertainty and anomalies of business process on strategic and operational performances and the development of dynamic capabilities in logistics and supply chain management. His current research focuses on the dynamic production scheduling and dynamic vehicle routing problems in process industries and logistics service environments. Ping Wang is the corresponding author and can be contacted at: wangp@tamug.edu

Joan Mileski is a Professor in Maritime Administration and of Marine Science and the Head of the Maritime Administration Department at Texas A&M University at Galveston (TAMUG). She holds a PhD in International Management Studies from the University of Texas at Dallas, an MS in Taxation from Pace University and BBA in Accounting from the University of Notre Dame. She has been a Certified Public Accountant for 34 years. Dr Mileski has been awarded several grants including from the USA and Texas Department of Transportation, has teaching and international research awards, and publishes in leading maritime journals such as Marine Policy and Maritime Policy and Management. She is a Fulbright Research Scholar alumni and a past President of the Women in the Academy of International Business.

For instructions on how to order reprints of this article, please visit our website: www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: permissions@emeraldinsight.com
Clustering potential of Istanbul maritime sector
Cengiz Bahadir Karahan and Levent Kirval
Istanbul Technical University, Istanbul, Turkey

Abstract
Purpose – Turkey is a maritime country with its current merchant fleet and shipyards, geographical location, young population and growth potential. Clustering, being one of the important improvement methods of global competition power, is widely used in the maritime sector. Analysing the clustering level and potential of Istanbul, which is the major city of Turkey, in regard to economic and social aspects is a basic step for increasing global competitiveness in this sector. This study aims to measure the clustering level of Istanbul’s maritime sector and also define the effect of clustering level on firm performance.

Design/methodology/approach – The clustering levels of Istanbul’s maritime transportation and supporting firms, shipyards and maritime equipment manufacturers are measured by means of a survey based on Porter’s diamond theory in this paper. The relationship between clustering level and firm performance is defined by using simple linear regression and fuzzy linear regression methods. The weights of the criteria are calculated by means of entropy method.

Findings – It is concluded that despite its deficits, Istanbul’s maritime sector has significant potential to become a major maritime cluster not only in its region but also worldwide. The effect of clustering level on firm performance was observed to be statistically significant, but not high. The results of the simple linear regression and fuzzy linear regression methods are compared.

Originality/value – According to the author’s knowledge, this paper is the first study using fuzzy linear regression and entropy methods to analyse maritime clusters. It evaluates the effect of clustering level on firm performance in the case of Istanbul maritime sector.

Keywords Competitiveness, Entropy, Regression analysis, Fuzzy linear regression, Istanbul maritime sector, Maritime clusters

Paper type Research paper

1. Introduction
Today, it is widely accepted that accelerating globalisation and liberalisation have erased geographical boundaries and decreased the importance of national and local competitiveness. On the other hand, some researchers often state that local, national and regional geography still have a very high impact in terms of competition on economic activities throughout the globe. Geographical concentration, also termed agglomeration or clustering of industries via high level cooperation between firms and related organisations in a certain area, accelerates national competitiveness in a very positive way (Porter, 1990; Saxenian, 1996; Roelandt and den Hertog, 1999; Rosenfeld, 2003; Enright, 2003).

Clustering is a global competition tool which is used not only by industrial sectors but also by service sectors such as logistics, maritime transportation and ports. This study assesses the Istanbul maritime sector by using the cluster approach. First, the definition of a cluster will be made and Porter’s Diamond Theory will be explained. In Section 2, literature regarding maritime clusters will be summarised. Section 3 will generally describe the Turkish maritime sector and Istanbul as a maritime city. In the Section 4, the quantitative
1.1 What is a cluster?
A cluster is a geographically proximate group of interconnected companies and associated institutions (e.g. firms, specialised suppliers, supplementary organisations such as associations, universities and R&D corporations) in a particular field, linked by commonalities and complementarities. They cooperate with each other without giving up their independence, in other words being in co-opetition they strive to gain local, national, regional and global competitive strength (Porter, 1990). Roelandt and den Hertog (1999) define a cluster as a network of interrelated firms, institutions of knowledge, buyers and sellers, suppliers, etc. Rosenfeld (2003) defines a cluster as an agglomeration of firms which can create synergy, and Enright (2003) also defines the cluster as an agglomeration in which the member firms have very close relations.

Porter has focused his research on the competitiveness of different countries throughout the globe and tried to answer the following question: “Why are some of these countries more competitive?” He has based his “Diamond Model” on the interrelationships of various factors such as factor (input) conditions, demand conditions, firm strategy and rivalry and related and supporting industries. The Diamond model explains briefly the relationships between these corners of the diamond as well as the outside effects of government and luck (Figure 1).

There are two dimensions of Porter’s cluster definition. The first is the existence of the network relationships between firms. These relations occur in two ways: vertical (input-output relations with forward and backward linkages) and horizontal (the relations among firms which produce complementary products/services and which use common specialised factor conditions such as technology and workforce). Most of these links consist of social relationships and networks among firms, and they create the benefits of clusters. The second dimension is the geographical closeness of the firms within clusters. Porter has

**Figure 1.**
Porter’s Diamond Model

Source: Porter (1990, 2008)
emphasised the critical role of co-location with his cluster definition. This closeness would be a network of relations in a particular portion of a city, an entire city, a region, a country or crossborder cooperation of multiple countries. Clusters are the networks of those firms and institutions creating synergy in a common geography (Porter, 2000, 2008).

