NATIONAL TECHNICAL UNIVERSITY OF ATHENS

School of Naval Architecture and Marine Engineering

Laboratory for Maritime Transport

DIPLOMA THESIS

"Analysis and Comparison of Shipping Companies' Valuation Methods"

Konstantinos Katsimpardis

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Abstract

The aim of this diploma thesis is to examine the effectiveness of various valuation methods when they are applied to public-traded shipping companies, to present their strengths and their flews and discuss different behavior aspects that each method might show. In particular, the3 methods are examined on the way they behave when applied into companies that operate on the most volatile markets of maritime, the wet market and the dry market. These two markets saw significant growth the last 15 years due to the extensive growth in international trade and the emerging national economies that developed lately. In contrast to other markets where the access is considered difficult the access to wet and dry market is relatively easy, which has allowed many "players" to give it a try and take a piece of the market. Going public has really been a blessing for shipping companies as it offers them the opportunity to access cheap funding, they are, however, under surveillance by investors and creditors as they compete against other companies. Evaluation methods are used by investors and creditors to monitor companies' performance and financial health, but the diversity of the market prohibits the existence of reliable results and, furthermore, due to the volatile environment, they cannot be sure about future performances and results. The main objective of our research has been the use of valuation methods on shipping companies and then the comparison of the results obtained with the view that public companies have on these companies for the same period.

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CHAPTER 1

INTRODUCTION

1.1 Intro to basic valuation methods

As business world has expanded significantly the last 30 years, new methods of valuation have been created in order to closely observe and evaluate businesses from different scopes. Starting from mid 40s, managers, investors, creditors and other financial markets participants have created numerous methods to observe the performance of a company. As the years went by, economists and analysts enriched the traditional models with new concepts and ideas about the techniques that can determine a fair value for a company or indicate if a performance has been efficient or not. The majority of the models represented special versions of the traditional method of Net Present Value (NPV) as from the beginning it was considered the best method at depicting the cash flow that could be generated by a company.

Of course, the structure of each valuation method that was invented was different, but it could be modified depending on the special conditions that are met in each case. For example, a model that gives reliable results for manufacturing industry might not behave well it is used for evaluating service companies. This phenomenon has to do with different cash flows that companies from different business areas have as well as different nature of operations. In our research, for example, we evaluate companies that operate in the shipping market which is characterized by many fluctuations in the freight rates and, as a result, in the income that companies report each year. Another issue has to do with the nature of operations and time that a project demands in order to return revenues. In some industries an investment made by a company might produce cash flows in a relatively shorter period of time than it might happen in another industry. An information technology company, for instance, can generate cash flows from an investment faster than a maritime or an oil & gas company. That happens because the former company can invest in a project

or innovation that can generate multiple cash flows when it goes out on the market. On the other hand, a shipping or an oil & gas company has to invest a huge amount of money in a project, such as a newbuilding project or an oil rig, there will be, however, a much longer period of time before the project generate revenues, and even then there will be need for more time before the investment becomes profitable, because the initial amount invested as well as the operating costs are significantly higher while the revenues fluctuate according to the demand and the supply in the market.

Last but not least, it is important to point out that each company, even those of the same industry, operates under different legislation, which might affects some operation and regular cash flows such as interest taxes. That depends on the legislation of the country that the company has been incorporated in. Since many companies are multinational and have operational sectors in more than one countries, it is important to estimate the potential cash flows according to the country of operation, which makes the overall method of calculation more complicated as many more parameters must be taken into consideration.

The aforementioned has led to many different valuation techniques each of which has numerous adjustments for different cases. Of course, more methods were created that are not based the idea of discounted cash flow because it came a time when it became obvious that investors should not rely only on the expected cash flows but on the overall financial position of the firm. For instance, when companies with very different balance sheets generate similar cash flows, one firm is more efficient if it has lower value of assets or lower outstanding debt. For this reason methods such as “comparables approach”, which considers more measures and features of a company than a simple DCF valuation.

At a point the use of many valuation models serves no purpose in the whole process. That has been argued by many economists and professionals. For this reason, after the rapid expansion of the valuation techniques, many economists claimed that “a good valuation model is simple and helps the investors to make informed decisions” (Viebig, “Equity Valuation”, Wiley Finance Series). A good model has to be simple, with some adjustments where required but also with simplifying assumptions that would enable the analyst to focus on specific valuating aspects and neglect other aspects. Different industries, different macroeconomic estimations, different growth rates among markets and companies, public

and private companies create a complicated environment that demands such adjustments and simplifications where and when it is possible.

1.2 Equity Markets and Valuation methods

Capital Markets played a key role in the expansion of the business world as they became the ultimate help for businesses to find what they want more, funding. New companies, or even established companies that want to expand their operations or to make some additional investments, managed to find funding in equity markets with lower cost than they would find from other sources. Of course, equity markets offer not only favorable terms but there are always some additional regulations that all listed companies have to comply with. The most important of them is, of course, the exchange of part of ownership of the company for an amount of money. Companies raise money from equity markets in two ways. The first one is the initial public offering (IPO) that occurs when a company is going public and is listed in an equity market for the first time and the second is a second issuance of new shares. Of course, the existence of these markets raised significantly the competition between the companies that are already publicly-traded and those that would like go public. This phenomenon led to invention of new valuation methods that are structured in such way that they consider the fact that these companies are public and therefore have many owner-investors who can easily change their positions and invest in other companies compete with other public companies as well as the fact that these companies compete with each other.

When reaching a point when valuation analysts have to choose one method to use, they usually decide among 6 main groups (Fernandez, 2007):

- Balance sheet-based methods
- Income-statement-based methods\
- Mixed methods
- Cash flow discounting-based methods
- Value creation methods

- Option methods

The 5 first categories have become the more popular during the last years, because they are easier to be implemented and they usually return results that have been proven to reliable. Although nowadays there have been created numerous complicated and detailed methods that entail many different features of a company, discounted cash flow methods and similar methods that are based on them are still the most popular .

The squeeze in the exchanges has contributed to another phenomenon, too. The competition among companies, public and private, has become tougher. As a result, the companies has to be very efficient in order to avoid bankruptcy. Many companies cannot compete with other companies that operate in the same business area and get financially distressed before file for bankruptcy sometimes. Companies going bankrupt is not necessarily a bad thing it should not be considered as one. It is rather a form of our legal system, that protects companies and, in case of public-traded companies, allows new companies, which are in better financial situation, to take their place. In this way, growth is boosted in the industry as the new company will have the necessary funds to invest more and produce more. For this situation there was a new category of valuation of methods created. This was the category of models whose purpose is not to estimate a fair value but to predict, if possible, which companies would be financially distressed the following years according to the balance sheet and the income statement observed at the time. These models' main purpose is to rank the companies studied according to data provided within the balance sheet and the income statement. The most popular model of this kind has been the Z – Score model that was created and published in 1968 by Edward I. Altman, a Professor of Finance at New York University. Even this model, however, in its original version, was suitable for a particular business area. In order to use it in other business areas or for other type of companies (public or private) some adjustments are necessary.

1.3 Scope of the diploma thesis

This project aims at analyzing 3 methods of valuation that were used to evaluate the performance of public shipping companies during periods of collapse in the markets. In this way, we try to find out how the methods we chose behave in situations of high fluctuations in the market and if the companies with positive valuation before the collapse can sustain the positive results even after the collapse of freight rates. The three valuations methods that we chose to use are not very popular. We chose these methods because we thought that it would be more interesting to implement some non-traditional methods of valuation in public shipping companies than implementing the traditional methods. The three methods that we implemented are:

- Economic Value Added (EVA)
- Altman Z – score
- Data Envelopment Analysis (DEA)

In the 2nd chapter there is a brief description of the companies we chose for our research and of the shipping markets. The 3rd, 4th and 5th chapter provide extensive description of the 3 valuation methods we used, EVA, Z – score and DEA respectively, while in the 6th chapter there is extensive presentation of the results obtained as well as brief statistical analysis where it is essential. At the end of the 6th chapter, there is a brief review on the methods used according to the results generated by each method. Finally, the 7th chapter summarizes the conclusions of the diploma thesis and suggest potential research ideas for the future.

CHAPTER 2

THESIS BACKGROUND

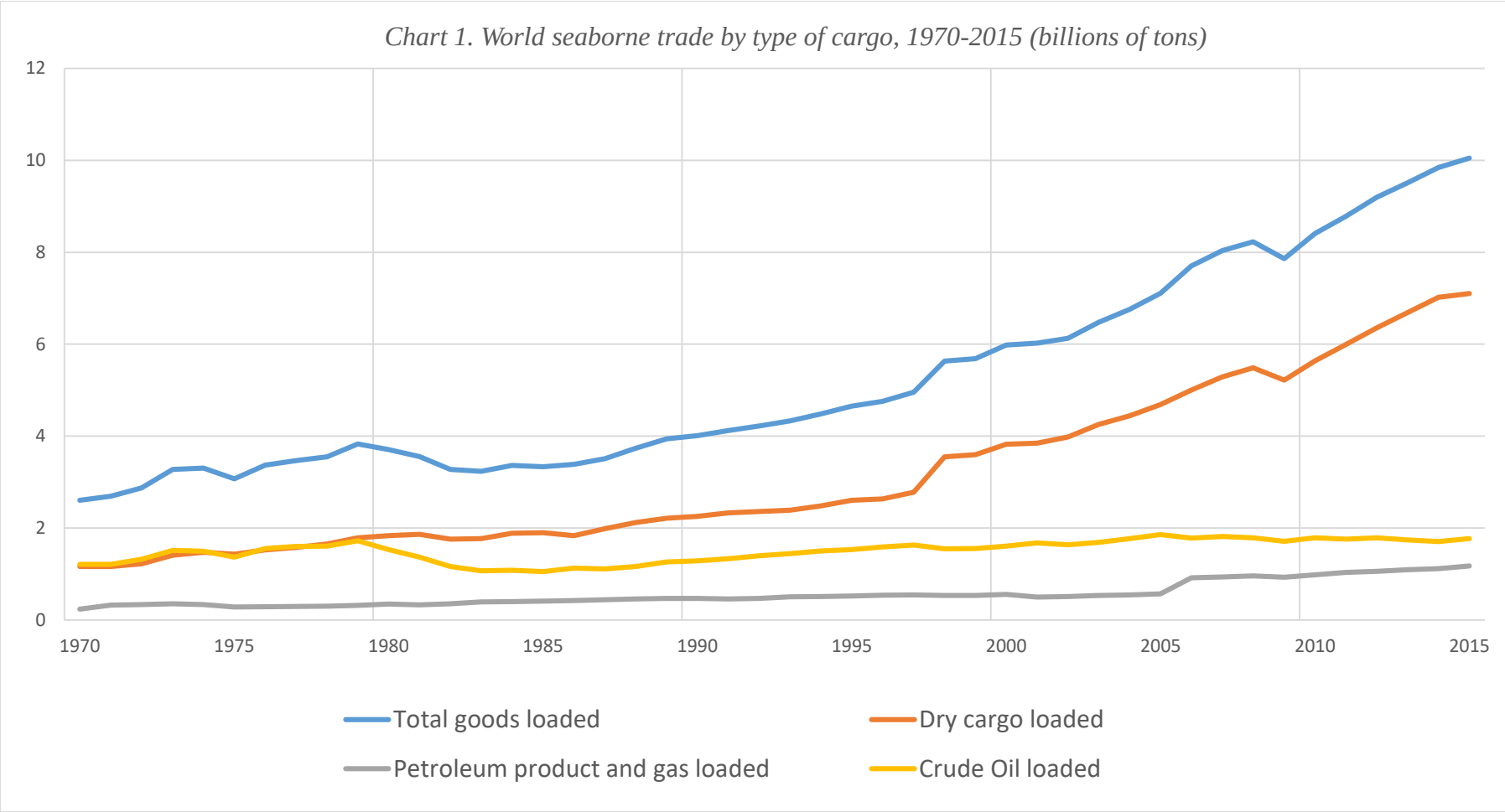
2.1 Intro to Shipping Industry

Shipping is a global industry with prospects closely tied to international trade activity and subsequently to the economic activity around the world. The reason maritime is closely related to international trade is mainly the fact that it is the most cost-effective mean of transporting large volumes of basic commodities and finished products. Considering the long distances and the amount of products transported, shipping industry can offer the cheapest transportation per ton transported since any other mean of transportation would demand much more time for long distances as well as the cost would be prohibiting. Moreover, during the last 30 years due to growth of the global economy and globalization, the international trade saw unprecedented growth. This growth, of course, resulted in a new modern "shipping environment" which was more dynamic and competitive than ever before.

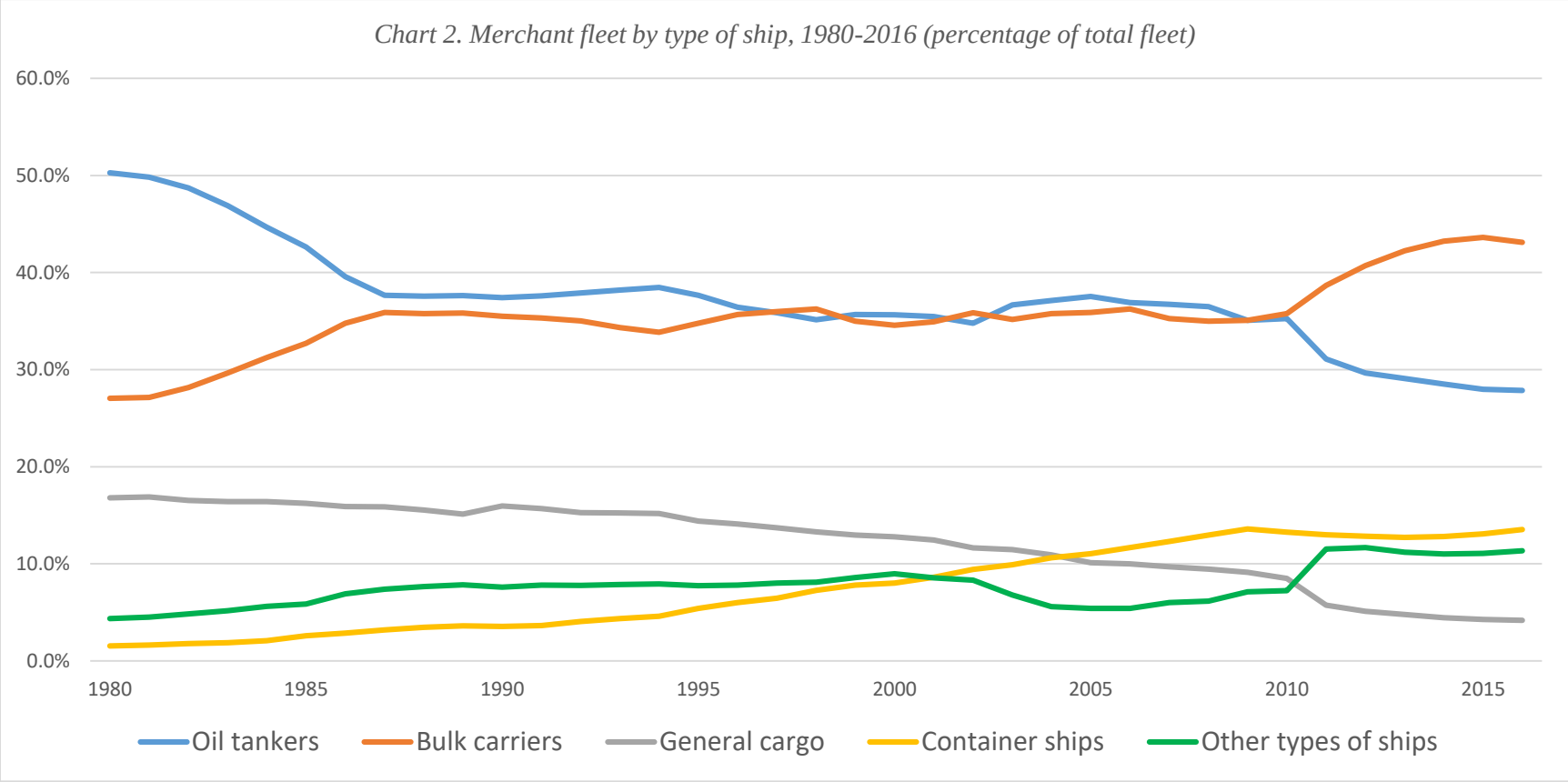
The substantial economic growth led to substantial changes in the shipping market such as enormous increase in freight rates, which made clear that market began to take a new form as more and more companies appeared to operate in this business area and investments saw a boost as well. The increased demand for transportation capacity led to more and bigger ships, while the accidents that took place rose the awareness for safety leading to new regulations that demanded improved technologies and operational practices, which most of times increase the operational expenditures.

