Multidisciplinary
SCIENTIFIC JOURNAL OF
MARITIME RESEARCH

University of Rijeka
Faculty of Maritime
Studies Rijeka

Multidisciplinarni
znanstveni časopis
POMORSTVO

Factors influencing the formation of freight rates on maritime shipping markets

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ABSTRACT

Maritime shipping has a significant role in maritime policies and overall economic development of every maritime country. The fact that 2/3 of the total world trade of goods are done by maritime routes and that the sea is the least expensive trade route is enough to see the importance of its existence for every maritime country. The whole world and overall world trade, in maritime and other sectors, are defined by the relationship between supply and demand and prices on the market. Precisely for this reason it is important to well understand these relations and their mutual impacts. Therefore, in order to present the changeable state of shipping markets, in this paper we will use the supply and demand model which is connected to the freight rate i.e. the price of maritime transport service, which through its influence on the shipper and the shipowner balances the supply and demand. The aim of this paper is to point out the factors which influence the maritime shipping markets. In the paper we indicated and analyzed ten main factors; five influencing the demand, and five influencing the supply on the maritime transport market.

ARTICLE INFO

Review article
Received 16 May 2015
Accepted 2 June 2015

Key words:
Freight rates
Maritime shipping
Shipping markets
Demand and supply
Economic development

1. Introduction

The role of maritime shipping in maritime policy and in the overall development of every country is very important. Its main task is to satisfy varying, by volume changeable and by characteristic elastic, demand for maritime transport.

To regulate supply and demand, the shipping market uses different economic mechanisms, and every turn of a cycle on the shipping market brings new possibilities and threats, so in a span of only several months the shipowner's cash flow can change significantly, which means that the market value of his fleet can fluctuate millions of dollars. It is said that maritime is a skill game and that playing with cycles depends on the possibilities to recognize, or even better, predict ups and downs on the freight market. Those who can recognize when all other "players" on the market are wrong have the best odds.

From an economic point of view, every maritime cycle is unique and to understand the state of the market it is necessary to develop systematic explanation of how the cycles on the freight market are generalized. In world practice, the supply and demand model is used for that. That technique is often used by economists to analyse wide consumption on the market.

2. Factors influencing the formation of freight rates on maritime shipping markets

The freight rates are influenced by market flows depending on the cargo being trade and they are expressed in the form of indices for each different market segment (Radonja et al., 2011: 321). Of many factors which influence the maritime shipping market, five factors influence the demand for maritime transport, and five factors influence the supply on the maritime shipping market. The factors influencing the demand for maritime transport are: world economy, international maritime trade, average achieved profit, political events and transport costs. On the supply side is: world fleet and its productivity, shipbuilding, shipbreaking and freights. The relationship between these variables and the way they mutually function is shown in figure 1, consisting of three components (Stopford, 2009: 114): 1) demand, representing the model A, 2) supply, representing the model B and 3) freight market shown in model C, connecting the other two by regulating the cash flow between those two sectors.

The way in which this mechanism functions is very simple. *On the demand side* there is world economy which through a series of different industries' activities creates goods that require maritime transport. The development