1.2 Benefits of clusters
Porter lists the benefits of clusters as follows:

- increasing innovation-based new forms of business models providing productivity and employment growth;
- facilitating access for specialised inputs and supplies with a high advantage against non-members of the cluster;
- improving coordination among firms in the cluster which helps coopetition, knowledge and experience sharing, common R&D and benchmarking;
- introducing new products and services through highly capable sub-contractors and innovation; and
- facilitating access for government subsidies, technology pools and financial tools (Porter, 2000).

2. Maritime clusters
Service sector clusters are not as prevalent as industrial clusters, but nevertheless, many studies have been conducted in this area. Maritime clusters, locating maritime transportation sub-sector at their cores, are good examples for these kinds of service sector clusters. Mainstream research about maritime clusters focuses on the maritime sector as a whole and its interrelation with the country’s competitiveness, but more specific clustering studies in sub-sectors such as ports and shipbuilding are also available. As for the maritime nations, regions or the cities with strong maritime clusters, one can easily observe that Norway is the leading country in the area due to its highly integrated, well-coordinated and technologically structured innovative maritime industry in close relationship and cooperation. London is another example for well-established and developed maritime clusters owing to its highly expertised maritime services sector in global dimensions. Also, there is the South Korea ship building cluster, with its skilled and hardworking labour force as well as Singapore and The Netherlands port clusters with their efficient and high capacity ports in Southeast Asia and Western Europe, respectively.

The literature regarding maritime clusters contains many case studies from European maritime countries such as Norway (Benito et al., 2003; Fløysand et al., 2012), The Netherlands (De Langen, 2002), the UK (Chang, 2011, 2012), Ireland (Brett, 2007; Morrissey and O’Donoghue, 2013; Morrissey and Cummins, 2016), Finland (Laaksonen and Makinen, 2013), Portugal (Salvador et al., 2016) and Lithuania (Viederyte, 2014a, 2014b) and as well as from maritime countries throughout the globe including China (Deng et al., 2013), Japan (Shinohara, 2010), Panama (Pagano et al., 2012; Pagano et al., 2016), Canada (Doloreux and Shearmur, 2009; Doloreux et al., 2015) and Malaysia (Othman et al., 2011).

The motives for the sectoral organisation via clusters are availability of labour pool, widespread supplier and customer base, knowledge spillovers, increase in innovation and low transaction costs (De Langen, 2002; Pinto et al., 2015). A good maritime cluster provides appropriate consulting and management, improves connections among firms, universities and research institutions, increases data sharing and facilitates sub-structure and financial aids to the sector (Chang, 2011; Othman et al., 2011; Salvador et al., 2016).
To establish a properly functioning maritime cluster, state aid at the initial phase is vital (Shinohara, 2010). Also, integrated maritime policies based on healthy statistical data is a key to gaining a global competition advantage (Wijnost, 2006). For the success of the maritime clusters, there is an on-going discussion about whether a topside-down or bottom-up approach is more effective (Floysand et al., 2012; Chang, 2012). Deficiency of leader firms in the maritime sector requires a topside-down approach. Developed countries have the advantage while establishing maritime clusters because of their high number of leader firms which have some multiplier effects. These firms in a maritime cluster could create some benefits for the entire cluster by engaging in structural R&D and innovation and by accessing international markets and international knowledge as well (De Langen, 2002).

There are four types of maritime clusters:

1. Maritime clusters involved in shipping and port operations with mainly cargo loading and discharging functions [e.g. Dublin (Ireland) (Brett, 2007)];

2. The maritime cluster is the centre for cargo allocation and value-added processing [e.g. Osaka (Japan)];

3. The maritime cluster is a supply chain hub in the global/regional economic and trade market [e.g. Rotterdam (The Netherlands) (De Langen, 2002)]; and

4. The maritime cluster has the knowhow and workforce expertise, upon which the international maritime services (ship finance, maritime law, marine insurance, ship registry, ship chartering and ship brokering) depend [e.g. London (UK) (Brownrigg, 2006)] (Zhang and Lam, 2013).

A maritime cluster has a life cycle, so once it has been established and developed, feedback loops should be used to reconstruct the cluster for sustainability (Floysand et al., 2012).

As for the Turkish maritime sector, some sub-sectoral research does exist, including a SWOT analysis of Istanbul’s maritime transportation sector (Deval and Saman, 2005), a model proposal for the Turkish maritime cluster taking the EU as an example (Gurbuz, 2008) and a partnership between military and civilian shipbuilding technologies forming a cluster to build military vessels (Akincilar Tan, 2011).

3. Turkish maritime sector and the role of Istanbul as a maritime city

Regarding the global economic environment which is highly dependent on maritime transportation, the current status of the Turkish maritime sector is not in good condition in proportion to its high economic, demographic and geographic potential. According to 2017 data (January 1, 2018 and greater than 1000 GT), the Turkish-owned national and international maritime fleet comprised 1,511 ships, 28,611,000 DWT and 277,000 TEU capacity. The sum of the Turkish-owned maritime fleet is ranked 15th in the World by tonnage (Chamber of Shipping, 2018). The Turkish-owned maritime fleet in numbers and tonnage has grown significantly, despite the adverse effects of the 2008 global financial crisis.