The next three charts illustrate clearly how the world trade rose significantly after 1990 and how the size of the world fleet adjusted to the new requirements. All the data was found in the official site of United Nations Conference on Trade and Development (http://unctadstat.unctad.org/) and in the relevant reports provided in this site.

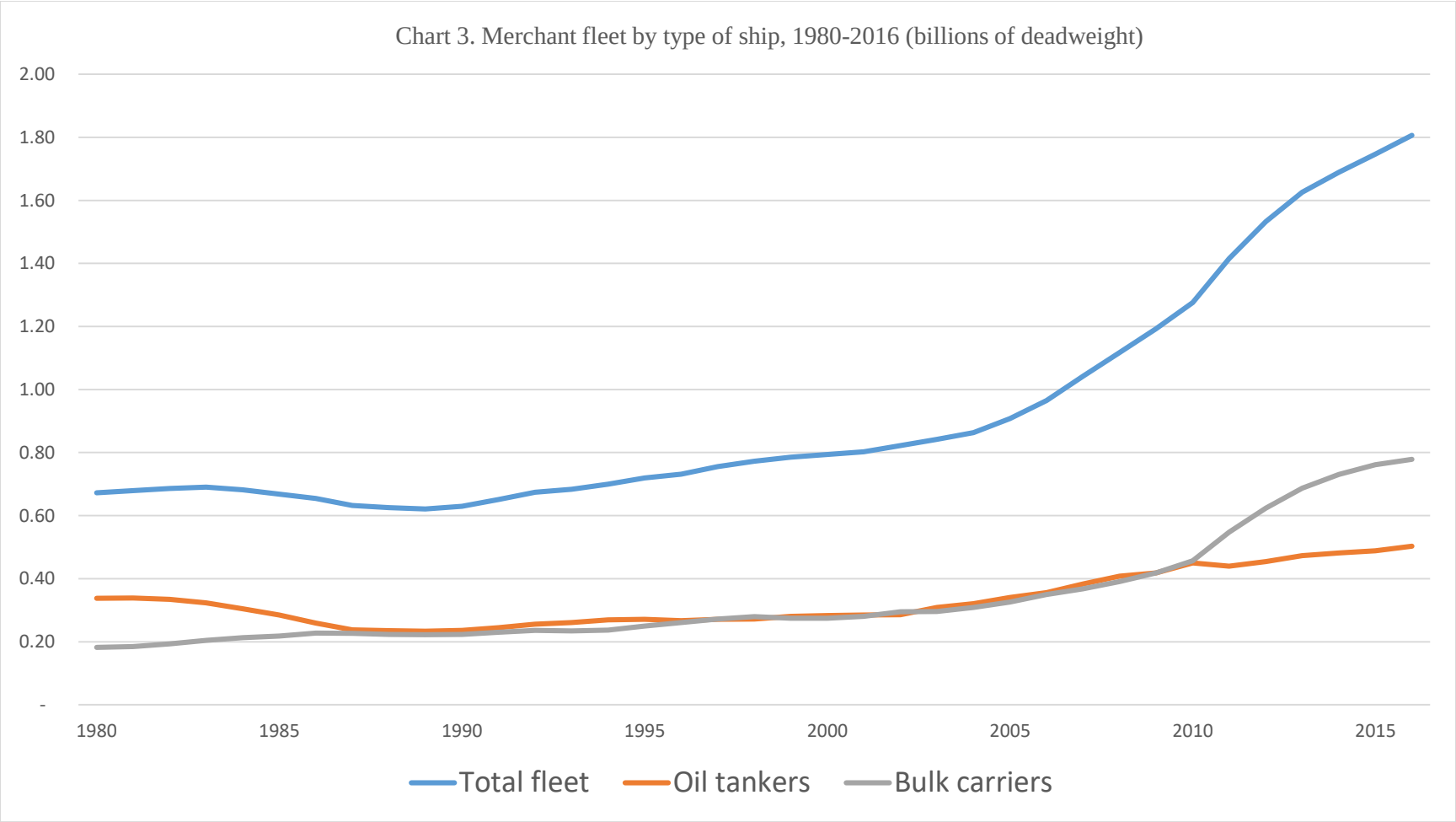
Chart 1. World seaborne trade by type of cargo, 1970-2015 (billions of tons)



Source: UNCTAD, unctadstat.unctad.org



Source: UNCTAD, unctadstat.unctad.org



Source: UNCTAD, unctadstat.unctad.org

The first chart illustrates how the global economic growth contributed to a substantial increase in the seaborne trade after the 80's. In more detail, the seaborne trade saw an unprecedented growth after the early 90's as it jumped from nearly 4 billion tons per year to 6 billion tons in 2000 and it surpassed the 10 billion tons in 2015. As it is obvious the most significant reason for this rise is the increase in dry cargo transported. On the other hand, crude oil and the petroleum products increased slightly during this period.

Chart 2 depicts how the dry cargo trade dominated and change the scene in maritime business. While in 1980 the bulk carriers fleet accounted for less than 30% of the world fleet and the tankers for almost 50%, the following years the scene changed significantly and they both had a percentage of about 45% for many years, until 2010, when the demolition of a considerable number of tankers and the delivery of many bulk carriers contributed to a new scene in the global shipping business. Specifically, the bulk carrier's share reached 43% in 2015 while the share of tankers the same year fell under 30%. Of course, an impressive increase of its share saw the containership fleet, as it jumped from 2% in 1980 to almost 14% in 2015.

In this project we try to explore the two biggest sectors of global shipping. That is the dry bulk market and the oil market. Chart 3 illustrates the rise in the total fleet the last 35 years as well as the increase in the deadweight of dry bulk carriers and of oil tankers, maybe the most competitive sectors of global shipping right now. The phenomenon of "overcapacity" led to extreme fluctuations in the shipping freight rates in all three basic sectors of maritime, but the wet and the dry bulk market were affected the most.

2.2 Shipping companies and equity markets

The number of shipping companies that operate in the areas of tankers and bulk carriers increased significantly and as a result the number of ships saw a substantial growth as well. Of course, this growth demanded more funding by different sources. While the number of companies that had gone public until then was limited, after 2000 more shipping companies went public in an effort to borrow money at low cost and fund their projects. This trend continued until the global crisis of 2008, when there was a slowdown as indexes that

capture the freight rates fell significantly during this year. The majority of the new comers in the stock exchange during that period were companies that operate in in dry and wet market as it is much easier to break into these markets than to break into the containership market. The next table summarizes all the shipping companies that executed an IPO (initial public offering) from 2006 to 2011.

Year	Company	Year	Company
2006	Aegean Marine Petreleum Network	2008	Brittania Bulk
	Chemoil Energy Limited		SafeBulkers
	Danaos Corporation	2009	-
	Eitzen Chemical ASA	2010	Baltic Trading
	Goldenport Holdings		Costamare
	Omega Navigation		Crude Carriers
	Pacific Shipping Trust		Navios Maritime Acquisition
	Teekay Offshore Partners		Scorpio Tankers
	Ultrapetrol	2011	Box Ships
2007	Capital Product Partners		Diana Containerships
	D'Amico International Shipping		Golar LNG Partners
	Dockwise		Hoegh LNG Holdings
	First Ship Lease		SinOceanic Shipping
	Gulf Navigation		
	Globus Maritime		
	Hellenic Carriers		
	Mercator Lines		
	Navios Maritime Partners		
	Nordic Tankers		
	OceanFreight		
	OSG Americas		
	Paragon Shipping		
	Rickmers Maritime		
	Sinotrans Shipping		
	StarBulk		
	Teekay Tankers		

Table 1. List of companies that filed for IPO from 2006 to 2011

Source: MarineMoney Publication, Volume 28, Number 4

It is obvious that before the global crisis of 2008 it was much easier to persuade investors to put money on shipping companies and take advantage of the returns that industry reported until then. After the crisis, however, the low freight rates and the high operational costs did not offer opportunities for profit.

In particular, as the next table illustrates, shipping stocks appeared to be extremely volatile after 2007, which was undesirable at the time for the markets, as around the world the investors wanted stability until they could bounce back from the global crisis of 2008. The next table shows the mean return of the industry to the shareholders for those years.

Mean Total Return to Shareholders	
2006	19%
2007	52%
2008	-55%
2009	33%
2010	10%
2011	-34%

Table 2. Mean Total Return to Shareholders for Shipping Industry

Source: Marine Money Publication, Volume 28, Number 4

In addition to the data reported in the previous table, another interesting info that demonstrates the same point is the impairment charges that were reported from the companies for fiscal year of 2011. According to the Magazine Marine Money Volume 28, for year 2011 the impairment charges reached a new record of 3.2 billion, which may not affect the cash flows but it is significant hit in the total book value. Impairment is an accounting principle that describes a permanent reduction in the value of a company's asset, usually a fixed asset. According to GAAP, an asset of a company is to be impaired when its fair value falls below the book value. In this way, however, the ratios that include balance sheet's data change dramatically and the financial picture of the company can be affected as well in a short period.

Of course, the markets we study in this project have been the most volatile, since the markets of the rest ships, those of containerships and gas carriers, did not experience such big fluctuations, as their financial results and the prices of their stocks show.

2.3 Diploma Thesis Description

As has been explained in the introduction, the scope of this project is to examine how valuation methods behave when applied in public shipping companies. We chose to focus on periods when the markets have taken a slump and shipping companies need to optimize their operations in order to maintain a decent performance.

The first step of the research entailed the choice of periods we should consider during our valuation. We used the most popular indexes that professionals observe in order to make their estimations or to take the decisions. Of course, since we study two different markets we had to observe different type of indexes for each.

For the tanker market we consider two indexes:

- Baltic Dirty Tanker Index (BDTI), which refers to tankers carrying crude oil. The BDTI is comprised of 12 major tanker routes and it is expressed in Worldscale rates.
- Baltic Clean Tanker Index (BCTI), which refers to tankers carrying refined products. This index is made up of six routes and it is also quoted in Worldscale rates.

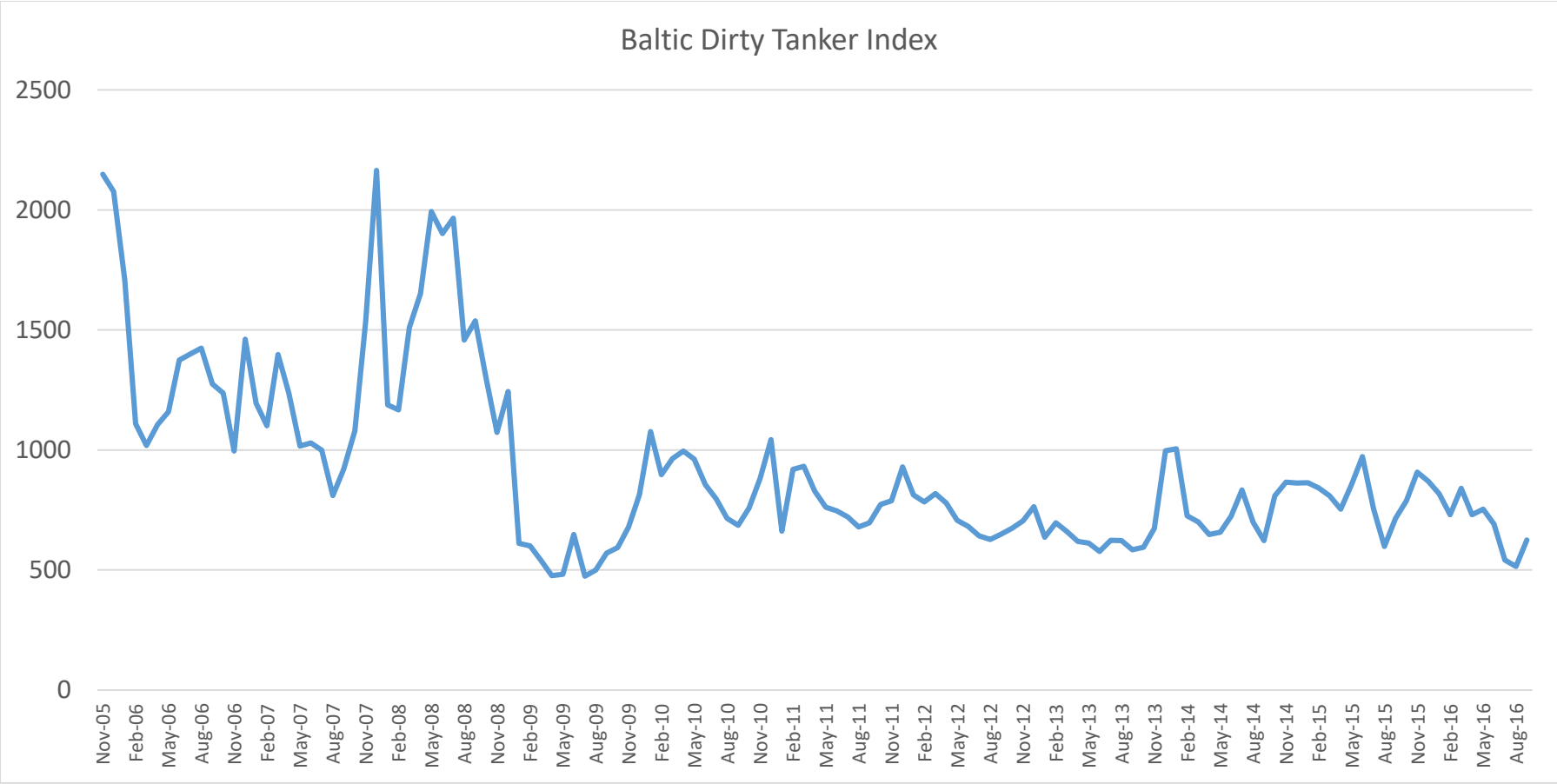
Shipowners have to decide whether they will put their tankers in clean market or in the dirty market depending on the revenues they expect they will produce. The two indexes do not necessarily move in the same direction the same time as the supply and the demand may be distorted because it is a common practice that speculators charterers of the market use storage tanks when price of oil is low, so that the charter freight rate go up even if the price oil has fallen. In a highly competitive market, where many speculators around the world follow such practices, it is logical that many distortions are created and the decision-making process for the shipowners becomes extremely complicated.

For the dry bulk market, there are more indexes as the Baltic Exchange has created one for each type of bulk carrier and some indexes specialized in some particular areas. The indexes that we considered are:

- Baltic Dry Index (BDI), which is a daily average of prices to ship raw materials. It represents the cost paid by an end customer to have a shipping company transport raw materials across seas on the Baltic Exchange. It follows 22 different routes around the world for various materials. This is the main index that use as components all the other indexes that the Baltic Exchange has created and calculates daily.
- Baltic Capesize Index (BCI)
- Baltic Panamax Index (BPI)
- Baltic Supramax Index (BSI)

During our project we reached the conclusion that it would be useless to observe all the indexes of dry bulk market since, after research, we saw that they move similarly. So, as far as the dry market is concerned, we used only the Baltic Dry Index. A similar phenomenon was noticed at the wet market as well. The ups and downs took place during same periods.