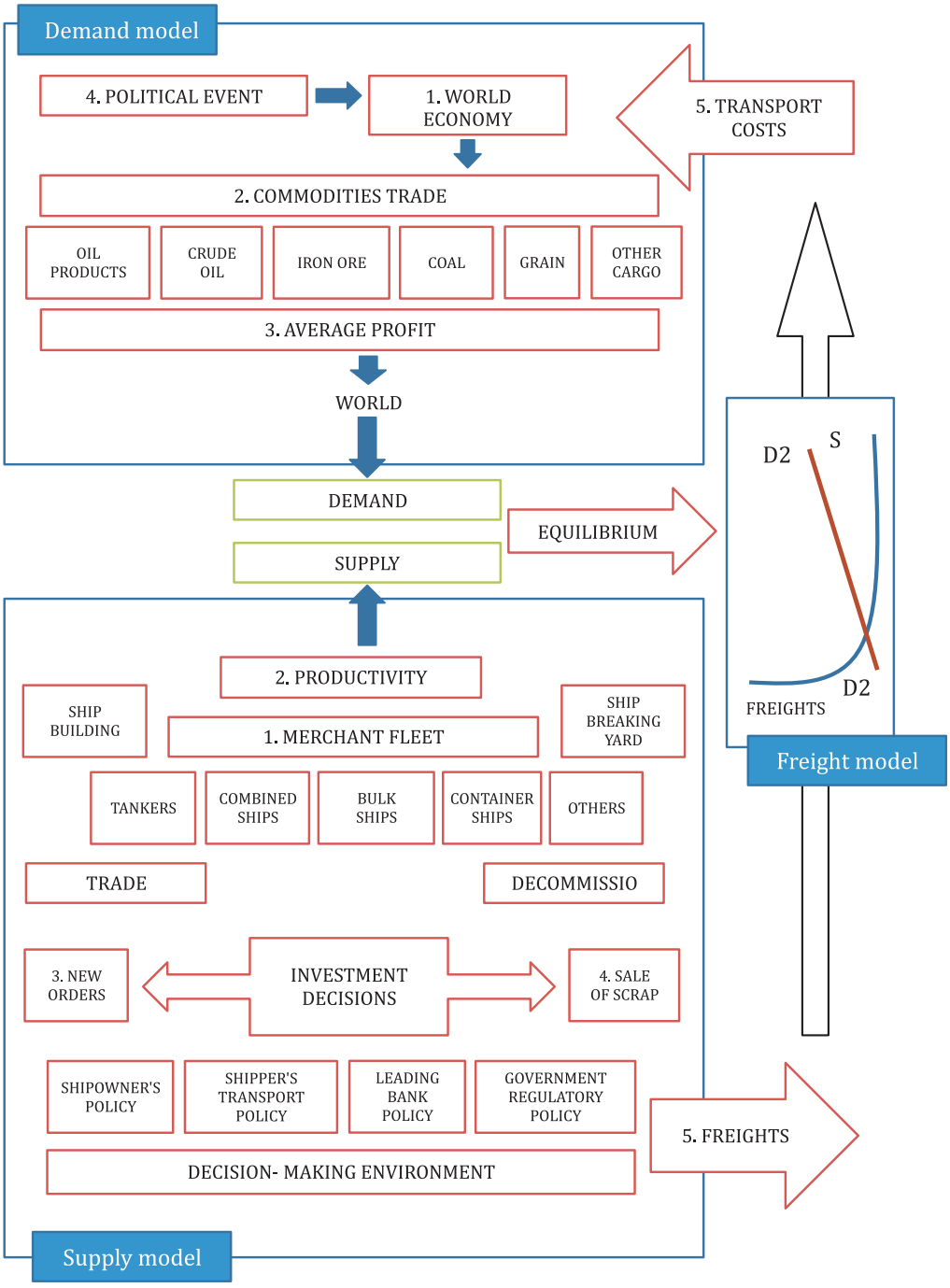


Figure 1 The shipping market model

Source: Stopford, M.: Maritime economics, Rutledge, Tavlor&Francis group, 2000, pg. 116.

in partial industrial sectors can modify the general growth trend, as can the changes of shipping distances, creating the final demand for maritime services.

On the supply side there is merchant fleet which represents a fixed shipping capacity market (Domijan-Arneri, 2014: 141). In a certain period of time only a part of that fleet can be used for trade, while in that time some ships can be decommissioned or used as a depot. The fleet can be expanded with newbuildings, or limited by shipbreaking. The amount of fleet transport ensures but also depends on the productivity of the management of ships in partial speed and in waiting time. Finally, shipper's policies, banks and legal regulators all influence the development of supply on the market.

The central place in Figure 1 (the shipping market model) is occupied by freights, which represent the equilibrium between supply and demand. This connection between the market balance and the freight is one of the most important economic connections in the shipping model and is controlled by the shipowners who decide

how to react in a certain situation. This model gives the cycles on the shipping market a characteristic pattern of uneven ups and downs.