Turkey has 180 ports, mostly operated by the private sector, on its coastline. These ports have a theoretical capacity of 600,000,000 tons and 25,543,028 TEUs. In 2017, 73,306 ships called into Turkish ports and handled 471,173,896 GT and 10,010,537 TEU of cargo (Chamber of Shipping, 2018).

There are 78 shipyards in Turkey, mostly located in the Marmara Sea and western Black sea coasts. Approximately 30,000 people are working in the shipbuilding sector. In 2017, the number of delivered vessels was 21 and their total tonnage was 98,940 DWT. (This tonnage
was 962,072 DWT in 2008). This sub-sector has been affected very badly by the 2008 global economic crisis, but it is trying to recover today (Chamber of Shipping, 2018).

Istanbul is the most developed city of Turkey in social and economic aspects. Half of the Turkish maritime sector firms are located in Istanbul. According to records of the Chamber of Shipping, approximately 4,000 of 8,000 Turkish maritime firms are located in Istanbul. Most of the Turkish flag ships’ homeports is Istanbul. Most of the ship owners, shipping firms and supporting services are located in Istanbul. Finally, the centres of Turkish shipbuilding and yacht manufacturing sectors are in Istanbul. Thus, any clustering effort in the Istanbul maritime sector will affect the Turkish maritime sector as a whole.

In this context, clustering can be one of the most effective methods to make the Istanbul maritime sector globally more competitive. The measuring of the current clustering condition and potential of Istanbul’s maritime sector through qualitative and quantitative tools is the first step of such an endeavour. After measuring these variables and determining the cluster’s level, its classification, current stages of its life cycle, competitive advantages/disadvantages, dimensions of the network relations, potentials, innovation capacities, abilities to create added value, etc., would be stated. Following this, the findings would be transformed into a clustering model for the Istanbul maritime sector in the light of successful maritime cluster examples through the globe.

4. Methodology
Maritime cluster studies mostly use descriptive, statistical and mixed methods based on Porter’s diamond model. Case studies of maritime sectors of some cities, areas or countries, which have used primary data from interviews and surveys supported by statistical secondary data, are very common in the literature (Benito et al., 2003; Deval and Saman, 2005; De Langen, 2005; NG, 2006; Finckenhagen and Fjeld, 2008; Shinohara, 2010; Othman et al., 2011; Laaksonen and Makinen, 2013; De Langen, 2013; Makkonen et al., 2013; Teijl, 2014; Ulvin, 2014; Doloreux et al., 2015). Several descriptive studies solely based on secondary data also exist (Deng et al., 2013; Lam et al., 2013; Viederyte, 2014a; Viederyte, 2014b; Gunther, 2014). An input-output approach is also used to analyse maritime clusters, but it requires a great deal of sound statistical data regarding the forward-backward linkages of the maritime sectors (Pagano et al., 2012; Morrissey and O’Donoghue, 2013; Morrissey and Cummins, 2016; Salvador et al., 2016). Wolfe and Gertler (2004) state that the mixed method, which is a combination of case studies and statistics, is the most effective method to measure and evaluate the level of clusters.

4.1 Classical regression method
One discrepancy seen in the maritime cluster research is the lack of econometric methods such as regression analysis. On the contrary, regression analysis is used in the general cluster literature. For example, positive effects of employment in the cluster on patents per employee (Porter, 2003) and the level of clustering on the entrepreneurship (Delgado et al., 2010) have been observed in this research. Also, the effects of clustering on income and employment increase and urban-rural inequality have been studied by means of regression methods (Yang, 2015).

In this research, to propose an effective clustering model for the Istanbul maritime sector, a mixed method based on a case study survey and econometrics/statistics is used. Simple linear regression analysis and fuzzy linear regression (FLR) analysis are used as econometric methods in this study. Regression analysis is used to describe the distribution of values of one variable, the response, as a function of other explanatory variables. When the different group scores pond to different levels of a quantitative explanatory variable, the
idea can be extended with the simple linear regression model, in which the means fall on a straight line function of the explanatory variable. The simple linear regression model makes it possible to draw inference about any mean response within the range of the explanatory variable. It offers a concise summary of the mean of the response variable as a function of the explanatory variable through two parameters: the slope and the intercept of the line (Ramsey and Shafer, 2002). In this study, clustering level is the explanatory variable and firm performance is the dependent variable. Standard equation of simple linear regressions is below:

\[ Y = \beta_0 + \beta_1 X_i + \varepsilon_i \]  

(1)

where \( Y \): dependent variable, \( X_i \): explanatory variable, \( \beta_0 \) and \( \beta_1 \): intercept and slope of the regression line and \( \varepsilon_i \): random error.