The next 3 charts illustrate the 3 indexes that we used during the research:


Baltic Dirty Tanker Index
2500
2000
1500
1000
500
0
Nov-05
Feb-06
May-06
Aug-06
Nov-06
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May-07
Aug-07
Nov-07
Feb-08
May-08
Aug-08
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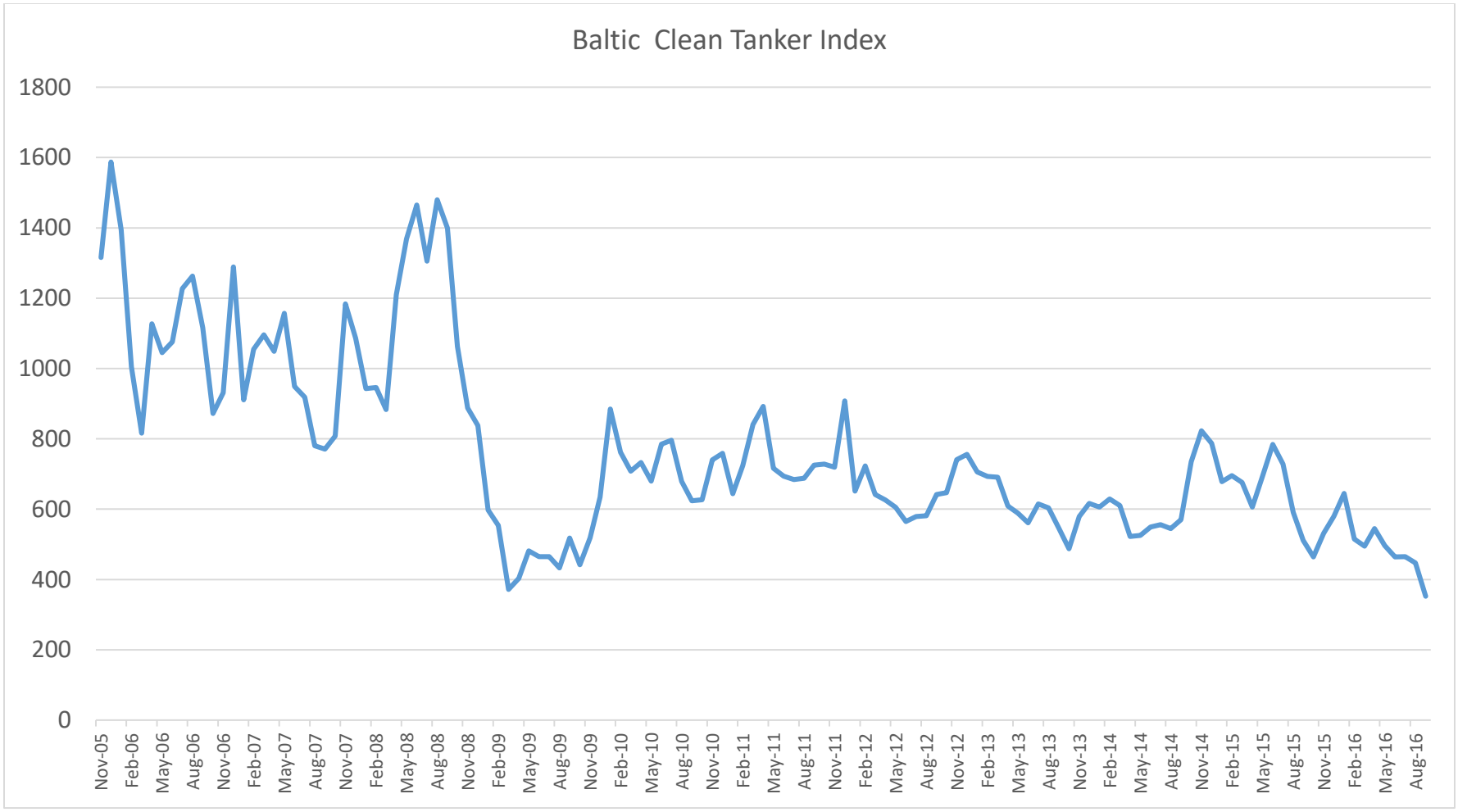
Baltic Clean Tanker Index
1800
1600
1400
1200
1000
800
600
400
200
0
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Aug-07
Nov-07
Feb-08
May-08
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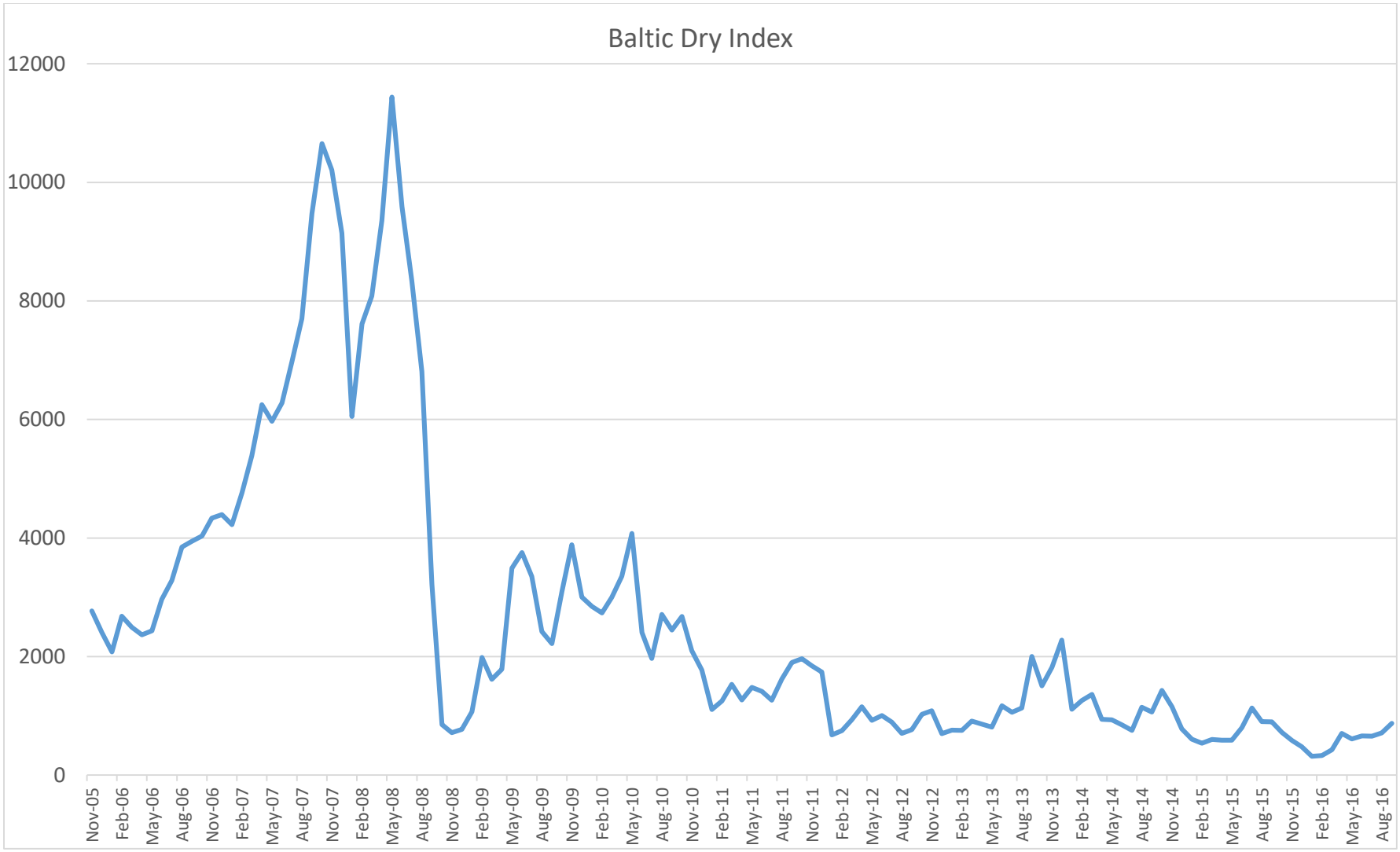
Baltic Dry Index
12000
10000
8000
6000
4000
2000
0
Nov-05
Feb-06
May-06
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May-07
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May-16
Aug-16

For each one of the above indexes we followed similar procedure in order to determine the most "interesting" for our research periods. Firstly, we determined a 10-year period as a sample. After considering the number of public companies for each period and the quality of data we could obtain from them we decided that the best choice would the period from 2006 to 2015, as we already knew that the market during these years saw significant falls and the majority of the companies and, as a result, the industry struggled. Secondly, we had to determine which years would be under focus during our research. For this step we used data obtained the site *investing.com*. Having recorded every value of each index for the last day of each month, we tried to observe the fluctuations from month to month. Considering the fact we were going to study each company for each fiscal year we, we decided that it would be more useful to find the average price for each fiscal year and then observe the fluctuations, because the fluctuations in the period of a month are relatively low and it may not be indicative of the time charter contracts that a company has achieved to sign. To be more specific, since a company has a relatively small number of ships compared to the days of reported index scores, it does not make sense to record every daily value, because the contracts would have a fixed price according to the index price at the day of the memorandum of agreement (MOA). So the average index price for each year can be indicative of the level of freight rates that a company has agreed on during a fiscal year. Eventually, the measure we chose as indicative for the level of freight rates is the fluctuation of the average price from year to year.

INDEX	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BDTI	1272.42	1206.92	1498.83	582.42	885.92	800.5	720.33	658.17	762.67	810.58
	-	-5.15%	24.19%	-61.14%	52.11%	-9.64%	-10.01%	-8.63%	15.88%	6.28%
BCTI	1096.75	980.33	1149	490.33	731.5	746.92	646.5	608	621.42	628.16
	-	-10.61%	17.21%	-57.33%	49.19%	2.11%	-13.44%	-5.96%	2.21%	1.08%
BDI	3239.25	7252.25	6069.833	2641.167	2674.833	1531.75	885.25	1255.75	1065.417	703.9167
	-	123.89%	-16.30%	-56.49%	1.27%	-42.73%	-42.21%	41.85%	-15.16%	-33.93%

Table 3. Indexes' fluctuations from 2006-2015

The second step of the research had to do with the choice of the companies that would be included in the sample of research. As explained previously, there was at the time an overwhelming number of public shipping companies that we could choose of in order to make up our sample. There were, however, some issues during the process of picking up the companies that would suit in our research process. The first one had to do with the quantity and the quality of the data that we would use. In order to obtain enough data for our research, we had to choose public companies that went public in 2006 or sooner, because the rest of the companies would not have published reports for the years under research. So automatically, we excluded companies that went public after 2010. The second issue has to do with the nature of the operations of each public company. When we started to examine carefully potential companies for our study we found out that many companies had not only strictly shipping operations but they would have other operations such as operating tugboats, providing technical consultancy, owning and operating fleet of airplanes etc. In other cases the company under examination would operate in shipping industry but in more than one market. The problem with such cases is that the revenues reported come from multiple markets and, as a result, a fall in one market would not be depicted in the revenues in the right way, as the revenues could stay stable if the other market goes up. In addition, the management teams in such companies can change their strategy in time and adjust their fleet and the operations so that the revenues of the company are not affected significantly. This situation led us to choose companies that operate in one market and have not expanded in more markets. In some cases the fleet contained a small number of ships of another market but we did not consider that this would be a problem as the higher percentage of the revenues would come from the market that the company has been categorized under.

Unfortunately, we could not find many companies that would operate exclusively in one market and would have executed an IPO before 2006, so in order to create a suitable sample of companies, we consider companies that went public after 2006 as well.

The companies that we selected after the examination are:

Wet Market

- Navios Maritime Acquisition
- Capital Product Tankers
- DHT Holdings
- Nordic American Tankers
- Scorpio Tankers
- Tsakos Energy Navigation
- Frontline ltd
- Teekay Tankers
- Concordia Maritime
- Torm
- First Ship Lease

Dry Bulk Market

- Safebulkers
- Diana Shipping
- CMB
- Eagle Bulk
- Malaysian Bulk Carriers BHD
- Genco Shipping
- Starbulk
- Navios Maritime Holdings
- Dryships
- Seanergy
- Pacific Basin

CHAPTER 3

ECONOMIC VALUE ADDED (EVA)

3.1 Early valuation methods and EVA

In the corporate finance realm, there have been invented many valuation techniques and measures, each of them considering different data of a balance sheet or income statement. The majority of the early valuation models relied on multiples comparison or absolute number comparison, as the limited choices in the market did not help the development of new methods. However, the vast enlargement of the public markets and the increase of the balance sheet and income statement data led to adoption of new valuation models or the adaptation of the existed models. More companies meant automatically more data to be observed and analyzed as well as motivation for new concepts that would give the investors the capability to closely observe the businesses and make detailed comparisons before reaching the decision-making stage.

The first adaptation in the models was the import of new measures of cash flow (EBITDA) and the adoption new concepts such as Net Asset Value (NAV) and Discounted Cash Flow (DCF). According to Rappaport (1986) within a business, there are seven drives that can lead to an increase in shareholder value. These are sales growth rate, operating profit margin , income tax rate , working capital investment, fixed capita; investment, cost of capital and forecast duration. Instead of measuring each driver, new value-based performance measures have been created and implemented on similar companies either private or public. These methods recognize the residual value created by the company for a specific period of time while they also make a charge for the capital employed by the company as it is not free. The most widely-used methods are Shareholder Value Added (SVA), Economic Value Added (EVA®), Market Value Added (MVA), Economic Profit (EP), Cash Flow Return on Investment (CFROI) and Cash Value Added (CVA).

During the last decade there have been conducted numerous studies about modern value-based valuation methods and the right use of them. The reported results have been mixed and controversial (Maditimos, 2006). The last decade, however, increased use of cash flow valuations, such as EVA, has been implemented by many investors or financial institutions and consultants.

3.2 What is EVA?

According to Gunther Fried (2008) EVA is a practical refinement of economists' concept of residual income. In other words it measures the value remaining within a company after the stockholders and all the providers of capital have been compensated. Unlike "multiples comparison" methods, EVA is a performance measure for a time period, that range from a quarter or an annum, common practice in evaluating shipping companies, while sometimes it can be used in evaluating a fixed period of an investment or project.

EVA was invented by Stern Stewart & Co [1], a global consulting firm in 1989 (Fraker, 2006). It is based on the idea that a company creates economic profit (residual income) when the value created by a certain project or a portfolio of projects or investments covers all the operating costs and the cost of capital. Unlike other valuation methods, including other value-based methods, EVA does not consider only the cost of interest but also the cost of equity. In other words, the formula includes the expected rate of return as cost of equity, which in combination with the cost of debt gives the total cost of capital. Only if the rate of return of the investment is higher than the cost of capital, positive value is being created for the shareholders and their demands are fulfilled (positive rate of return). This opinion is also supported by Peter Drucker in a Harvard Business Review article, where valuation methods of conventional accounting are also criticized: "*Until a business returns a profit that is greater than its cost of capital, it operates at a loss. Never mind that it pays taxes as if it had a genuine profit. The enterprise still returns less to the economy than it devours in resources…until then it does not create wealth; it destroys it".* According to Shil (2009), another advantage of EVA compared with other valuation practices is that it corrects and adjusts all the distortions that are prevalent in then information generated by the accounting practices. Furthermore, depending on the investor's purpose, it can be used

in comparing companies of different industries when it comes to portfolio management practices. Nevertheless, it is recommended that EVA is used for comparison between companies that are similar in size (in term of assets and revenues), because the increase in operating profits is substantial compared to the one of the assets of the company.