3. Factors influencing the demand for maritime transport on the maritime shipping market

3.1. World economy

Shipping – which transports around 90 per cent of global trade – provides the principal mode of transport for the supply of raw materials, consumer goods, essential foodstuffs and energy to the global population (www.imo.org). The world economy has the most important influence on the shipping demand because it creates the most demand for maritime transport by importing raw materials for production or trade of ready products. Globalization and information technology, rapid and substantial changes in the environment require both from individuals, as well as from companies and the whole society to change their business philosophies and orientation towards their core business while at the same time outsource some other activities. (Bistričić et al., 2011: 30) In accordance with that, understanding of trends on the shipping market requires an excellent knowledge of developments in the world economy. The relationship between maritime trade and world industry is not simple, so it is important to pay attention to: *business cycles, trade elasticity* and *trade development cycle*.

The business cycle lays down the bases for freight cycles. The fluctuations in economic growth rates function through maritime trade, creating a cyclical pattern of demand for ships. The business cycles are also influenced by combinations of external and internal factors. External factors include events such as wars or sudden changes in commodities prices, while internal factors refer to the dynamic of the structure of the world economy which introduces cyclical activities rather than linear growth. The fact is, no two business cycles are identical, even though they can have a lot in common, and there is no exact formula how to predict the timing of the future or the past of a business cycle.

If we take into consideration the long-term relationship between maritime trade and world economy, we discover trade elasticity which takes into consideration whether the maritime trade grows at a faster or slower or same rate as industrial production. To describe those relationships, economists use the concept of *trade elasticity* (Stopford, 2009: 121) which represents the relationship between the percentage of growth of maritime trade and the percentage of growth of industrial production.

There are two reasons why the trade elasticity of individual regions is likely to change over a long period of time. The first is that the balance of demand for available local resources is prone to changes over time, and the second is that the industrial development leads to changes in demand for certain goods.

3.2. International maritime trade

International maritime trade is a very important component of the shipping market and is a result of the overall trends in the world economy. In modern times it is mostly the result of demand, especially from larger and more powerful consumers, i.e. countries with higher ranking in economic scales. The maritime market is very sensitive and reacts to any change in any direction of world trade. The volume of world trade is oscillating; therefore, the demand for shipping space has to adjust to those oscillations (Mitrović et al., 2010: 54). Well organized and therefore relatively cheap maritime transport is a moving force of the world economy and world trade and the role of shipping companies are therein enormous and not easy at all (Zelenika et al., 2008: 80).

The structure of the world merchant fleet according to basic ship types, size and age, and its changes, give a better picture of the dynamic and the state of supply on the ship capacity market (Dundović et al., 2001: 172). The structure of the merchant fleet arises from the structure of seaborne cargo, modern transport technologies, business strategies and market conditions.

The relationships between maritime trade and industrial economy are conditioned by seasonal variations of some types of commodities. For example, many agricultural goods are the subject of seasonal variations caused by harvests and their values. Seasonality has a disproportional effect on target markets, and since it is difficult to plan the transport of seasonal agricultural commodities, the shippers of such commodities hardly lean on target market contracts in order to gather their demand for tonnage. As a result, fluctuations on the grain market have a bigger influence the contract market than much larger trades such as iron ore, where the tonnage demands higher gathering through long-term contracts. On the other hand, some agricultural products such as fruits, but also meat and dairy products, need cooling or freezing, so these trades require special ships and freezer containers.

Even though every business is different, there are four types of changes to watch out for. Those types of changes are: *changes in demand* for certain goods, *changes in the source* where the suppliers acquire goods, *changes caused by a change of location* of the facility development, which can have a direct influence on the volume, i.e. the quantity of seaborne cargo and on the type of required ship, and *changes in the shipper's transport policy*.

3.3. Average profit

The demand for maritime transport depends on the distance over which the cargo is shipped, and that distance is normally referred to as the "average profit" of maritime trade. To calculate the average profit we usually measure the demand for maritime transport and conditions of "ton-miles" which can be defined as the tonnage of borne cargo multiplied with average distance over which it was transported. As an example we can mention the closing of

the Suez Canal, which drastically increased the distance between some ports and resulted in the increase of the shipping demand and expansion on the freight market in all occasions.