4.2 Fuzzy linear regression method

Classic regression is problematic if the data set is too small, or there is difficulty verifying that the error is normally distributed, or if there is vagueness in the relationship between the independent and dependent variables, or if there is ambiguity associated with the event or if the linearity assumption is inappropriate. These are the very situations fuzzy regression was meant to address (Shapiro, 2004). As both dependent and independent variable are subjective description (they are based on professionals’ evaluations by using a five-point Likert-type scale) in our study, we used FLR, which was first introduced by Tanaka et al. in 1982. They used linear programming to determine the regression coefficients as fuzzy numbers. FLR aims to model vague and imprecise phenomena using the fuzzy functions defined by Zadeh’s extension principle (Zadeh, 1975), which provides a general method for extending non-fuzzy mathematical concepts to deal with fuzzy quantities (Kim et al., 1996). As the regression coefficients are fuzzy numbers, the estimated dependent variable is also a fuzzy number (Chang and Ayyub, 2001). Fuzzy model takes the form (Wang and Tsaur, 2000):

\[ \tilde{Y} = \tilde{A}_0 X_0 + \tilde{A}_1 X_1 + \ldots + \tilde{A}_N X_N = \tilde{A} X, \]  

(2)

where \( X = [X_0, X_1, \ldots, X_N]^T \) is a vector of independent variables; \( \tilde{A} = [\tilde{A}_0, \tilde{A}_1, \ldots, \tilde{A}_N]^T \) is a vector of fuzzy coefficients presented in the form of symmetric triangular fuzzy numbers (TFN) denoted by \( \tilde{A}_j = (a_j, c_j) \) with its membership function (MF) described as below:

\[ u_{\tilde{A}}(a_j) = \begin{cases} 
1 - \frac{|a_j - a|}{c_j}, & a_j - c_j \leq a_j \leq a_j + c_j, \forall j = 1,2,\ldots,N, \\
0, & \text{otherwise.} 
\end{cases} \]  

(3)

where \( a_j \): central value and \( c_j \): spread value. The equation (2) can be rewritten as:

\[ \tilde{Y}_i = (\alpha_0, c_0) + (\alpha_1, c_1) X_1 + (\alpha_2, c_2) X_2 + \ldots + (\alpha_N, c_N) X_N \]  

(4)

To find fuzzy coefficients, the following linear programming problem should be solved (Tanaka et al., 1982).
\[
\begin{align*}
\text{min} J &= c_1 + \ldots + c_n \\
\text{subject to } &c \geq 0 \text{ and} \\
\alpha' x_i + (1 - H) \sum_j c_j |x_j| &\geq y_i + (1 - H) e_i \\
- \alpha' x_i + (1 - H) \sum_j c_j |x_j| &\geq -y_i + (1 - H) e_i \\
i = 1, \ldots, N. &
\end{align*}
\]

For any given data pair, \((x_i, y_i)\), the foregoing conceptualisations can be summarised by the fuzzy regression interval \([Y^L_i, Y^U_i]\) shown in Figure 2 (Shapiro, 2004).

\[
Y^h = 1 = \frac{Y^U_i - Y^L_i}{2}
\]

\[
e_i = \frac{Y_{i(upper)} - Y_{i(lower)}}{2}
\]

4.3 The questionnaire and the research sample

The primary data required for this study are collected by means of “The Clustering Level of Istanbul Maritime Sector Survey” which took place between 20 February and 10 June 2017. The survey criteria were based on Porter’s diamond model and research of Benito et al. (2003), De Langen (2002), Doloreux (2008) and Pinto et al. (2015) are used while creating the questionnaire. Cronbach’s alpha score of the questionnaire is 0.83, which shows that internal consistency is high. A sample of 200 firms was chosen randomly among the

**Figure 2.**
Fuzzy regression interval

**Source:** Shapiro (2004)
maritime firms in Istanbul. The contact details of the firms were given by the Chamber of Shipping in Istanbul. These firms were invited to fill in the survey forms by e-mail, and the entire survey was conducted on-line by means of the Istanbul Technical University VETI (data collecting system) System. In total, 112 forms were completed. Those forms filled in only partially were not evaluated.

4.4 Entropy method
To properly analyse the data sets of the survey results, a definition of the weight of each criterion is vital. In multi decision-making problems, these criteria have different weights and can be easily weighted according to their importance levels. As the entire decision matrix data are known, in this study, an entropy method is used as a tool for criteria evaluation. In this method, the decision matrix for a set of alternatives contains a certain amount of information. A criterion does not function particularly effectively when all the alternatives have similar outcomes for that criterion. Further, if all the values are the same, we can eliminate the criterion (Hwang and Yoon, 1981). The greater the value of the entropy, the smaller the entropy weight, then the smaller the different alternatives in this specific attribute, and the less information the specific attribute provides and the less important this attribute becomes in the decision-making process. This is an objective method in weighting calculations. It is based on the Shannon’s (1948) entropy concept as a measurement of uncertainty. The steps of the entropy method are as follows (Wang and Lee, 2009):

4.4.1 Step 1: Normalisation of decision matrix.

\[ p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \quad i = 1, 2, 3, \ldots, m \]  

where \( p_{ij} \) is normalised values, \( x_{ij} \) denotes given values (results from the survey) and \( i \): alternatives and \( j \): criteria.

4.4.2 Calculation of entropy value of each criterion.

\[ e_{j} = -\frac{1}{\ln m} \sum_{i=1}^{m} p_{ij} \ln p_{ij} \quad j = 1, 2, 3, \ldots, n \]  

where \( e_{j} \): entropy value and \( p_{ij} \): normalised values.

4.4.3 Calculation of weight of each criterion.

\[ w_{j} = \frac{1 - e_{j}}{\sum_{j=1}^{n} (1 - e_{j})} \quad j = 1, 2, 3, \ldots, n \]  

where \( w_{j} \): weight values and \( e_{j} \): entropy values.