EVA can also be recognized as a management tool used by executive directors in order to closely observe the operation and performance of departments individually or the performance of the company as a whole unit. Especially when it comes into corporate groups, where two or more corporations engaged in entirely different business areas fall under the same a conglomerate, the value-based approach such as EVA is superior to other accounting methods because it recognizes the cost of capital for its subsidiary and the riskiness for each one. Operating in different business areas and markets, each subsidiary bears different interest expenses as the cost of capital differs from sector to sector. Unlike traditional measures, EVA includes the cost of equity and the cost of debt in its formula so that the impact of interest bearing debt as well as of the return the investors anticipate is depicted in the final value after the operating profit. Other non-value-based valuation have the drawback that results are mainly a rate of return but by maximizing these rates does not necessarily results in return maximization for the shareholders. Such rates are return on investment (ROI), return on invested capital (ROIC), return on capital employed (ROCE), return on net assets (RONA) and return on assets (ROA). All these rates can mislead investors and managers since highest gross margin on sales of a company does not necessarily indicate that the current strategy produces the highest profit possible.

Compared to other value-based measures EVA is less complicated as the other methods are based on specific cash flows or consider more data such as depreciation that makes the measure more subjective than EVA. Taking into account subjective data can lead into different conclusions or even distortions of the outcome depending on different human perceptions. Of course, these methods can be more effective under certain conditions and common perception between analysts. According to Klinkermann (1997), however, EVA is more useful and more widely used just because it is easier for more people to understand it and implement it in the same way so that the subjective perceptions be eliminated.

Two similar valuation techniques are discounted cash flow (DCF) and net present value (NPV). According to these methods the value of a company is derived from present value of future incomes. The core of these models is working with time value of future incomes. EVA can be used in a similar way for future cash flows and in this occasion the results are similar to those of DCF and NPV (Maditimos, 2006). In other occasions it can be used as a performance measure for past periods and then make comparisons between companies under evaluation for specific fluctuations in the market. That's exactly what the present project is about.

On the other hand, EVA presents also some limitations that should be considered before its implementation. First of all, it is criticized to be a short-term measure and that it does not suit in companies with focus on long-term investments. In order to avoid this pitfall during the project, companies with high growth rate were excluded from the study. Secondly, in connection with the first criticize, there can be no objective measurement of EVA for long-term investments as future returns cannot be measured. This problem is presented mainly when EVA is used not as a performance measure (periodic EVA) but when it takes into account future cash flows estimations. Another problem presented in EVA use is inflation. Especially periodic EVA fails to consider inflation during the valuation and, as a result, the residual income does not depict the true impact on owners' wealth. Last but not least, EVA cannot be used for special research purposes such as distress prediction, where traditional financial rations have been more efficient.

3.3 EVA Calculation

3.3.1 EVA formula

As it has been explained, there are two major ways a company can improve its economic value added (EVA). The first is to increase its revenues and the second is to decrease its capital costs. For the former method the EVA formula uses Net Operating Profit After Tax (NOPAT) while the latter method is expressed by considering the capital costs. In this way, EVA is calculated by subtracting the capital charges from NOPAT[1]:

$$EVA = NOPAT - Capital\ Employed \times WACC$$

$wacc$: $weighted\ average\ cost\ of\ capital$

If the EVA is positive the company creates value for the owners, whereas a negative EVA reflects that owners' wealth gets reduced.

The last formula is derived from the initial fundamental concept of EVA which is that a company can produce positive economic value if the rate of return on capital $\boldsymbol{r}$ is higher than the cost of capital $\boldsymbol{c}$. In other words, the perspective is that EVA is a spread between a firm's return on invested capital (ROIC) and the cost of capital multiplied by the total capital invested[2].

$$EVA = (r - c) \times capital\ employed \ \rightarrow$$

$$EVA = (r \times capital) - (c \times capital) \ \rightarrow$$

$$\boldsymbol{EVA = NOPAT - (c \times capital)}$$

1,2 Shil (2009),"Performance Measures: An Application Of Economic Value Added", International Journal Of Business and Management, Vol.4 , No.3 March 2009

Of course the capital of a company consists of equity and debt, which have different interest expenses. In addition, the debt usually consists of different loans, each of which has different interest rate. For these reasons, when the formula is implemented a weighted average cost of capital (WACC) is used.

The next paragraphs illustrate the way the three components (NOPAT, WACC, capital) of EVA formula are calculated.

3.3.2 Calculation of Net Operating Profit After Taxes (NOPAT)

The first step in calculating EVA is to make adjustments to a company's net income in order to produce its NOPAT. These adjustments are necessary as the net income has to be calculated according to the "generally accepted accounting principles", which often distort the current economic measured of a company. Of course, the adjustments must have been determined before the valuation and must be the same for all the companies under research. Stern & Co., the consulting company that introduced EVA, has identified more than 120 potential adjustments that can be made in a company's net income in areas such as R&D, inventory, costing, depreciation and amortization. However, usually no more than ten adjustments are sufficient before the calculation of NOPAT. The choice of the adjustments depends on various factors such as the industry under research and the strategy of the company. The strategy of a company plays a crucial role, because, during periods when companies invest in new projects or assets in order to grow in size, it is usual that they will not perform as high profitability as before. Of course, the investors expect from such companies to deliver higher profit margin in the future. The way these adjustments will be made depends on company's reports (balance sheets and income statements). Usually analysts do not meet major problems as the data provided with those reports are regulated by GAAP. Nevertheless, since there is almost always a bias in the perceptions of some assets or transactions, companies' CFOs should clarify some statements or practices. For

public companies, these clarifications can be found in the annual report that is published each year.

Unlike, the other two components of EVA, capital and WACC, NOPAT plays the most vital role in fluctuations that can be observed in the EVA of a company during a series of years. That happens because cost of capital from year to year does not fluctuate as much as revenues and subsequently profit. On the other hand, in some industries, such as maritime, the potential earnings from year to year fluctuate in such degree that EVA formula can produce a highly negative result after a highly positive year. During our research this trend was obvious at dry bulk shipping companies during years that shipping freight rates fell more than 50% in one year. The interest expenses cannot deviate considerably from year to year because the interest rates as well as the capital employed do not fluctuate as much for reasons that will be explained in next paragraphs.

NOPAT and adjustments in our study

During the data collection for our study we use all the available annual reports issued by the companies under valuation for the years 2006-2015. Some companies provided the value of NOPAT while other companies provided other income or revenue data that could lead to NOPAT after some adjustments. These adjustments are made in order to convert the accounting profit into economic profit, which is the one that affects owners' wealth straightforward. In many cases the reported number would be EBIT (earnings before interest taxes). Then NOPAT is derived from EBIT by subtracting the calculated taxes as shown:

$$\boldsymbol{NOPAT = EBIT \times (1 - t)}$$ [3]

t: tax interest

3. Gregory T. Fraker (2006), "Using Economic Value Added (EVA) to measure and improve Bank Performance", 2006 Paper Writing Contest, RMA – Arizona Chapter

The tax interest is provided in the same annual report. Usually investors observe it because it can show the competitiveness of a business based on the country it is incorporated. In addition, in case of a tax reform the analysts must make updated estimations for future results.

3.3.3 Calculation of Capital Employed

The value of capital that must be used in EVA calculation must be defined after adjustments in order to isolate the interest-bearing liabilities. Of course, the first source of the essential data is the balance sheet where all the assets and liabilities are recorded. However, these items are not listed as funding sources which would be the ideal scenario, if we wanted to implement the formula instantly. Consequently, all the non-interest-bearing liabilities or assets has to be excluded from the list. Depending on which column of the balance is used, the invented capital can be calculated either as liability or as asset. However, in some cases the interest bearing capital can be calculated from other sources that are included in the report. That depends on the company policy as the GAAP does not mandate that a list of borrowing funds be included in the annual report of public companies.

Public maritime companies are high leveraged (high debt to equity ratio), which means that they have high interest expenses. Depending on financing strategies, similar companies in size and business can have extremely different interest expenses. That happens because there are four main ways of financing ships (Stopford, 2009): equity, debt, newbuilding finance and leasing. Usually shipping companies use interest-bearing funds (mainly loans and sometimes bonds) when they want to invest in new investment projects (newbuilding ships) and the majority of the company's equity is raised during initial public offerings (IPOs) while secondary share offerings are less popular, as they are used only when the management team judges that the cost of raising money thorough a secondary offering would be lower than taking a loan from an institution. So the new ships act as collateral to

these liabilities and in case of default the underwriters have the right to detain them. Because most of the times the newbuilding project entails more than one ship, the financing is completed including loans, additional share offering and cash. However, the majority of the amount spent is derived from loan or loans. In order to calculate the interest-bearing funds we use a list of these loans which is usually provided in the annual report of each company or we use the balance sheet to see the fixed assets of the company. The last method is not state of the art but as mentioned the majority of public companies finance their projects with loans. In other rare cases the whole amount of interest expense is provided and we can use this figure in order to avoid the multiplication WACC × CAPITAL which provides approximation of the cost of capital for reasons that will be explained in the next paragraph.

As "fixed asset" we recognize all the tangible assets, property, plant and equipment that a company owns and exploit them in its operations. In shipping industry the fixed assets are the vessels chartered to clients. Unlike other industries where companies might have diversity in the services they provide, in maritime the only service is shipping service which is provided through ships. The majority of shipping companies report the current value of their vessels and other properties the hold in business centers that are usually commercial agencies. During our research we used the value of interest-bearing debt that the company reported, while in some cases that there was no info reported we use the value of the vessels owned by the company.

3.3.4 Calculation of Weighted Average Cost of Capital (WACC)

The estimation of cost of capital is the greatest challenge during the implementation of EVA. The level cost of capital depends primarily not on the source of the money but on the use of the funds. Usually the provider of the funds (capital markets, commercial banks, private funds, individual investors) determine the level of the interest rate according to various factors such as business risk , current interest level, LIBOR, macroeconomic variables, financial structure and volatility of incomes. Generally in business world the

interest rate represents the minimum acceptable rate of return on the investment from the viewpoint of investors and creditors.

In companies under research the capital consists of two parts: equity and debt (liabilities). The equity represents the part of a company that is left after all liabilities have been deducted and it is owned by the shareholders. For purposes of liquidation after a bankruptcy, it represents the value of the company that is left for the stockholders after all liabilities are paid to the creditors. The equity is raised through the stock market which is difficult to access. Especially for shipping companies there are two major difficulties according to Stopford, which are even worse for small shipping companies. The first and most important is the volatility in the earnings that shipping companies present as a consequence of shipping cycle while investors look for consistent results. The other issue has to do with the corporate structure required by the equity markets. Usually the structure of public companies is stricter compared to that of private companies as major investors and creditors demand that the strategy is constantly observed and evaluated. For this reason, there is usually an auditor inside the company who observes the daily proceedings and constantly records the decisions made by directors. The above policies slow down the decision-making procedure inside the firm, which is a disadvantage for shipping companies as the volatile market as well as its nature (decisions over spot or time charters, decision on routes and areas etc.) demand fast reactions if not pro-actions.

Debt represents the value of the liabilities that company has to another party (lender, creditor). The majority of shipping companies hold a portfolio of loans that use to finance their operations. Usually those loans are used to finance the newbuilding projects and the vessels act as collateral to them until their full repayment, which is usually balloon repayment. The repayment period depends mainly on the value of the loan and duration of the project but it is a usual practice that an extension is provided during periods of low freight rates in the market. As far as the interest rate is concerned, loans are generally made at spread over LIBOR (London Interbank Offered Rate). The companies we studied during the project usually reported a spread that ranged from 0.8% to 2 %.

Cost of Equity

The cost of equity represents the rate of return that investors expect. In other words, it is compensation the market demands in exchange for owning the asset and bearing the risk of it. Of course, there are many ways to calculate the cost of equity and there is also a bias in it as each investor can have different expectations and estimations on the companies. Nevertheless, there are some models that are used from the majority of the investors to estimate an expected rate of return. These models take into account many variables before present an estimation such as current market trends, past-stock performance growth rates etc. During the implementation of EVA the recommended model for the calculation of the cost of equity is CAPM (Capital Asset Pricing Model).

The general idea behind the CAPM is that investors demand to earn a compensation for two reasons (Bodie, Kane, Markus, 2014). The time value of money and risk. The time value of money is represented by the risk-free rate in the formula and compensates the investors for placing a part of their wealth in any investment over a period of time. In finance the risk-free rate investment is defined as one where we know the expected return with certainty. Of course, there are two basic conditions that have to be met in order an investment to be considered risk-free and subsequently define the risk-free rate on the market for the current period (Damodaran, 2008). The first one is that there must be no default risk. Such securities are usually government securities, not because governments are experts at running business, but because they can control the printing of money. So they can honor claims that have been made. The second condition is that there can be no reinvestment risk. In case a part of the return was reinvested then the estimation of the expected return will not meet the actual return and there is extra risk that investors have to bear. It is common practice to take the yield on government bonds as the actual risk free rate. During our valuation we used the yield on the 10-year U.S bond for each year. We used data that we found at Damodaran site.

The other half of the CAPM formula represents risk and calculates the amount of compensation the investor needs for taking on additional risk. This is calculated by taking a risk measure (beta) that compares the returns of the asset to the market over a period of

time and to the market premium (r_m-r_f): the return of the market in excess of the risk-free rate. Beta reflects how risky an asset is, compared to overall market risk and is a function of the volatility of the asset and the market as well as the correlation between the two. For stocks, the market is usually represented by index S&P 500 but in special cases it can be represented by more robust indexes as well. During our research we use the risk premium found in Damodaran site for each year and we obtained the beta value for each stock from yahoo finance site.

The formula for calculating the cost of equity is [4] :

$$C_E = r_f + \beta \times (r_m - r_f) \rightarrow$$

$$\boldsymbol{C_E = r_f + \beta \times risk\ premium}$$

C_E = Cost of Equity

r_f = risk free rate

β = stock beta

r_m = market return

Cost of Debt

Contrary to cost of equity, cost of debt is much easier to be calculated as it is expressed straightforward in the contracts of the loans. As mentioned in previous paragraph it is usually contracted as a spread over LIBOR, in other words it is usually a floating rate and it is expressed as a percentage of the loan. Since the companies we studied are public and the competitiveness is high, there is constant intention for company growth and higher

4. Shil (2009),"Performance Measures: An Application Of Economic Value Added", International Journal Of Business and Management, Vol.4 , No.3 March 2009

performance compared to competitors. For these reasons, all the companies held a portfolio of loans (and sometimes corporate bonds) from different sources and each one has different contracted floating rate. Fortunately, the annual reports provided by the companies included weighted average cost of debt. So, during our research, there was no need for calculation of the cost of debt.

WACC calculation

The last step before calculating EVA is the calculation of the cost of capital, which is easy after the estimation of cost of equity and the record of interest rates on the liabilities have completed. We use the formula described below [5]:

$$\boldsymbol{WACC = C_E \times \frac{E}{C} + C_D \times \frac{D}{C}}$$

C = Capital = Equity + Debt

E = Value of Equity

D = Value of Debt

C_E = Cost of Equity

C_D = Cost of Debt

WACC = Weighted Average Cost of Capital

CHAPTER 4

Altman (Z) – Score

4.1 Distress situations and bankruptcy prediction

As the study focuses on evaluating companies and their performance during turbulence in the markets, it is reasonable that some of these companies will have such a poor performance that the likelihood of bankruptcy increases. Corporate bankruptcy has been a major issue in business areas for a long period. There are multiple factors that contribute to bankruptcies and other distressed conditions but usually the most frequent reasons are (Altman and Hotchkiss 2006):

- Chronically sick industries (e.g. agriculture and textiles)
- Deregulation of industries (e.g. airlines, financial services, health care, energy)
- High real interest rates in certain periods
- International competition
- Overcapacity within an industry
- Increased leveraging of corporations
- Relatively high new business formation rates in certain periods

Even those reasons alone, however, cannot lead a firm to bankruptcy. Most of the times some of these conditions in combination with managerial incompetence is the main reason firms run out of cash and other liquid funds.