When analysing changes in the average profit, the commodities trade can be very complex, demanding information in the shape of detailed merchant matrices. Oftentimes the important question is the one about the balance between long-term and short-term supplier profit.

3.4. The influence of political disturbance on the shipping demand

Particular characteristics of political development regarding the shipping market are those which when they appear, they can lead to sudden and unexpected changes in the demand on the market. More precisely, they are capable of turning the shipping market upside down. The term "political events" refers to events such as revolutions, political nationalizations of foreign properties, local wars and strikes.

Every insight into the balance of the development of shipping markets must take into consideration the potential of important facts of political nature, while the facts speak for themselves in prediction of the importance of changeable behavior of the shipping demand.

3.5. Transport costs

Many developments in maritime trade depend on the effectiveness of maritime operations. Raw materials will only be transported from distant sources if the costs of maritime operations can be reduced to an acceptable level or if it's possible to achieve basic profit in the quality of products. Precisely this is what makes the transport costs so significant for the industry.

During the last century the improved effectiveness, larger ships and even more effective organization of maritime operations lead to a steady reduction of transport costs and a better quality of services. Introduction of more affordable overseas transport had a tremendous impact on world trade. This also opened new merchant routes and created new maritime connections.

4. Maritime transport supply

The shipping supply is controlled by four groups of decision-makers: shipowners who are primary decision-makers and who order new ships, send old ships for scrapping and decide when it is best to save on tonnage; charterers who can become shipowners themselves or influence the shipowners by issuing time charters; bankers who finance the transport, which means that oftentimes the banks are the ones who put financial pressure which leads to a fall on weak markets, and regulatory authorities which adopt safety decisions. Precisely for this small group of decision-makers the supply side in the shipping model is very prone to changes.

4.1. Marchant fleet

Shipbreaking and newbuildings determine the growth of the fleet and since the average economic lifespan of a ship has been about 25 years, only a small part of the fleet is in fall every year so the speed of adjustment to changes on the market is measured in years, not months. The key point in the shipping market model is the mechanism by which the supply adjusts when the shipping demand fails to turn out as expected. Three decades ago changes happened in the merchant fleet; those changes lead to an expansion of the merchant fleet, but also to a significant decline. Adjustment to those changes is a process which includes changes in types of ships within the fleet.

As for the current state of the world fleet according to ship type, the data from 2014 (ISL, 2014) show that the leading place is held by the bulk carrier fleet (bulk, OBO) with 44%, followed by the tanker fleet (oil, chemicals, liquefied gas) with 35.4%, containers with 13.5%, general cargo fleet (conventional, special, car transport, frigo, RO-RO) with 6.7% and passenger ships (passenger and cruise ships and RO/passenger) with 0.4%.

4.2. Productivity of the merchant fleet

Even though the merchant fleet is limited in size, the productivity with which the ships are used gives it an element of flexibility.

The fleet productivity (P) depends on four main factors, which are: ***speed*** which determines the time a ship spent travelling. Research shows that thanks to a combination of operational factors, even the good merchant ships generally operate at an average speed which is well below their designed speed. The fleet speed changes over time, which means that if the new ships have been delivered with lower designed speed that will progressively reduce the fleet's transport capacity. Much like the age of ships, beside exceptionally good maintenance, deterioration of the ship's hull will greatly reduce the maximal operative speed. ***The time spent in a port*** is also very important, and the physical execution of ships and terminals sets the upper limit. For example, the containerization dramatically reduced the time liners spend in a port. ***Deadweight utilization*** (DWU) refers to the capacity of cargo which was lost thanks to bunkers, warehouses etc., which prevent the ship from being completely loaded and the ***time a ship spent at sea*** loaded with cargo, which is divided into loaded days at sea and non-productive days (time in ballast, port...). Ships designed for flexibility of cargo transport can improve their loaded time at sea because they can change the cargo for transport at the back end of the ship.