It can be easily understood that the sum of all weight values are 1.
In the study, 45 criteria for the clustering level variable and 3 criteria for the firm performance variable were defined. Then, the criteria were weighted by using the entropy method and the relationship between clustering and firm performance was measured by means of simple linear regression and FLR methods.

5. Findings of the study
In our study, we asked the following research questions: "What is the clustering level of Istanbul's maritime sector?", "How can we propose an appropriate model of clustering for Istanbul's maritime sector?" and "Is there a positive correlation between clustering level and firm performance?". By means of our survey, we have tried to find answers to these questions.

Distribution of 112 maritime firms to the sub-sectors is almost balanced. This provides us with a means of comparison for the sub-sectors. The percentage of the respondents which has executive roles in the firms (owner/co-owner and high level managers) is high (73 per cent). These executives have great experience in maritime sector. So it can be assumed that the answers reflect the true nature of the surveyed firms and the sector. Also, educational levels of respondents are high (percentage of undergraduate and master's/PhD degrees is 88 per cent). This strengthens the scientific findings of the survey (Table I).

5.1 Factor conditions
It is not surprising that Istanbul, which is the most-developed city of Turkey in terms of social and economic aspects, has above average factor condition scores. Istanbul is attracting the younger generation due to its many advantages, so the high-quality workforce of Turkey tends to be educated and employed in Istanbul. According to the survey results, the status of substructure is above average (3.36) but comparing with the high levels of other factors, it is not satisfactory, and there is still a long way to go. The highest score is the reachability to suppliers (4.27), but the quality of suppliers is not particularly high (3.76). The score of opportunities to reach financial institutions is above average (3.49), but it is far behind expectations because Istanbul has a goal to become a financial centre in its region and in the globe. It has been seen that the Ship/Yacht Building and Maritime Equipment sub-sectors are more pleasant in terms of sub-structure (3.76) and reachability to financial institutions (3.83) compared with other sub-sectors. The reachability to R&D is the lowest but slightly above the average (3.13). As a summary of all factor condition questions, the answers to the question of "What is the level of positive effect of your location choice on your business performance?" show that Istanbul is far above the average (4.12) and has a very promising level for factor conditions (Table II).

5.2 Demand conditions
When we evaluate demand conditions of Istanbul's maritime sector, we can easily find that customer demand for high-quality goods and services is high (4.42). Also, the demand structure is forcing firms to innovate, and this shows us the need for an innovative maritime sector (3.34). There is a demand variety in the Istanbul maritime sector (3.74), but the low level of foreign demand (2.60) is a limiting factor against the global competitiveness of the sector (Table III).
5.3 Firm strategy and rivalry
In Istanbul’s maritime sector, the level of national and international competition is high (3.65 and 3.68) and the number of internal and external rivals is significant (4.09 and 4.17). Entrance barriers to the internal and external markets are also high (3.71 and 3.97). These competition levels are significant factors which enforce the firms to cluster. The competing
firms are cooperating at the same time in R&D (2.66), standardisation (3.09), lobbying (2.79), marketing (2.58) and procurement (2.51) at just below average frequencies. To achieve the goal of having a globally competitive Istanbul maritime sector, this cooperation level should be increased. When we analyse the answers to the questions which provides us the level of innovation of the firms, it can be seen that these firms (mostly the Ship/Yacht Building and Maritime Equipment firms) are giving importance to innovation and its education (2.97 and 3.69). On the other hand, R&D costs/Turnover (2.7) and Innovation investments/Total investments (1.76) ratios are lower than the average. Generally, the sector is aware of the importance of innovation, but it is impossible to define maritime firms as innovative. Finally, when we analyse answers to the questions which measure the firms’ approaches to the necessity of clustering, it can easily be seen that most of the firms have a very positive vision for clustering.

5.4 Related and supporting industries
In Istanbul’s maritime sector, the levels of relationship and cooperation of the firms with their customers (4.34) and suppliers (4.05) are high; with financial institutions (3.33), their rivals (3.15), business associations and chamber of commerce (3.05) and experts (consulting firms, engineering firms, etc.) (3.02) are average; and with universities (2.11) and R&D institutions (1.96) are low. In this aspect, there is a meaningful relationship and cooperation among the stakeholders in the sector but one cannot adequately provide details regarding the established and developed maritime cluster. Successful clusters only can be achieved by good relationship and cooperation between firms and their rivals, universities and R&D institutions. The level of relationship and cooperation is higher in the Ship/Yacht Building and Maritime Equipment sub-sector than the others. It is evaluated that this situation stems from the facts that; this sub-sector is well organised and clustered, the locations of the firms are close to each other, enabling an effective cluster (all of the shipyards in Istanbul are located in the Tuzla area), firms are cooperating in procurement of common raw material and equipment, and also they are giving joint proposals as consortiums to the large shipbuilding projects. Finally, cooperation for innovation level is just above average (3.27) in this sub-sector, and below average in the others (2.75 and 2.62) (Tables IV and V).