Bankruptcy of mid-cap and large-cap companies* can have major impacts in investors' portfolios and wealth. For this reason there have been created several methods and techniques that try to estimate the likelihood of a company going bankrupt. According to Fitzpatrick (1932), Merwin (1942), Horrigan (1965) the first methods were extremely simple and naïve considering their evolution afterwards. These methods were actually

based on calculating financial rations of already bankrupt ratios and comparing them with those of non-bankrupt firms. These models did not attempt to predict a bankruptcy but their purpose was only to analyze financial rations of non-bankrupt companies separately. The first valuation method on *predicting bankruptcy* was introduced by Beaver in 1966. However, even this model was still univariate as the first multivariate method was introduced a few years later, in 1968 by Altman. Altman used multiple discriminant analysis to predict corporate failure.

In his study about corporate failure, he supported that the use of a multivariate model was necessary if the aim of the problem is the prediction of a bankruptcy, whereas the other univariate models could only act as an *indicators* of bankruptcy and not as a *predictors*. At present, it might seem obvious that one variable or ratio alone cannot be a signal for potential bankruptcy, but the two periods (2010s and 1960s) have some fundamental differences. First and foremost the number of companies has increased significantly from 1930s, when the first models were introduced, to 1960s, when Altman introduced his multivariate method for the first time, and from 1960s to 2010s. Economists did not have the data and the experience to introduce new valuation methods as Altman did in 1968 or improve the old ones as Altman did in 2000 when he introduced some modifications in order make the model suitable for valuating private firms as well. Secondly the observation on those companies and the information available to the public has increased substantially. Either for regulation purposes or for performance evaluation the income statements and the balance sheets were enriched with more detailed data and concepts of accounting that allow analysts, investors or even the managers of the companies to observe the company performance, evaluate the financial position at the time and predict the likelihood of bankruptcy. Asset manager investors need to have reliable tools for the selection of companies into their portfolios. However, the whole concept of portfolios is that each manager or company has different expectations of the market, which, if analyzed in more detail, means that there are different expectations on how the companies-investments will perform. That's the reason each investor can use different modifications on each model or even interpret the same results in a different way. That's the reason that some financially distressed companies still find the necessary funds to save themselves even if their performance is poorer than that of other companies in similar position. Financial distress

of the companies is on the one hand detrimental to investor returns, but, on the other hand, higher risk might give opportunities for higher returns. Responsible for assessing such securities and the risk issues with each one is the rating agencies whose main job is to give estimations of the bankruptcy probability depending on such tools. Usually investors hire such rating agencies as consultants before they invest money in public distressed companies, as they are supposed to be more expertized in such assessments.

4.2 Altman's Z – Score

Altman's original Z-Score was based on a sample of 66 publicly held manufacturing companies. Half of the companies were distressed manufacturers that had filed for bankruptcy from 1946 through 1965, while the other half were, randomly selected, non-bankrupt companies from the same time period. The asset size of each one of the companies ranged from $1 million to $25 million (Altman, 2000). Due to the large number of variables that may be significant indicators of financial distress, Altman chose 22 financial ratios based on relevancy and their popularity in the market. His goal was to find a small number of ratios that could best distinguish between bankrupted and non-bankrupted corporations. From these 22 ratios, five were selected as being the best combination to predict corporate bankruptcy. These five ratios are [6]:

A: Working Capital/Total Assets

The working capital/total assets ratio is a measure of the net liquid assets of the firm relative to the total capitalization. *Working capital* is equal to *the difference between current assets and current liabilities*, while *total assets* include both *current and fixed assets (non-current assets).* In this ratio, liquidity and size characteristics are taken into account. A firm that reports operating losses for a considerable period will have low ratio of working capital to total assets as in such cases the current assets are the first to be decreased.

B: Retained Earnings/Total Assets

Retained earnings report the *accumulated reinvested earnings* or losses of a firm. It is found in the Stockholders Equity section of the Balance Sheet. The ratio measures the cumulative long-term profitability of the company and implicitly considers the age of a firm. Studies

have shown that corporate failures are much more common in a firm's earlier years, as many firms that go bankrupt are relatively the young ones that have not yet had the time to build up their cumulative earnings. Hence, it makes sense that young companies are more likely to default on their obligations. In addition, ratio B measures the leverage of a firm. Companies with high retained earnings relatively to total assets have to a greater extent financed their assets through retention of earnings rather than debt financing, which may reduce the likelihood of bankruptcy.

C: Earnings Before Interest and Taxes/Total Assets

This ratio illustrates the productivity of the company's assets before tax or leverage factors are taken into consideration. Firms depend on operating efficiently through the earning power of their assets in order to have long-term viability. Return on total assets appears to be particularly appropriate for predicting bankruptcies, since it has the highest weight coefficient in each one of the Z-Score models. EBIT is found in the company's Income Statement.

D: Market Value of Equity/Book Value of Total Liabilities

The market value of equity is the combined market value of all shares of common and preferred stock. Total liabilities include all current and long-term liabilities found in the firm's Balance Sheet. Ratio D indicates how much the company's assets *can decline in value before the liabilities exceed the assets and it becomes insolvent*. Equity to debt also emphasizes the leverage of the firm. The higher the debt is, relatively to the equity, the higher the risk is for the stakeholders of the firm. In addition, this ratio adds a *market dimension* to the Z-Score, within the meaning that falling stock prices and subsequently decreasing market capitalization, may be a sign of upcoming problems. This should ensure that *systematic risk* is incorporated in the model, which is essential when considering public companies that might be affected by unexpected events such a financial crisis. The market

6. Altman, 2014, "Distressed Firm and Bankruptcy prediction in an international context: a review and empirical analysis of Altman's Z-Score Model", New York University

value of a company is inherently connected with its credit capability. This happens because when the stock market sentiment is overall positive, and stock prices are high, it is much easier for a company to borrow money and attract cash on the stock exchange through equity issues. Thus, the market value's impact on ratio D partly incorporates the funding accessibility of enterprises in the Z-Score model, in the sense that a low ratio may indicate that the company might encounter difficulties in obtaining financing, which is an indicator of bankruptcy in the near future if the firm is already in distressed position.

X5: Sales/Total Assets

The turnover-asset ratio is a standard financial ratio measuring the *ability of the company's assets to generate sales and the management's capacity in dealing with competitive conditions.* Sales are referred to as revenues in the company's Income Statement. Another measure that could also be used instead of Sales is net sales, which reflects the deduction of returns, allowances and discounts. Altman found that ratio E is the least significant on individual basis, but it is quite important for manufacturers because of its unique relationship to the other ratios in the Z-Score.

Depending on the industry of the companies studied the Z-Score formula undergoes some modifications before the calculation. The modifications are applied mainly on the coefficients of the ratios that are included in the formula. The initial concept of Z-Score was:

$$Z = 1.2 \times A + 1.4 \times B + 3.3 \times C + 0.6 \times D + 1.0 \times E$$

Altman provided some boundary zones for interpretation of the results:

- Z > 2.99 : Grey Zone : Considered financially healthy
- 1.81 < Z <2.99 : Grey Zone : Could go either way
- Z < 1.81 : Distress Zone : Risk that the company will go bankrupt within 2 years

Because of the limitations of the initial formula (created for public manufacturing companies exclusively), Altman proposed a series of changes in the formula in order to expand the usefulness of the model to other companies. The first modification was about ratio D. Instead of Market Value of Equity, Altman proposed Book Value of Equity to be included in the ratio. In this way, Altman avoids restricting its applicability to public companies. Of course, there should also be some change in the coefficient of ratio D because the weight of the Book Value of Equity is different than the Market Value of Equity. Hence, it is recommended to reduce the coefficient of ratio D, even though it has already the lowest weight of the other four coefficients.

The other issue in the model is the ratio E, which includes Asset turnover. As Asset Turnover varies significantly depending on the industry under research, Altman proposed to exclude this ratio when the model is used for valuation of private companies. In this way, we minimize the sensitivity of industry effect, which makes the model useful for a wider range of companies. As an example, Altman compared data from retail and service companies to prove that the retail companies had significantly higher turnover ratio than service companies. As a result, if the original model was employed to predict bankruptcy in service firms (non-manufacturing firms) the scores would underpredict bankruptcy. That's an issue that we considered before we choose which model to use during the present project.

Having proposed these modifications, Altman named the new model as Z´´- score and proposed the new boundary zones (Altman, 1984):

$$Z'' = 3.25 + 6.56 \times A + 3.26 \times B + 6.72 \times C + 1.05 \times D$$

Altman provided some boundary zones for interpretation of the results:

- Z > 5.85 : Grey Zone : Considered financially healthy
- 4.35 < Z < 5.85 : Grey Zone : Could go either way

- Z < 4.35 : Distress Zone : Risk that the company will go bankrupt within 2 years

4.3 Problems and limitations of Z-Score models

The Z-Score models have proven to be a reliable tool for predicting corporate failures in a broad variety of contexts and markets. However, it should be noted that the Z-Score is not valid in every situation, as the models have drawn several objections over the years.

The first issue that Z-score models have to do with is the selection of suitable firms for valuation, as it is important to use companies that have assets more than 25 million because in different occasion the ratios will not be suitable for the calculation of a reliable Z-score. According to Altman (2000), the financial ratios, have the effect of deflating statistics by size, and therefore a good deal of the size effect is eliminated.

Another issue with these models is the quality of the data used. As the data are taken from balance sheets and income statements which are unaudited, (only the annual report is required to be audited) possible write-offs can have dramatic impacts in the Z-scores from quarter to quarter. In other words, those models are extremely sensitive to false accounting practices. As an example Altman refers to retained earnings to total assets ratio which is subject to manipulation via corporate quasi-reorganizations and dividend declarations causing bias among analysts. Z”- score model for non-manufactures is more vulnerable to potential manipulation of accounting data than the original Z-score model. In particular, because the market value of equity has been substituted by the book value of equity, Z” - score cannot detect potential reaction of the market in new-published news for the company. The market reacts to bad or good news that can influence the company’s performance, but in most of those cases these news cannot have immediate impact on the firm’s balance sheet. Of course this is the way the public companies operate as they are obliged by the regulations to disclose such kind of information. On the other hand, private companies are not obliged to follow such practices, so in case there is an incident like an

unexpected failure in a project that will damage the income flow of the company, the Z"-score model will not be able to detect it as the book value cannot show the reaction of the market to these news.

There are, however, some occasions, when the market volatility can have negative impact on the results produced by the original Z - score (Aasen, 2011). During periods when the stock market is relatively high, the Z-score outcomes will be higher than in times when stock prices are low. Mispriced stock, which is a common phenomenon especially during periods of bubbles, can create bias among the Z-scores. That is the main reason, it is recommended to supplement the results coming from Z-model with results coming from other analytical tools.

Last but not least, we have to point out that Z - score models are not suitable for evaluating financial firms (Aasen, 2011). The frequent use of off-balance-sheet items such as securities and other investment instruments create a portfolio, whose value can change significantly from day to day and affect the value of assets on the balance sheet and consequently the outcome of Z-score model.

4.4 Use of Altman (Z) models in maritime industry

In our research we had to deal with an industry with many ups and downs in the last decade and high leveraged companies. We used the Z-score model because we studied public companies exclusively. As it has been explained in previous chapter, public maritime companies use mainly borrowed funds, such as loans and bonds, to finance their projects and as a result they have always high liabilities to equity ratio. The many fluctuations observed in the market influence the revenues of the companies and especially the dry market companies return highly disappointing results for the investors. As a result, during our calculations we obtained extremely low results for some companies although the investors seem to still support them since they have not dumped their shares yet. The reason for that phenomenon is that when they are compared with other companies in the industry some companies have the potential of an uptrend when the market recovers. Of course,

some companies cannot avoid the bankruptcy and the asset seizure as it has happened in many companies after periods when market is low. For this reason, the interpretation of the results is based on comparing the results according to the number and type of ships, deadweight on the water and value of assets. Our research showed that a reliable measure that depicts the size of the company in terms of owned vessels and deadweight on water is the fixed assets as they are reported in a balance sheet, because the fixed assets entails the value of the vessels owned. So it is used as measure of size when then companies are categorized according to the fleet. In this way, we try to see if the companies that underperform or on the other hand those that overperform have some characteristics in common.

CHAPTER 5

Data Envelopment Analysis (DEA)

5.1 Introduction to DEA

The third method that was used during this diploma thesis is the “Data Envelopment Analysis” or, in other words, DEA, as it is usually called. This method is based on linear programming for measuring the relative performance of organizational units in cases where there are multiple inputs and outputs. It was originally developed by Charnes, Cooper and Rhodes in 1978 to evaluate nonprofit and public sector organizations such as banks, hospitals, schools. However, the last years its use has expanded in many other business fields and industries, because it has been proven to be able to locate problems and deficiencies that are not visible with other valuation techniques.

The basic concept of DEA is based on the fact that no matter what companies or organizations are under examination they can all be seen as producers. Each producer implements a production process where a varying level of inputs gives out a varying level of outputs. Depending on the industry and on the scope the examiner has on the issue, the number of variables used can change. For example, consider a shipping company. Each shipping company employs a certain number of vessels, to transfer goods providing service to many different charterers. However, there are numerous ways to exploit the ships and their service capabilities and each company choose a different way to do that. As each company has different size in terms of assets, owned vessels, chartered vessels from other companies, it is difficult to determine which one is “the best” or “the most efficient”.

The general concept behind this example is that, if a given producer, A, is capable of producing Y(A) units of output with X(A) inputs, another producer, call him B, should also be able to do the same with the assumption that both must perform equally efficiently. Similarly, if producer B is capable of producing Y(B) units of output with X(B) inputs,

then other producers should also be capable of the same production schedule. Producers A, B, and others can then be combined to form a composite producer with composite inputs and composite outputs. Since this composite producer does not necessarily exist, it is typically called a virtual producer. The heart of the analysis lies in finding the "best" virtual producer for each real producer. If the virtual producer is better than the original producer by either making more output with the same input or making the same output with less input then the original producer is inefficient. The last analysis might look like a vicious circle, but in real world the valuation process with DEA detects one best virtual producer and, afterwards, the rest of the producers are credited according to the relative efficiency.

In other words, DEA is a form of frontier analysis that recognizes that some DMUs perform below optimum levels. In this method, each DMU is optimized against all other DMUs. That is, the linear program assigns weights to the variables such that each DMU looks the "best" it can be. DEA constructs the efficiency frontier and calculates the efficiency score for each DMU based on its distance from the frontier. Depending on the orientation the analyst has assigned to the program, our model can be input-oriented or output-oriented. An input oriented problem focuses on maximizing the company's performance by reducing its inputs, or in other words, produces the observed outputs with the optimum resource level. On the other hand, an output-oriented program focuses on maximizing the unit's performance by increasing the outputs given that inputs remain stable.

Whereas these type of models use only inputs or outputs in the objective function as controllable factors, there have been invented some more extensive models where inputs and outputs are simultaneously inserted into the function to calculate the efficiency for each company. Slacks-Based Model or SBM, as it is called, is one of these models (Anadol, 2014). During our study, however, only the traditional radial models were used and in all cases we chose input-oriented models.

Contrary to other valuation methods and especially methods that are based on indexes, DEA has the advantage that is focuses on a single estimation, one number, which depicts how efficient has been the use of the inputs compared to the outputs and consequently the value added that has been achieved. When we use traditional rations for valuation purposes, such as comparable ratios, the result depicts only partial efficiency or

inefficiency in only a part of the operation of the company, which does not provide any information about the overall valuation of the company compared to other companies. In addition, when such methods are used the analysts usually determine the efficient companies as those that exceed an average value, which is not a reliable result statistically, because the average value or whichever value has been chosen as significant value can significantly deviate if the results of our sample have high standard deviation. So the comparison with many ratios, each of which depicts only a part of the whole commercial activities of the company cannot provide as much info as a DEA model provides. DEA can make a valuation in many different ways according to the nature of the industry and with many different adjustments depending the purpose of the research. That can happen by creating more than one model, each of which can have multiples outputs and inputs of different combinations. In that way we can see the efficiency of one company relatively to the other companies of the group for inputs or outputs that do not even have the same measure units. In our research we did not use models with different units as all the variables we used came from the balance sheet where everything is measured in dollars. However, there have been studies where there are two different inputs that have different measure units.