4.3. Shipbuilding

The shipbuilding industry also plays an active role in the process of adjustment to the shipping market. Generally, the limit of deliveries should adjust to the changes in demand

during longer periods too. Adjustment to the limit of deliveries is not easy because shipbuilding is a long business cycle and delivery of ships lasts between 1 and 4 years, depending on the number of orders in the order book. Orders are assumed on the basis of assessment of future demand.

From the viewpoint of the shipbuilding industry, the type of ship which is being built is important because ups and downs in the deliveries of specific ships have an impact on their market odds.

According to the data of the Shipping Statistics and Market Review (ISL, 2014), the world order book grew at the beginning of 2014 by 13.4% compared to the year before and it reached 93 mil cgt (274 mil dwt). The ratio of 'tonnage' under construction and tonnage being serviced is 17.1% with bulk carriers – 36.7%, tankers – 31.6% and container ships – 20.7%.

As in the last decade, South Korea, China and Japan with 88% still dominate the world shipbuilding industry (ISL, 2014: 116). Korea leads in the construction of tankers and container ships, while Japan turned to the construction of bulk ships. Almost 2/3 of the current world order book (in terms of cgt) refers to these two countries.

4.4. Shipbreaking and operative losses

The merchant fleet growth rate depends on the balance between deliveries of new ships and deletion of fleet in the form of ships which are sent for breaking or lost at sea.

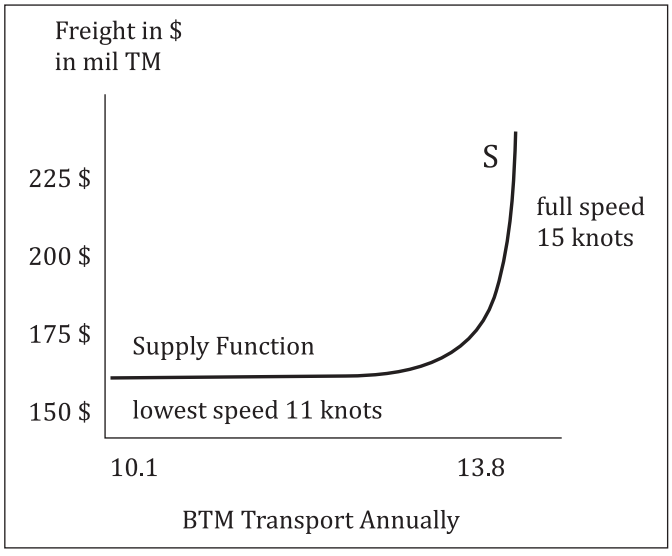
The shipbreaking has a significant role in removing ships from the market, explaining or predicting when the ship really will be sent to a breaking yard. It is also a complex issue and it causes disturbances in assessment of the development of ship's capacities. The reason for this is that sending ships to breaking yards depends on the balance of a large number factors which can have influence in many different ways, those being (Stopford, 2009: 137) years, technical obsolescence, breaking prices, fast earning and market expectations. **Years** are the primary factor which determines the tonnage of the ship sent for breaking. The ships deteriorate as they get older and the costs of routine repairs and maintenance increase. Therefore, owners of old ships face a combination of high costs and spend more time in planned or unplanned maintenance. Since physical deterioration is a process, there are no specific years when the ship is given for breaking. **Technical obsolescence** can regulate the years when a specific type of ship will be sent for breaking because it had been replaced with a more efficient type of ship. The decision on sending a ship for breaking is also influenced by **breaking prices** which widely fluctuate, depending on the supply and demand. A period of intensive shipbreaking can reduce the prices of cut metal so it is important to emphasise that shipbreaking is a business decision which depends on owners' expectations of the future operative profitability of the ship and its **financial position** (Stopford, 2009: 138). If during a recession the shipowner thinks that there is a chance of expansion on the freight market in the near future, it is unlikely he will sell the non-profitable ships to breaking yards because the possible earnings during expansion are high enough to justify operative losses for the period before that time.

According to the data (ISL, 2014) on shipbreaking in the period between January and December 2013, 44,73 mil. dwt (ships ≥ 300 gt) have been demolished: tankers – 13,6 mil. dwt (30,4%), bulk ships – 21,38 mil. dwt (47.8%), container ships – 6,08 mil dwt (13.6%), general cargo ships – 3,57 mil dwt (8.0 %) and passenger ships 0,08 mil. dwt (0.2 %).