5.5 Criteria for firm performance
Three questions were asked to measure firm performance. Sustainability was measured with firm age, contribution to employment was measured with the increase of the number of employees and finally contribution to economic growth was measured with turnover growth. All three answers of the sub-sectors are close to average.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maritime transportation</th>
<th>Supporting firms for the maritime transportation</th>
<th>Ship/yacht building and maritime equipment</th>
<th>All sub-sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Customers forcing the sector for innovation</td>
<td>3.40</td>
<td>3.47</td>
<td>3.17</td>
<td>3.34</td>
</tr>
<tr>
<td>10. Demand variety</td>
<td>3.73</td>
<td>3.92</td>
<td>3.58</td>
<td>3.74</td>
</tr>
<tr>
<td>11. Proportion of foreign demand</td>
<td>2.84</td>
<td>2.65</td>
<td>2.33</td>
<td>2.60</td>
</tr>
</tbody>
</table>

Table III. Survey results for demand conditions ($n = 112$) (1 = lowest, 5 = highest)
5.6 Istanbul maritime cluster mapping

It was asked from the participants of the survey to write down the top three sub-sectors which they related to. Figure 3 explains those relationships in a Web form. The most intense relationships are between maritime transportation and their suppliers, between shipyards...
and marine equipment manufacturers and between maritime transportation firms and shipyards. Maritime transportation is at the centre of the Web due to its strong relationships with the most of the sectoral stakeholders. This fact requires that maritime transportation should be at the centre of the Istanbul Maritime Cluster Map. Figure 4 is a map proposal for the Istanbul Maritime Cluster.

5.7 Entropy calculations
Tables VII to XII

5.8 Regression analysis of the survey results
5.8.1 Simple linear regression analysis. Descriptive statistics show that the variables are normally distributed which enables parametric tests (Figure 5 and 6) (Table XIII).

We conducted a simple linear regression analysis of the variables using the EViews 9 statistics program.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maritime transportation</th>
<th>Supporting firms for the maritime transportation</th>
<th>Ship/yacht building and maritime equipment</th>
<th>All sub-sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>35. Level of relationship and cooperation with your customers</td>
<td>4.27</td>
<td>4.37</td>
<td>4.40</td>
<td>4.34</td>
</tr>
<tr>
<td>36. Level of relationship and cooperation with your suppliers and subcontractors</td>
<td>3.97</td>
<td>3.97</td>
<td>4.23</td>
<td>4.05</td>
</tr>
<tr>
<td>37. Level of relationship and cooperation with your rivals</td>
<td>2.91</td>
<td>2.65</td>
<td>3.90</td>
<td>3.15</td>
</tr>
<tr>
<td>38. Level of relationship and cooperation with universities</td>
<td>1.99</td>
<td>2.08</td>
<td>2.26</td>
<td>2.11</td>
</tr>
<tr>
<td>39. Level of relationship and cooperation with R&amp;D institutions</td>
<td>1.90</td>
<td>1.88</td>
<td>2.10</td>
<td>1.96</td>
</tr>
<tr>
<td>40. Level of relationship and cooperation with business associations and chamber of shipping</td>
<td>3.00</td>
<td>2.92</td>
<td>3.23</td>
<td>3.05</td>
</tr>
<tr>
<td>41. Level of relationship and cooperation with experts (consulting firms, engineering firms, etc.)</td>
<td>3.01</td>
<td>2.83</td>
<td>3.23</td>
<td>3.02</td>
</tr>
<tr>
<td>42. Level of relationship and cooperation with financial institutions (banks, insurance, leasing/factoring, stock brokers, etc.)</td>
<td>3.35</td>
<td>3.21</td>
<td>3.43</td>
<td>3.33</td>
</tr>
<tr>
<td>43. Variety of relationship and cooperation</td>
<td>2.10</td>
<td>1.95</td>
<td>2.41</td>
<td>2.18</td>
</tr>
<tr>
<td>44. Data and experience sharing between related and supporting industries strengthens sector/sub-sector as a whole</td>
<td>3.84</td>
<td>3.85</td>
<td>4.06</td>
<td>3.91</td>
</tr>
<tr>
<td>45. Do you participate to the cooperation activities of innovation through your sector/sub-sector?</td>
<td>2.75</td>
<td>2.62</td>
<td>3.27</td>
<td>2.88</td>
</tr>
</tbody>
</table>

Table V.
Survey results for related and supporting industries ($n = 112$) (1 = lowest, 5 = highest)
Table VI.
Survey results for firm performance
\((n = 112)\) (1 = lowest, 5 = highest)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Maritime transportation</th>
<th>Supporting firms for the maritime transportation</th>
<th>Ship/yacht building and maritime equipment</th>
<th>All sub-sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age of your firm</td>
<td>2.65</td>
<td>2.76</td>
<td>2.83</td>
<td>2.74</td>
</tr>
<tr>
<td>2. Change in the employment in your firm</td>
<td>2.90</td>
<td>2.71</td>
<td>2.80</td>
<td>2.80</td>
</tr>
<tr>
<td>3. Change in the turnover in your firm</td>
<td>2.70</td>
<td>2.92</td>
<td>2.83</td>
<td>2.81</td>
</tr>
</tbody>
</table>
The $p$-value (0.000375) for the F test statistic was less than 0.01, indicating strong evidence of alternative hypothesis against the null hypothesis. The squared multiple correlation ($R^2 = 0.1091$) indicates that approximately 11 per cent of the variability in the firm performance variable is explained by the clustering level variable. Thus, the remaining 89 per cent of the firm performance can be explained by other variables. Although results from our model were found to be statistically significant, the explanation ratio of independent variable (clustering level) for dependent variable (firm performance) is not high. Therefore, there is a limited positive effect of clustering level on the firm performance in this case. This result could be stemmed from the fact that the criteria in the questionnaire were evaluated by the sector professionals in parallel with their subjective thoughts about the cluster concept. Also, the number of the criteria for the independent variable was quite high, but dependent variable had only three criteria, which probably caused some measurement errors. For
future research, to obtain detailed financial facts from the maritime firms about their performance is strongly recommended.