What does DEA do?

As Cooper mentions in his textbook "Data Envelopment Analysis", Springer, there can be 4 different perspectives on the use of DEA:

1. First of all, DEA compares service units considering all resources used and services provided in order to identify all the efficient and inefficient units of the sample. This is achieved by comparing the mix and volume of all services provided and resources used by each company or unit with those of other companies or units.
2. Secondly, the identification of inefficient units helps the examiners to examine these units thoroughly and make them more efficient by implementing new, better practices. In this way, the inefficient units might achieve potential savings and approach the best units. In addition, DEA estimates the amount of additional service an inefficient unit can provide without the need to use additional resources.

3. The last point is connected with the fact that DEA can calculate the amount and type of cost and resource savings that can be achieved.
4. From management perspective, DEA can help the transformation of information from efficient units of a company to inefficient units of the company. In this way, the managerial expertise will contribute into the improvement of the productivity of the inefficient units, which means that the costs will decline the profitability will increase.

These four types of information show how valuable DEA is as they prove that DEA can identify relationships that are not identifiable with alternative techniques. The comparison with better companies reveal the weaknesses of inefficient companies and the sectors where better performance is required. Of course, in order to reach a conclusion the analyst has to define carefully the model and its variables. Depending on the variables used as well as the combinations made with them numerous models can be created and each one can deliver different outcomes that can be interpreted differently.

Except the aforementioned fundamental uses of DEA, there is another one which is the one which our research perspective is based on. That is the changes in efficiencies year after year. Throughout our research with DEA what we do is to observe the variations in the scores that each company achieves from year to year. During the valuation with DEA we obtain results in percent form (100%, 90% etc.) and then we calculate the relative difference from the previous year to see how the company reacted to market fall. In this way we can evaluate how efficient was a company's reaction to the declining market not only compared to other companies, but also compared to the performance of the same company during the previous years.

Compared to other valuation techniques DEA has specific advantages and disadvantages that are listed below:

Advantages:

- DEA takes into consideration many inputs and outputs
- There are no conditions or functions between inputs and outputs, so the method is very simple
- Each unit is directly compared to other similar units or their combination
- The inputs and outputs can have completely different units of measurement if required

Disadvantages:

- As all valuation methods and all optimization techniques, DEA can have flaws that create significant problems and deviation
- DEA calculates the relative efficiency and not the real efficiency. In other words, each unit is compared with other similar companies and not with the theoretical optimum performance that it could achieve
- Each unit demands a separate problem of linear programming, so big research projects with big data bases require a significant amount of time to be solved. For cases like these special software programs are required

5.2 How does DEA work?

As mentioned the DEA is a linear programming-based technique for measuring the performance efficiency of units which are called Decision-Making Units or DMUs. *Efficiency* can be simply defined as the ratio of output to input. More output per input reflects *relatively greater efficiency*. If the greatest possible output per unit of input is achieved, the company has reached a state of *optimum efficiency* and it is not possible the company to become more efficient without new technology or other changes in the production process. So the basic measure used in DEA is the ratio of total outputs to total inputs [7,8]:

$$\boldsymbol{Efficiency = \frac{Output}{Input}}$$

As almost always the companies under examination use more than one input to produce more than one output, the previous ratio transforms into

$$\boldsymbol{Efficiency = \frac{Output1 + Output2 + \ldots\ldots}{Input1 + Input2 + \ldots\ldots}}$$

The next step includes the consideration of some weights that always apply in production processes. Usually the weights represent the prices that the company has paid for each input and the value of money that the company has made for each output respectively.

$$\boldsymbol{Efficiency = \frac{Output1 \times u_1 + Output2 \times u_2 + \ldots\ldots}{Input1 \times v_1 + Input2 \times v_2 + \ldots\ldots}}$$

where u_i , i=1,2,… is the weight given to $output_i$

v_j , j=1,2,… is the weight given to $input_j$

7. R. Ramanathan (2003), "An Introduction to Data Envelopment Analysis: A tool for performance Measurement", Sage Publications

8. Μέργος (2011), «Ανάλυση αποδοτικότητας ναυτιλιακών εταιρειών με εφαρμογή της Data Envelopment Analysis» , Εθνικό Μετσόβιο Πούτεχνείο

Of course the final form of the ratio is the one where we substituted the total outputs and the total inputs with the Value Added and the Capital Employed respectively.

$$\boldsymbol{Efficiency = \frac{Value\ Added}{Capital\ Employed}}$$

The "Value Added" and the "Capital Employed" can be determined in various ways and it is usually the examiner the one who decides which features of the financial statement should be used to substitute the two terms. During our research we used two different models, each of which used 2 input variables and 1 output variable.

5.3 Technical Efficiency-Price Efficiency

Farrel, in his article "The measurement of productive efficiency" (1957), claimed that efficiency can be separated into two different concepts: the *technical efficiency* which expresses the unit's capability to produce the maximum possible output from a certain amount of inputs and the *price or allocative efficiency* which expresses the unit's capability to use the inputs in the optimum combination for a given relation among the prices of the inputs.

Technical Efficiency is the most common efficiency concept as it expresses the conversion of physical inputs (such as the services of employees and machines) into outputs relative to best practice. In other words, given current technology, there is no wastage of inputs whatsoever in producing the given quantity of output. An organization operating at best practice is said to be 100% technically efficient (optimal efficiency). If operating below best practice levels, then the organization's technical efficiency is expressed as a percentage of best practice. Managerial practices and the scale or size of operations affect

technical efficiency, which is based on engineering relationships but not on prices and costs.

On the other hand, *price or allocative efficiency* refers to whether inputs, for a given level of output and set of input prices, are chosen to minimize the cost of production, assuming that the organization being examined is already fully technically efficient. Allocative efficiency is also expressed as a percentage score, with a score of 100% indicating that the organization is using its inputs in the proportions that would minimize costs. An organization that is operating at best practice in engineering terms could still be allocatively inefficient because it is not using inputs in the proportions which minimize its costs, given relative input prices. As a result, allocative efficiency completes technical efficiency as part of the overall efficiency of a unit.

The combination of technical and allocative efficiency in usually referred as *cost efficiency*. y. An organization will only be cost efficient if it is both technically and allocatively efficient. Cost efficiency is calculated as the product of the technical and allocative efficiency scores (expressed as a percentage), so an organization can only achieve a 100% score in cost efficiency if it has achieved 100% in both technical and allocative efficiency

The procedure of valuing a sample of companies each of which uses one or more inputs in order to produce one or more outputs is based on Pareto optimality or Pareto efficiency as it is also called. According to Pareto optimality an efficient unit can be defined in two different ways:

- An output-oriented approach defines a unit as efficient if it is not possible to increase the output without first increasing the inputs
- An input-oriented approach defines a unit as efficient if it is not possible to decrease the use of an input if the output is not to be decreased as well

In our project, where we compare a number of companies, the above definitions can be mathematically defined as below. In the following mathematical expressions y (r=1,…,s) represents the outputs and x (i=1,…,m) represents the inputs.

- According to an output-oriented approach, a company j_0 is efficient if there is no other company j, $j \neq j_0$, for which $y_{r'j} > y_{r'j0}$ for r′ and $y_{rj} \geq y_{rj0}$ $\forall$ r ≠ r′ while $x_{ij} < x_{ij0}$ $\forall$ i
- According to an input-oriented approach, a company j_0 is efficient if there is no other company j, $j \neq j_0$, for which $x_{i'j} < x_{i'j0}$ for i′ and $x_{ij} < x_{ij0}$ $\forall$ i ≠ i′ while $y_{rj} > y_{rj0}$ $\forall$ r

5.4 DEA mathematical model

As explained the model estimates the relative efficiency for each DMU compared to all the other units of the sample. According to the simplest model, this is achieved by maximizing the ratio of the weighted average output of the unit to the weighted average input of the unit.

$$\underset{v_i, u_r}{Max}\, h_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{r=1}^{m} v_i x_{i0}}$$

$$s.t \quad \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \leq 1 \;\; \forall\, j = 1, \dots, n$$

$$u_r, v_i \geq \varepsilon$$

$$i = 1, \dots, m \;\; r = 1, \dots, s$$

- h_0 relative efficiency of DMU
- 0 is the DMU under research of the sample j=1,…,n DMUs
- j is then number of DMUs
- r is the number of outputs, r = 1,…,s
- i is the number of inputs i = 1,…,m
- y_{rj} is the amount of output r for DMU j
- x_{ij} is the amount of input i for DMU j
- ε is very small positive number ($\varepsilon = 10^{-6}$)
- vi , ur are the weight coefficients for input i and output j respectively, that maximize the objective function for the DMU that is under research

This model is known as CCR model derived from the initial letters of the names Charles, Cooper and Rhodes. It is a non-linear optimization problem that can take linear form after modifications. However, it represents in the simplest way possible how the DEA functions. The concept is quite simple. A unit, call it j_0, chooses certain weight coefficients u, v so that the relative efficiency is maximized. The same coefficients are used in the rest of units and for each one the relative efficiency is calculated. If no other unit is detected that has higher relative efficiency than unit j_0, then j_0 is efficient; otherwise it is inefficient.

The last non-linear model was transformed to an output-oriented linear model by Charles and Banker in 1978. The new mathematical form is given below [9]:

$$\underset{v_i, u_r}{Max}\, h_0 = \sum_{r=1}^{s} u_r\, y_{r0}$$

$$s.t \quad \sum_{i=1}^{m} v_i x_{i0} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \; \forall \, j = 1, \dots, n$$

$$u_r, v_i \geq \varepsilon$$

$$i = 1, \dots, m \quad r = 1, \dots, s$$

As it is obvious the concept of this interpretation is different. This time we try to find the relative efficiency h_0 for each unit compared to the other units. The model detects the highest value for h_0 by comparing all the inputs and the outputs from all the units, so that none calculated h exceeds the value of 1. In more detail, for each unit we determine the values for u_r and v_i, so that these values are used for the calculation of the relative efficiency for each other unit. Afterwards, the unit under examination changes and the same procedure takes place. This procedure takes place under the limitations set by the model.

In the whole procedure the inputs and outputs, x and y respectively, are known data while u, v are the variables that take numerous values in order to calculate the relative efficiency in each step. Since our sample consists of n different units, the method is applied n times and we receive n pairs of weight coefficients (u, v) that have been calculated in a way that the value of h_0 does not exceed 1. Of course the efficiency calculated for each company is depending entirely on the chosen sample. If the relative efficiency is $h_0=1$, it does not necessarily mean that the unit is efficient, but that the unit under examination has the best performance among all the units of the sample. This aforementioned concept is crucial concept to DEA. Basic purpose of DEA is not to recognize the most efficient companies, but to recognize those companies that could produce the same level of outputs they currently do with lower level of inputs or could produce higher level of outputs with the current level of inputs.

Below we use a graph to describe the procedure (the next graph and the description were taken by a DEA tutorial of Chang Jung Christian University that is public)

Figure 1 The Data Envelope

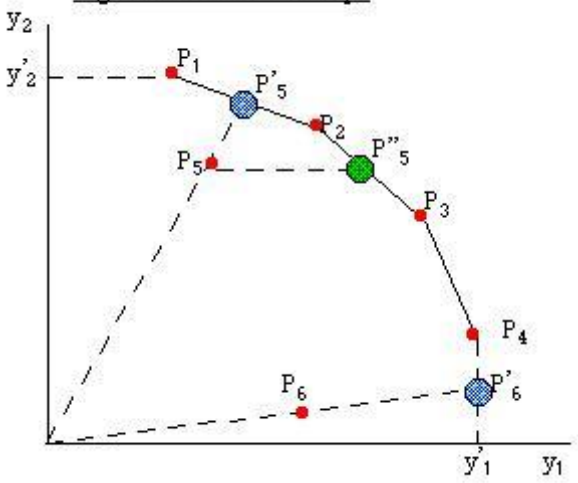

Figure l shows a set of units P1, P2, ... P6 with each unit consuming the same amount of a single resource and producing different amounts of outputs, y1 and y2 as shown. For a given amount of resource input, units providing greater amounts of the outputs will be the efficient ones. Applying the DEA approach to this set of units will identify units P1, P2, P3 and P4 as efficient and they provide an envelope round the entire data set units P5 and P6 are within this envelope and are inefficient. The data envelope has been notionally extended to the axes by the lines P1y2' and P4y1' to enclose the data set.

For unit P5 the peer group consists of the units P1 and P2 and a set of targets for P5 is provided at P5'. These targets are obtained by a pro rata increase in the outputs of unit P5. Clearly there are other possible targets for P5 and for example if the output level Y2 could not be increased for P5 then a target P5" could be set which would rely entirely on increasing output y1. For unit P6 the pro rata increase leads to the set of targets P6'. However P6' is clearly dominated by P4 which produces the same amount of output y1 but more output y2. In this case the pro rata increase needs to be supplemented by a further increase in the output of y2 to provide an efficient target. Returning to unit P5 the set of targets P5 can be obtained from a weighted average of the peer units P1 and P2. Thus P5

can be thought of as a composite unit made up of a weighted average of the peer units and this composite unit provides a target for the inefficient unit.

The case of economies of scale and returns to scale

The two mathematical models of DEA we have referred until now have a major assumption; this assumption is that we have only constant economies of scale during our research. However, since the purpose of DEA is to detect inefficient companies according to potential changes in outputs or inputs, it is important to take economies of scale into consideration, as well as the returns to scale. Scale efficiency is a measure inherently relating to the returns to scale of a technology at any specific point of the production process. Traditionally, it measures how close an observed plant is to the *optimal scale* (Førsund and Hjalmarsson, 1979). More precisely, scale efficiency reflects the average productivity at the observed input scale with respect to the efficient (optimal) scale (Førsund, 1996). T

"Economy of scale" is a microeconomic concept that refers to the cost advantages that enterprises might obtain due to size, output or scale of operation. A firm's efficiency is significantly affected by its size. Large firms are often more efficient than small ones because they can gain from economies of scale, but firms can become *too large* and suffer from diseconomies of scale. As a firm expands its scale of operations, it is said to move into its *long run*. The benefits arising from expansion depend upon the effect of expansion on productive efficiency, which can be assessed by looking at changes in average costs at each stage of production.

"Returns to scale" is another concept that describe the proportional change in the level of outputs with respect to proportional change in the level of inputs. In other words, the law of returns to scale states that when there is a proportionate change in the amounts of inputs, the behavior of output also changes, as in the long run all factors of production are variable and subject to change due to a given increase in size (scale). While economies of

scale show the effect of an increased output level on unit costs, returns to scale focus on the relation between input and output quantities, which is under examination during a DEA.

According to the models we have described until now, if the all inputs were to increase by a factor of 2, the outputs would increase by 2 as well, because the models assume constant returns to scale. In the real world however, this is not the case. The scale efficiency is crucial when evaluating units of a sample and analysts should take it into consideration. For this reason Banker, Charles and Cooper came up with a new model in 1984 which was named BCC after the initial letters of their names. The mathematical form of this model is described below [9,10]:

$$\underset{v_i, u_r}{Max} h_0 = \sum_{r=1}^{s} u_r \, y_{r0} - \omega_0$$

$$s.t \quad \sum_{i=1}^{m} v_i x_{i0} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} - \omega_0 \leq 0 \; \forall \, j = 1, \dots, n$$

$$u_r, v_i \geq \varepsilon \; \forall \, r, i, \omega_0$$

9. Μέργος (2011), «Ανάλυση αποδοτικότητας ναυτιλιακών εταιρειών με εφαρμογή της Data Envelopment Analysis» , Εθνικό Μετσόβιο Πούτεχνείο

10.Banker, Copper, Seiford, Zhu(2011), “Returns to Scale in DEA”, Handbook on Data Envelopment Analysis, Springer

This model inserts a new variable which is ω_0. Specifically, this variable acts as an index of scale efficiency, which depicts increasing economy of a scale for a company if $\omega_0 > 0$, decreasing economy of scale if $\omega_0 < 0$ and constant economy of scale if $\omega_0 = 0$.