5. The level of freights on the maritime shipping market

Freights are the last regulator the market uses to motivate decision-makers to adjust their capacities in short-term conditions and to find ways to reduce their costs in the long term. Freight is shipowner's fee for rendered maritime transport service and in maritime transport it is always determined in connection to the structure of the shipping market as well as the supply and demand relationship on that market (Glavan, 1992: 130).

The third part of the shipping market model refers to the **freight market** which connects supply and demand (Stopford, 2009: 139). The way in which it functions is perfectly simple. Shipowners and shippers negotiate to determine the level freights which reflect the balance of ships and cargo available on the market. In case there are too many ships, the freight will be low and vice versa. Once the level of freight has been established, the shipowners and shippers adjust to it and that eventually leads to the equilibrium in the relationship between the supply and demand. To analyse this process, we use three key economic concepts: *supply function, demand function* and *equilibrium price* (Stopford, 2009: 139).



Graph 1 Supply function

Source: Stopford, M.: Maritime economics, Rutledge, Tavlor&Francis group, 2009, pg. 140.

The supply function for an individual ship is shown in graph 1. The curve is round and it shows the amount of transport the owner supplied on each level of freight. In this case it is a VLCC (very large crude carrier) of 280 000 dwt. When the freight level is under 155 $ for mtm i.e. when the freight is low, the owner decommissions the ship, not offering transport. As freights grow to over 155 $ per mtm, the ship is commissioned again and in order to save fuel, it sails at the lowest possible speed of 11 knots/hour. At higher freight levels it will speed up to approximately 220 $ per mtm; the ship then sails at full speed of 15 knots and it provides 13.8 btm of maritime transport annually, which is a lot for just one ship.

The economic theory helps us determine the supply curve. The market supply is completely competitive; the shipowner maximizes the profit by making the ship sail at marginal cost speed (cost that provides additional ton-miles of transport) that equalizes the freights. The relation between speed and freight can be defined as (Stopford, 2009: 139):

$$S = \sqrt{[R/(3 \cdot p \cdot k \cdot d)]}$$

whereas:

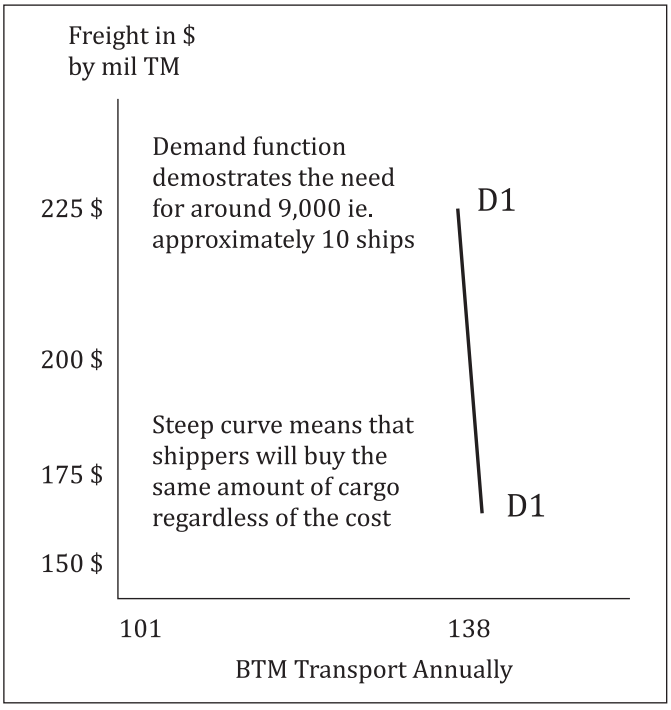
R – freight amount
S – optimal speed in miles/day
p – freight level at journey
k – constant of ship fuel
d – distance

This formula defines the shape of the supply curve. The optimal speed depends on the price of fuel and the readiness of the ship for longer journeys.

In reality the supply function is more complex than simple relations between speed and freight. The speed is not just the way the supply answers to freights. The owner can use the advantage of low freights to decommission his ship or conclude a short-term storage contract.