5.8.2 Fuzzy linear regression analysis. As both dependent and independent variable are subjective description, and there is vagueness in the relationship between them, we conducted an FLR analysis (Table XIV and XV).

By means of these data, we fit straight lines through two or more heuristically determined data points in such a way that they bound the data points from above and below. \( Y_U = 0.73x + 2.09 \) and \( Y_L = 0.93x - 1.63 \). The mean of these lines is \( Y_{h=1} = 0.83x + 0.23 \) (Figure 7).

Central values \((a_j)\) were found by means of standard regression analysis between \(x\) values (clustering level) and the \(Y_{h=1}\) values. Spread values \((c_j)\) were found by means of standard regression analysis between \(x\) values (clustering level) and the \(e_i\) values. H-value can be selected between 0 and 1. It was selected as 0.5 by the researchers. Finally, the FLR equation for \(H = 0.5\) was formed as below:

\[
(Firm \, performance(\bar{Y})) = (0.23, 0.93) + (0.83, 0.05)(Clustering \, level) \tag{13}
\]
6. Conclusions
Clustering is a national, regional or local cooperation and development model of interrelated firms and supplementary institutions in a particular sector to gain global competition advantage. Countries use maritime clusters as a tool to increase their global competition power in the maritime sector. They generally locate their maritime transportation sub-sector in the heart of the cluster organisation and supporting firms for the maritime transportation and ship/yacht building and maritime equipment sub-sectors on the periphery. It is imperative for Turkey to develop its maritime capacity in the near future. Due to the fact that 90 per cent of international trade is carried out via seaways, Turkey has no other option than to invest in its maritime sector.

That being said, the clusters should be analysed by using quantitative methods to comprehend the level of clustering in any region or city. In this context, by conducting a survey and analysing the results with statistical methods, the level of Istanbul’s maritime cluster has been measured in this article. Istanbul, as a city, provides a very suitable environment for its maritime sector to cluster. However, it is impossible to say that there is an established and developed maritime cluster at present. Istanbul’s maritime cluster is about to prosper. According to the Zhang and Lam’s classification, it is evaluated that the
Figure 5. Descriptive statistics of the variables

Figure 6. Scatter plot, box plot and simple linear regression line showing the relationship between clustering level and firm performance
Istanbul maritime sector is partly at the third stage, which means that it is a regional supply chain hub in economic and trade markets. Becoming a global player at the third stage and also transitioning to the fourth stage requires a strong maritime cluster.

One of the major deficits of Istanbul’s maritime cluster is the very low level of cooperation among maritime firms. The maritime firms in particular tend not to cooperate with their rivals in the cluster. Successful clusters can only be achieved by good relationships and cooperation between rivals in the cluster. Also, firms’ low level of relationship and cooperation with related institutions such as universities and R&D institutions weakens the innovative potential of Istanbul’s maritime cluster.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.264985</td>
<td>0.418786</td>
<td>3.020598</td>
<td>0.0031</td>
</tr>
<tr>
<td>Clustering</td>
<td>0.507191</td>
<td>0.138186</td>
<td>3.670349</td>
<td>0.0004</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.109106</td>
<td></td>
<td>Mean dependent var</td>
<td>2.783750</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.101007</td>
<td></td>
<td>S.D. dependent var</td>
<td>0.719675</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.682361</td>
<td></td>
<td>Akaike info criterion</td>
<td>2.091181</td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>51.21788</td>
<td></td>
<td>Schwarz criterion</td>
<td>2.139726</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>–115.1061</td>
<td></td>
<td>Hannan-Quinn criter.</td>
<td>2.110877</td>
</tr>
<tr>
<td>F-statistic</td>
<td>13.47146</td>
<td></td>
<td>Durbin-Watson stat</td>
<td>2.366884</td>
</tr>
<tr>
<td>Prob (F-statistic)</td>
<td>0.000375</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Dependent Variable: PERFORMANCE; Method: Least Squares; Date: 12/01/17 Time: 04:38; Sample: 112; Included observation: 112