The CCR model provides an efficiency outcome which is usually called overall efficiency because it consists of two separate concepts that were discussed earlier. These are technical efficiency and price or allocative efficiency. One DMU can present maximum efficiency when both technical and allocative efficiency are maximum.

5.5 DEA in practice

In practice DEA is implemented with the help of numerous software packages that process all the data that have been inserted. The first packages, that were created, presented some problems regarding the process of negative data such as negative value added. This is a very common phenomenon in our research because many shipping companies had higher operating costs than revenues for a number of years.

For this reason we used two different software packages during our study. The first was MaxDEA Basic version 6.13. This package presented no problem during the implementation of first DEA model that we created, but during the second model, where many output values were negative. it would not work. For this reason, a second software package was used whose name was OSDEA version 1.3.0. Both packages are distributed freely in the Internet.

CHAPTER 6

Valuation Results and Analysis

6.1 Results of tanker market

6.1.1 Results of EVA

In this section we present the outcomes obtained by the "Economic Value Added" method for both dry bulk market and wet market. For each company we used the official documents published by the companies, which is the 20-F form. According to SEC (Securities and Exchange Commission), each foreign private issuer with listed equity shares on exchanges in USA is required to submit this form at the end of each year so that investors can evaluate these investments. The information requirements for 20-F form are not as strict as the requirements for domestic U.S. companies that make regular filings, but the essential information for the calculation of EVA are included in this form either it issued by a domestic U.S public company or a foreign public company. In previous chapter we explained in detail what information is needed for the implementation of EVA method. The goal of the mandatory use of 20-F forms is to standardize the form of the info provided, so that any potential bias among the calculations is eliminated. Of course, the full elimination is not possible, so further adjustments and changes during our research were necessary.

During our research we calculated the EVA for each company from 2006 to 2015. Although the main topic of our project is the study of the performance of maritime companies during periods of low freight rates, we decided to expand the range of our research in order to observe, if possible, other fluctuations in the performance of shipping companies. So before we focus on periods where the market experienced a heavy downturn we have included two tables that show the calculated EVA for each company for each year and the difference from year to year.

Furthermore, we decided to calculate the aggregated EVA for all companies from 2006 to 2015 and see if the industry as a whole performed poorly during the periods indicated from

the indexes. As indicated in table 1, the industry as a whole did perform worse than any other year during these years.

The empty cells indicate that no data was found for the company either because the company provided no data for the year or because the company was still private at the time and consequently had no obligation to publish its financial statements.

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME					-49,587	-41,947	-49,098	-117,118	-80,045	-13,224
CAPITAL PRODUCT PARTNERS		-11,666	22,407	-14,928	-29,782	22,639	-71,798	33,218	-24,099	-27,335
DHT HOLDINGS	2,858	8,977	13,534	-9,990	-13,624	-61,499	-109,205	-21,103	-48,742	42,810
NORDIC AMERICAN TANKERS	-5,821	-29,526	72,432	-45,735	-55,332	-127,071	-115,621	-142,626	-53,534	77,112
SCORPIO TANKERS				-1,619	-21,753	-95,649	-46,383	-31,209	-54,151	112,579
TSAKOS ENERGY NAVIGATION	52,366	59,360	145,314	-47,558	-61,322	-168,313	-131,462	-144,345	-83,091	14,887
FRONTLINE LTD	623,600	351,051	738,315	163,949	819,810	846,594	-29,963	-135,166	-883	207,774
TEEKAY TANKERS	17,178	18,450	61,792	15,925	-9,558	-39,346	-374,782	-24,495	14,003	83,413
CONCORDIA MARITIME					-11,276	-12,598	-8,644	-17,696	-7,723	8,151
TORM	144,706	51,158	429,048	158,550	94,772	-378	-164,747	85,654	19,406	156,741
FIRST SHIP LEASE		-48,135	-33,643	-8,137	-18,409	-33,942	-15,604	-70,141	-12,267	-4,027
TOTAL	834,889	399,669	1,449,199	210,458	643,937	288,491	-1,117,307	-585,027	-331,127	658,882
DIFFERENCE FROM ONE YEAR BEFORE		-52.13%	262.60%	-85.48%	205.97%	-55.20%	-487.29%	47.64%	43.40%	298.98%

Table 1. Economic Value Added for each company separately and aggregated for all the companies together from 2006 to 2015

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME	-	-	-	-	-	15%	-17%	-139%	32%	83%
CAPITAL PRODUCT PARTNERS	-	-	292%	-167%	-100%	176%	-417%	146%	-173%	-13%
DHT HOLDINGS	-	214%	51%	-174%	-36%	-351%	-78%	81%	-131%	188%
NORDIC AMERICAN TANKERS	-	-407%	345%	-163%	-21%	-130%	9%	-23%	62%	244%
SCORPIO TANKERS	-	-	-	-	-1244%	-340%	52%	33%	-74%	308%
TSAKOS ENERGY NAVIGATION	-	13%	145%	-133%	-29%	-174%	22%	-10%	42%	118%
FRONTLINE LTD	-	-44%	110%	-78%	400%	3%	-104%	-351%	99%	23635%
TEEKAY TANKERS	-	7%	235%	-74%	-160%	-312%	-853%	93%	157%	496%
CONCORDIA MARITIME	-	-	-	-	-	-12%	31%	-105%	56%	206%
TORM	-	-65%	739%	-63%	-40%	-100%	-43534%	152%	-77%	708%
FIRST SHIP LEASE	-	-	30%	76%	-126%	-84%	54%	-350%	83%	67%

Table 2. Difference of Economic Value Added from year to year from 2006 to 2015

1st period:2008-2010

As has been explained in previous chapter, the first big fall in freight rates is noted in 2009. That year the average price of the Baltic Dirty Tanker Index declined sharply by 61.14% from 1498.83 points in 2008 to 582.42 points in 2009. Similarly the Baltic Clean Tanker Index plunged by 57.33% reaching an average of 490 points for 2009 while the average price for 2008 was 1149.

The table 4 shows the fluctuations of the calculated EVA. We have calculated the percent difference of EVA for the first year of low freight rates and one year after. In this way we try to show the impact of low spot prices to future revenues. To be more precise, the low spot prices influence the price of time-charter contracts in a negative for the shipping company way, because the term-charter contracts fall. As a result, the companies report low revenues and the calculated EVA fall. This phenomenon is obvious not only in table 4, but also in the first table of our presentation (table 1), where lower value of aggregated EVA is noted not only in the year of the sharp decrease, but also one year, or in some occasions two years afterwards.

The companies in green shading are the three largest companies in our sample for the period 2008-2010. We classify the companies by "size" by calculating the fixed assets of each company. We decided to use the fixed assets and not the total assets of each company because the value of fixed assets is a better of the fleet employed by the company to produce the revenues reported. That happens because the total assets includes the value of the current assets that might distort the real value of the company if the managers of the company has accumulated too much cash compared to other companies. Since this project focuses on evaluating companies according to their operational activities and considers all the operational values such as operational profit, operational revenues, fixed assets, it would be wrong to compare other measures than the strictly operational. In addition, maritime companies do invest usually in derivative products to manage their financial risk and the value of these products is usually calculated in current assets. Fixed assets, on the other hand, represent in most cases the closest value to the value of the vessels and for our purpose, which is the operational evaluation of the companies, this value is more useful. The value of fixed assets as obtained by the 20-F forms is given in table 3.

COMPANY	2008
CAPITAL PRODUCT PARTNERS	641,607.00
DHT HOLDINGS	462,387.00
NORDIC AMERICAN TANKERS	740,631.00
TSAKOS ENERGY NAVIGATION	2,209,317.00
FRONTLINE LTD	2,100,717.00
TEEKAY TANKERS	522,796.00
TORM	2,235,863.00
FIRST SHIP LEASE	845,187.00

Table 3. Fixed Assets for each company in 2008

COMPANY	difference 2009-2008	difference 2010-2008
NAVIOS MARITIME	-	-
CAPITAL PRODUCT PARTNERS	-166.62%	-232.92%
DHT HOLDINGS	-173.81%	-200.67%
NORDIC AMERICAN TANKERS	-163.14%	-176.39%
SCORPIO TANKERS	-	-
TSAKOS ENERGY NAVIGATION	-132.73%	-142.20%
FRONTLINE LTD	-77.79%	11.04%
TEEKAY TANKERS	-74.23%	-115.47%
CONCORDIA MARITIME	-	-
TORM	-63.05%	-77.91%
FIRST SHIP LEASE	75.81%	45.28%

Table 4. Economic Value Added fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
NAVIOS MARITIME	-	-	9
CAPITAL PRODUCT PARTNERS	6	7	8
DHT HOLDINGS	7	6	5
NORDIC AMERICAN TANKERS	4	8	10
SCORPIO TANKERS	-	-	7
TSAKOS ENERGY NAVIGATION	3	9	11
FRONTLINE LTD	1	1	1
TEEKAY TANKERS	5	3	6
CONCORDIA MARITIME	-	-	4
TORM	2	2	2
FIRST SHIP LEASE	8	5	6

Table 5. Company rankings according to EVA from 2008 to 2010

As can be seen in table 4, even big companies report significantly lower results during periods of low freight rates, despite the size of their fleet. Although two of the three biggest companies showed relatively better performance than the other companies for 2009, Tsakos Energy Foundation reported a highly negative value for 2009. Although, there are other companies that report similarly negative results, Tsakos Energy Navigation stands out because it was the only one of the big companies that could not bounce back in 2010. From classification table 5, it is obvious how much TEN was influenced by the crisis as it dropped from the 3rd position in 2008 to 9th position in 2009 and to 11th position in 2010, which is the last position among the rest of the companies for 2010. Torm followed more or less the same pattern with TEN, however Torm never reported negative EVA as TEN did already from 2009. As far as the other companies are concerned, the chart 2 illustrates the decline they experienced during this period with the exception of First Ship Lease which, however, reported steadily negative results. Frontline did not perform poorly during this period of crisis as it never reported negative EVA, being the only company to achieve that.

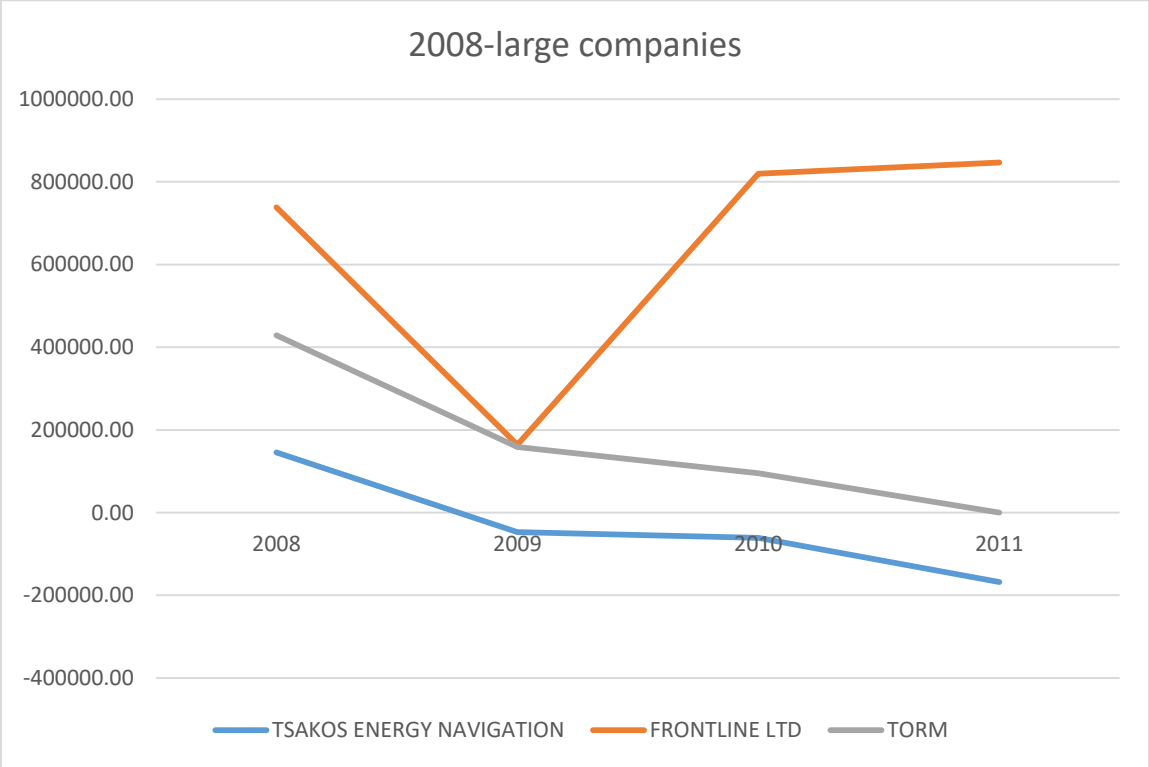

Chart 1. EVA from 2008 to 2011-Large companies

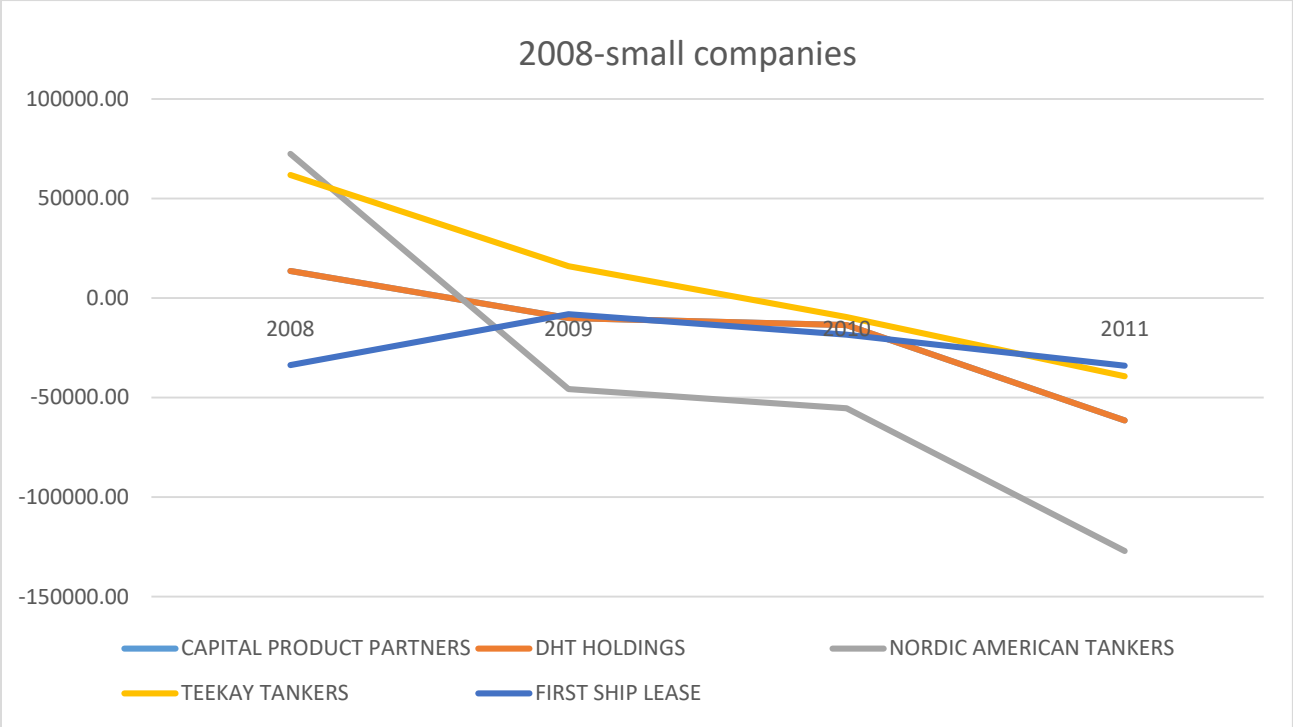

Chart 2. EVA from 2008 to 2011-Small companies

2nd period: 2011-2013

The choice of the next period we should study was more complicated because the two indexes (Clean and Dirty Tanker) declined during different periods. The Baltic Dirty Tanker Index declined in 2011 when it reached an average of 787 points from 886 in 2010, while the Baltic Clean Tanker Index declined by 13% in 2012 reaching an average of 647 points from 747 points in 2011. In order to decide which year we should consider the starting year of recession we used the table 1, where we had calculated the aggregate for all the companies together. As explained in previous paragraph the choice then became obvious as the EVA of 2012 was significantly lower than that of 2011. In particular, it was the first year from 2006 that the aggregate EVA was negative. The procedure we followed during this period was the same as previous, however, now the sample was greater and the classification different. Before the tables with the outcome of our research we include Table 6 which illustrates the new classification, according to the fixed assets of each company in 2011. As previously, the names of large companies are located in green cells.