The falling flow of the short-term supply curve depends on three factors which determine the savings in the costs of marginal ships; the first one is that old ships generally have higher operative costs so the saving point will be at a higher level of freight; the second one is that larger ships have lower transport costs per ton of cargo than smaller ships, so if both smaller and larger ships compete for the same cargo, the larger ship will have a lower saving point and would generally push smaller ships into decommission during a recession (Stopford, 2009: 141). The third factor which considers the relationship between speed and freight has been explained.

The demand function demonstrates how charterers adjust to the changes in price. The demand curve is almost vertical. This is mainly an assumption, but there are several reasons why this shape is similar for all bulk cargos. The most convincing reason is the lack of any transport method. The shippers need the cargo even when they have the time to conclude alternative contracts, they have a need for ship regardless of the cost. Contrary to that, low prices will not lure the shippers to buy another ship.



Graph 2 Demand function

Source: Stopford, M.: Maritime economics, Rutledge, Tavlor&Francis group, 2009.

Equilibrium and the importance of time. The supply and demand curves meet at the equilibrium price. At that price the buyers and sellers found a common acceptable price and at that price the buyers are ready to buy a certain number of ships, and the owners are ready to have a certain number of ships available. The balance is made. In the real world the price at which the buyers and sellers are willing to trade depends on the amount of time they have to adjust their positions on the market. On the basis of that there are three time periods that need to be considered (Stopford, 2009: 142): present or current equilibrium, short-term equilibrium and long-term equilibrium.

The present equilibrium describes the levels of freight contracted for "urgent" ships and cargos, which results in temporary ups and downs. This is an owner's market which constantly tries to anticipate the choice of the next cargo or decide whether to risk a journey in ballast for a better loading point. Two sides negotiate to find a price at which the supply meets the demand.

The short-term equilibrium means that in the short term there is more time for owners and charterers to respond to the changes in freight by commissioning or decommissioning ships. At **short-term supply** the state of the market looks approximately like this. When the less effective ships are in decommission, the supply is very low, but as ships slowly return to operations the supply grows. In case the fleet is sailing at a maximal speed and is completely at sea, the freights increase and can lure out the several remaining ships. In the end there is no more available maritime transport until new ships are delivered. In the case of **short-term demand** it is easier to see how the

freights are determined. The market stays at a freight at which the supply is equalized with the demand. When the demand is low the freight stabilises. A significant increase of the demand will increase the freight too, probably because the ships are commissioned again in order to meet the increased demand. A slightly smaller increase of demand is enough to triple the limit of freights because now the market price is determined by the oldest and less effective ships which request high freights to be lured into service. In the end, without the available ships the charterers fight each other for available capacities depending on how much they need transport. The prices can then grow to any limit. However, this is not an appropriate situation because the shippers seek less expensive supply sources, and high freights almost always attract "insane" investments from owners and shippers.

At the *long-term equilibrium*, the ship fleet can adjust by ordering new ships and breaking old ships. The long-term condition of adjustment mechanism balances the supply and demand through three types of markets: the sale and purchase market, the newbuilding market and the demolition market.

6. Conclusion

Questions like what determines the freight on the shipping markets or how are the average profits going to be spent or will the average be enough to pay off the new ship are of great importance to all investors who reasonably want to know what to expect in long-term conditions, taking one cycle after another. Precisely for these reasons it is important to understand the complete state of the maritime shipping market as well as the state of the world economy in general, because success in this game of maritime cycles demands nothing else but life experience in the maritime industry, understanding of connections between the world economy and politics and a sharp eye for conclusion of favourable contracts.

The fact is that the whole world and the overall world trade, in maritime and in other sectors, spins around the supply and demand and prices on the market. Precisely for this reason it is important to understand their interconnection and other internal and external factors which influence the conditions on every market, including the shipping market. Therefore the aim of this paper is to indicate the importance of these very influential factors.

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This article is a result of a research performed by a postgraduate student on the MoS (Motorways of the Sea) project within the obligations of a doctoral study, Subject C – "Research project".