<table>
<thead>
<tr>
<th>i</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>...</th>
<th>112</th>
</tr>
</thead>
<tbody>
<tr>
<td>x&lt;sub&gt;i&lt;/sub&gt;</td>
<td>3.56</td>
<td>2.91</td>
<td>2.39</td>
<td>2.1</td>
<td>3.56</td>
<td>2.33</td>
<td>2.06</td>
<td>3.3</td>
<td>3.7</td>
<td>2.4</td>
<td>...</td>
<td>3.99</td>
</tr>
<tr>
<td>y&lt;sub&gt;i&lt;/sub&gt;</td>
<td>4</td>
<td>2.38</td>
<td>1.73</td>
<td>2.68</td>
<td>4</td>
<td>2.17</td>
<td>2.56</td>
<td>3.02</td>
<td>2.43</td>
<td>2.61</td>
<td>...</td>
<td>3.47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>i</th>
<th>Real value (Y)</th>
<th>Simple linear regression (Y)</th>
<th>FLR Lower limit</th>
<th>Upper limit</th>
<th>Mean</th>
<th>Limits for H = 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>3.07058496</td>
<td>1.6808</td>
<td>4.6888</td>
<td>3.1848</td>
<td>2.43</td>
</tr>
<tr>
<td>2</td>
<td>2.38</td>
<td>2.74091081</td>
<td>1.0763</td>
<td>4.2143</td>
<td>2.6453</td>
<td>1.855</td>
</tr>
<tr>
<td>3</td>
<td>1.73</td>
<td>2.47717149</td>
<td>0.5927</td>
<td>3.8347</td>
<td>2.2137</td>
<td>1.4</td>
</tr>
<tr>
<td>4</td>
<td>2.68</td>
<td>2.3300861</td>
<td>0.323</td>
<td>3.623</td>
<td>1.973</td>
<td>1.145</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3.07058496</td>
<td>1.6808</td>
<td>4.6888</td>
<td>3.1848</td>
<td>2.43</td>
</tr>
<tr>
<td>6</td>
<td>2.17</td>
<td>2.95393103</td>
<td>1.4669</td>
<td>4.5209</td>
<td>2.9939</td>
<td>2.225</td>
</tr>
<tr>
<td>7</td>
<td>2.56</td>
<td>2.30979846</td>
<td>0.2858</td>
<td>3.5938</td>
<td>1.9398</td>
<td>1.1</td>
</tr>
<tr>
<td>8</td>
<td>3.02</td>
<td>2.9387153</td>
<td>1.439</td>
<td>4.499</td>
<td>2.969</td>
<td>2.195</td>
</tr>
<tr>
<td>9</td>
<td>2.43</td>
<td>3.1415917</td>
<td>1.811</td>
<td>4.791</td>
<td>3.301</td>
<td>2.555</td>
</tr>
<tr>
<td>10</td>
<td>2.61</td>
<td>2.4822434</td>
<td>0.602</td>
<td>3.842</td>
<td>2.222</td>
<td>1.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>3.47</td>
<td>3.28867709</td>
<td>2.0807</td>
<td>5.0027</td>
<td>3.5417</td>
<td>2.81</td>
</tr>
</tbody>
</table>

**Table XV.** Comparison of the simple linear regression and the FLR results
A lack of a coordination authority which has some coordination responsibilities among the maritime cluster is another major hindrance for Istanbul to become a better maritime cluster in the near future.

The number of leader firms in Istanbul’s maritime cluster is insufficient to gain a global competitive strength in the maritime sector. For the development of the Istanbul maritime cluster in the near and middle term, the presence of leader firms which have the ability to create synergy through the maritime sector is a vital need. In the meantime, the government should take most of the responsibility to enhance the maritime cluster using a topside-down approach. Most firms participating in the survey stated that government support for the maritime sector should be increased. On the contrary, most of the firms prefer a bottom-up approach which gives them much more power in decision-making processes. It is such a contradiction for them, so a combination of two different approaches would be a solution. This issue is vital because to propose an appropriate model of clustering for Istanbul’s maritime sector, policy makers and the sector professionals should decide which approach is more suitable and useful for the cluster.

Another dimension of the clustering model proposal is the definition of the core sub-sector. Maritime transportation is at the centre of the cluster web due to its strong relationships with the most of the sectoral stakeholders. As a model proposal, Istanbul Maritime Cluster Map is formed by this research.

From the survey, it can be easily understood that maritime firms are evaluating the cluster concept in a positive way. Even some professionals who had not heard about this concept previously, stated that they would participate in such an organisation. This implies that we can look into the future more hopefully in this area.

In this study, the effect of clustering level on firm performance was evaluated by means of simple linear regression and FLR methods. As a result of simple linear regression, the relationship of the variables in our model is statistically significant, but the effect of
clustering level on firm performance is not high. We evaluate that this situation stemmed from the fact that both dependent and independent variable were subjective description and also the number of the criteria for the firm performance variable were inadequate to measure its actual level precisely. So we used a FLR method to analyse that relationship.

For further research, input/output analysis should be carried out to illustrate the Istanbul maritime cluster’s economic linkages. However, this requires a significant amount of statistical data based on firms’ financial activities. This method is imperative for understanding the true nature of interconnections among the cluster participants.

References


**Corresponding author**

Cengiz Bahadir Karahan can be contacted at: cbkarahan@itu.edu.tr

---

For instructions on how to order reprints of this article, please visit our website:

[www.emeraldgrouppublishing.com/licensing/reprints.htm](http://www.emeraldgrouppublishing.com/licensing/reprints.htm)

Or contact us for further details: permissions@emeraldinsight.com
Maritime Business Review

Number 3

209 Editorial board

210 Protectionist vs liberalised maritime cabotage policies: a review
Ana Cristina Paixão Casaca and Dimitrios V. Lyridis

243 Liner shipping alliances and their impact on shipping connectivity in Southeast Asia
Wei Yim Yap and Seyed Mehdi Zahraei

256 Modeling the determinants of dry bulk FFA trading volume from a cross-market perspective of spot and forward
Shiyuan Zheng and Shun Chen

276 An empirical analysis of service quality factors pertaining to ocean freight forwarding services
S. Subhashini and S. Preetha

290 Strategic maritime management as a new emerging field in maritime studies
Ping Wang and Joan Mileski

314 Clustering potential of Istanbul maritime sector
Cengiz Bahadir Karahan and Levent Kirval