COMPANY	2011
NAVIOS MARITIME	1,019,000.00
CAPITAL PRODUCT PARTNERS	1,073,986.00
DHT HOLDINGS	454,542.00
NORDIC AMERICAN TANKERS	1,022,793.00
SCORPIO TANKERS	322,457.00
TSAKOS ENERGY NAVIGATION	2,231,996.00
FRONTLINE LTD	1,334,512.00
TEEKAY TANKERS	716,567.00
CONCORDIA MARITIME	477,050.00
TORM	2,258,550.00
FIRST SHIP LEASE	784,696.00

Table 6. Fixed Assets for each company in 2011

Unlike the previous period we studied, during the period 2011-2013 the majority of the companies did not follow a specific trend but they hovered around the EVA they have achieved one year before the fall in freight rates. For 2012 all companies reported negative

EVA as a result of the fall in freight rates. It is worth mentioning, though, that the calculated EVA was already negative for most of the companies for year 2011, as the market had not never fully recovered from the crisis of 2009. Considering that the two indexes never returned to the level that they were before 2009, this is phenomenon was expected as the revenues of the companies never managed to fully recovered. So even the increase in some EVAs from 2011 to 2012 or to 2013 depict a decrease in losses and not an actual increase of value. Only two companies, Capital Product Tankers and Torm, achieved a positive EVA in 2013.

Another interesting fact illustrated in table 7 and in charts 3 and 4 is the fact that most of the companies had different many fluctuations from 2011 to 2013 as far as its EVA is concerned. That's an indication that the managers of the companies were more prepared for a potential downfall than they were back in 2009 and they followed different strategies. Of course, that is completely logical if we consider that in 2011 the indexes hovered around 750 points, while in 2008 the indexes hovered around 1500 points. The low freight rates must have kept the owners in alert in case of another crisis as the damage would be greater this time, because of the highly negative results.

Table 8 highlights the volatile environment that the market has been experiencing during this period. We can see that the classification has changed a number of times, but the most interesting fact is that this time we have many shifts and usually long shifts for all the companies regardless of their size.

COMPANY	difference 2012-2011	difference 2013-2011
NAVIOS MARITIME	-17.05%	-179.21%
CAPITAL PRODUCT PARTNERS	-417.14%	46.73%
DHT HOLDINGS	-77.57%	65.69%
NORDIC AMERICAN TANKERS	9.01%	-12.24%
SCORPIO TANKERS	51.51%	67.37%
TSAKOS ENERGY NAVIGATION	21.89%	14.24%
FRONTLINE LTD	-103.54%	-115.97%
TEEKAY TANKERS	-852.54%	37.74%
CONCORDIA MARITIME	31.38%	-40.47%
TORM	-43534.25%	22786.12%
FIRST SHIP LEASE	54.03%	-106.65%

Table 7. Economic Value Added fluctuations from 2011 to 2013

COMPANY	2011	2012	2013
NAVIOS MARITIME	7	5	8
CAPITAL PRODUCT PARTNERS	2	6	2
DHT HOLDINGS	8	7	4
NORDIC AMERICAN TANKERS	10	8	10
SCORPIO TANKERS	9	4	6
TSAKOS ENERGY NAVIGATION	11	9	11
FRONTLINE LTD	1	3	9
TEEKAY TANKERS	6	11	5
CONCORDIA MARITIME	4	1	3
TORM	3	10	1
FIRST SHIP LEASE	5	2	7

Table 8. Company rankings according to EVA from 2011 to 2013

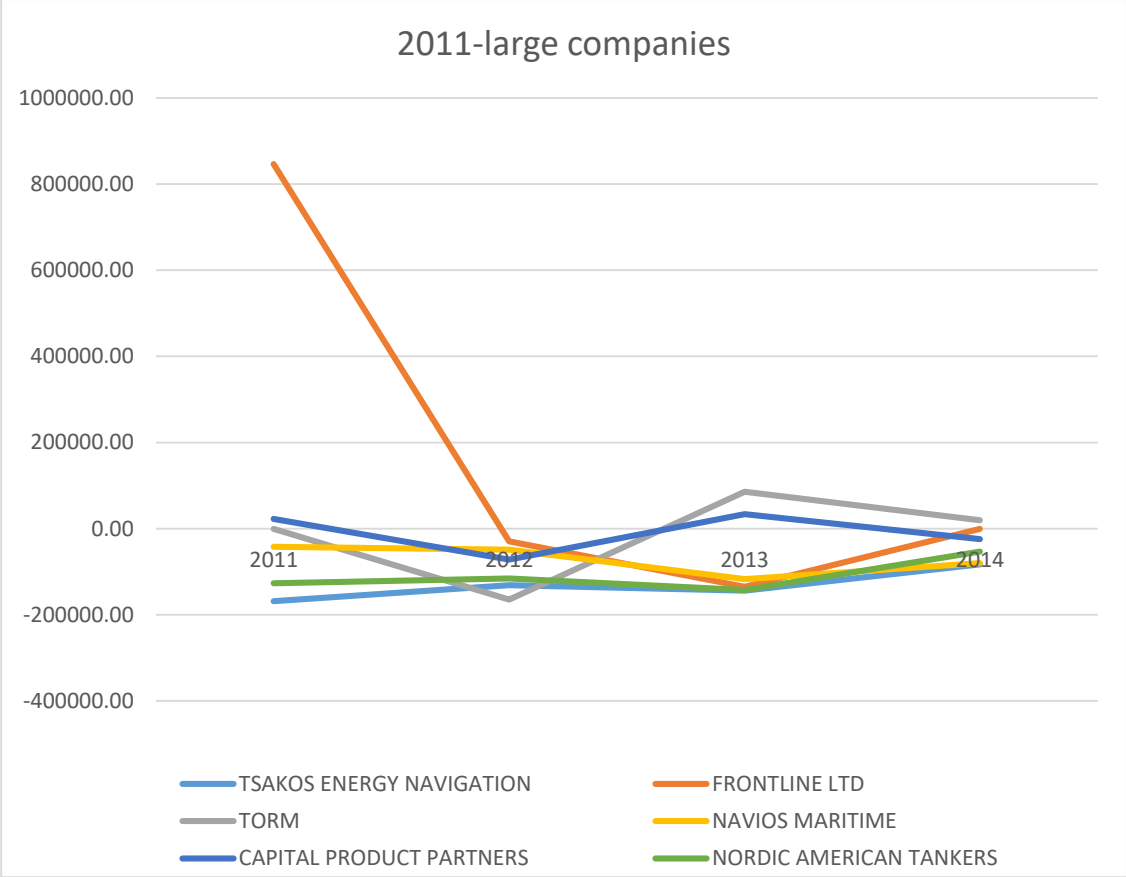

Chart 3. EVA from 2011 to 2014-Large companies

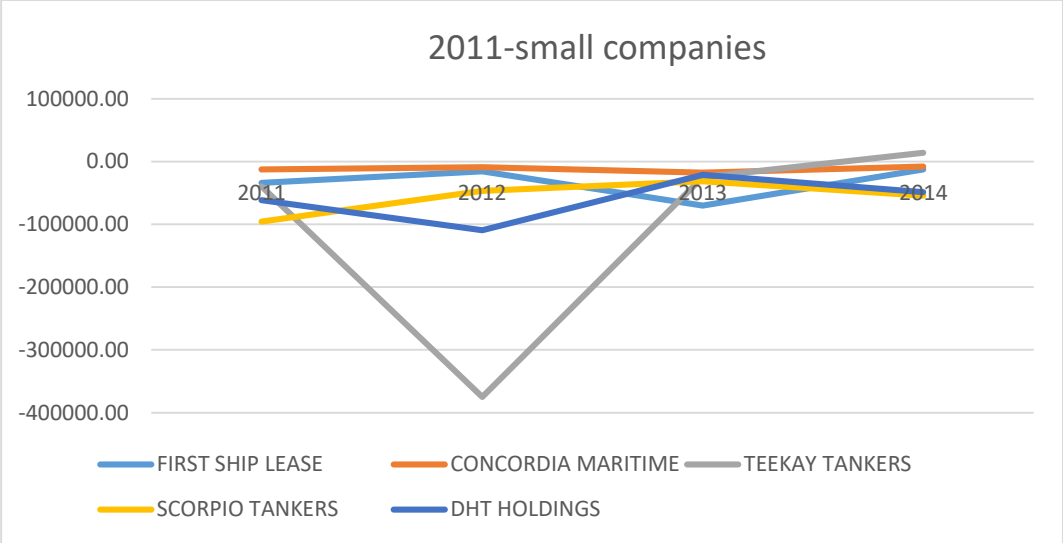

Chart 4. EVA from 2011to 2014-Small companies

6.1.2 Results of Altman Z - Score

The procedure described in the previous paragraph for the evaluation of shipping companies with EVA is the same we followed for the evaluation with Altman Z-score. We calculated the Altman Z-score for all the companies from 2006 to 2015 but for detailed analysis we focused on terms 2008-2010 and 2011-2013, when the indexes experienced the biggest declines as has been described.

Unlike EVA, that highlighted the poor performance of the industry during 2009, 2011 and the years afterwards, Z-score could not illustrate the poor performance of the industry or even of each company separately. That happened for two main reasons. The first has to do with the fact that since the ratios have different coefficients and the companies do business in a highly volatile environment, where the revenues can deviate way more than in other industries, the potential decrease in one ratio with a low coefficient can match a potential increase in another ratio with a high coefficient. For example, when the company reports low Earnings Before Interest Taxes (EBIT) and the ratio EBIT to Assets falls, an increase in working capital or a decrease in assets can manipulate the Z-score. Another issue is the volatile environment of maritime business. Altman Z-score formula is more suitable for companies that present a stability as far as their operation is concerned, a situation completely different than the one that maritime companies have to deal with. Maritime environment demands instant decision-making and constant evaluation of the condition of the market before apply a particular strategy. So except the volatility in revenues and earnings, the assets, the retained earnings, the market value of equity fluctuate irregularly based on the strategy that the managers follow. In this situation Z-score cannot predict financial distress as it would in other occasions where the companies examined present more stable financial data.

As explained in previous chapter due to the high leveraged companies that we study we expected very low Z-scores. However, what we wanted to examine from the beginning of the project was not the values for each year separately but the fluctuations from year to year. Besides, especially in maritime business the prediction of bankruptcy is tough. Since shipping tends to be cyclical, investors comprehend that their investors will experience

many low points as well as many high points. So investors, lenders and creditors usually show patience before they dumped their shares. Creditors and lenders, who usually are the ones who provoke a bankruptcy, have in many occasions extend the payback period of the companies so that companies have the time to find and apply new strategies in order to lower their debt. Of course, that kind of situations, although very common in business world, cannot be predicted by Z-score. That is the reason Z-score cannot be considered as a reliable indication of financial distress in maritime but only as a measure to compare different companies.

Since we could not reach safe conclusions by the analysis of the fluctuations of Z-score, we tried to examine the ranking table for each period and see if there is a pattern from year to year for the companies examined. As we will explain in the next pages, Z-score tends to give more stable results in the rank of the companies than EVA did. Further analysis for that data will be given in next paragraphs.

Starting from the first period, 2008-2011, table 10 illustrates that during the years of low freight rates there were not big changes in the companies' rankings. Regardless of their size, the companies did not show large shifts from their initial position in 2008. The biggest shift was noted for three companies: Tsakos Energy Navigation, Torm and First Ship Lease that shifted from 5^{th}, 6^{th} and 8^{th} place to 8th, 9th and 11^{th} place respectively. The most striking feature of the table, however, is that the top 4 teams for all 3 years were the same 4 with some changes of positions. These top 4 companies were Nordic American Tankers, Frontline Ltd, Teekay Tankers and DHT Holdings.

During the next term we observe a similar picture as most of the companies did not experience large shifts. The only exceptions were Scorpio Tankers and Concordia Maritime. Scorpio Tankers improved impressively its Z-score (compared to other companies) as it climbed from 8^{th} place in 2011 to 2^{nd} place in 2013. On the hand, Concordia Maritime lost 5 positions falling from the 4^{th} place in 2011 to 9^{th} in 2013.

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME					0.25	0.39	0.42	0.60	0.76	0.78
CAPITAL PRODUCT PARTNERS		1.02	0.92	0.92	0.96	0.54	1.07	1.34	1.23	1.09
DHT HOLDINGS	14.08	8.22	4.72	4.63	6.57	0.07	-0.16	0.80	0.75	1.34
NORDIC AMERICAN TANKERS	2.83	4.79	27.41	63.71	8.24	1.29	0.93	1.36	2.24	2.77
SCORPIO TANKERS				0.41	0.90	0.24	1.39	4.85	0.76	0.74
TSAKOS ENERGY NAVIGATION	1.38	1.43	1.22	0.91	0.74	0.44	0.43	0.50	0.65	0.95
FRONTLINE LTD	11.75	17.37	11.85	12.89	10.55	2.70	2.57	5.72	4.97	3.74
TEEKAY TANKERS	0.91	2.29	1.28	1.24	1.07	0.76	-0.33	0.72	1.05	1.00
CONCORDIA MARITIME					0.78	0.75	0.23	0.49	0.50	0.70
TORM	6.32	2.62	1.16	0.76	0.38	-0.69	0.08	0.45	0.69	0.25
FIRST SHIP LEASE		0.11	0.12	0.15	0.10	0.05	0.07	-0.97	0.16	0.24
TOTAL	37.26	37.85	48.69	85.61	30.53	6.54	6.71	15.85	13.76	13.60
DIFFERENCE FROM ONE YEAR BEFORE		1.58%	28.63%	75.83%	-64.33%	-78.58%	2.53%	136.29%	-13.20%	-1.14%

Table 9. Altman Z-score for each company separately and aggregated for all the companies together from 2006 to 2015

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME	-	-	-	-	-	55.60%	7.12%	41.43%	27.44%	3.10%
CAPITAL PRODUCT PARTNERS	-	-	-9.49%	-0.96%	4.53%	-43.23%	97.59%	24.75%	-8.07%	-11.09%
DHT HOLDINGS	-	-41.65%	-42.59%	-1.88%	41.89%	-98.99%	-340.26%	602.54%	-6.92%	78.77%
NORDIC AMERICAN TANKERS	-	69.50%	472.07%	132.42%	-87.06%	-84.40%	-27.94%	46.28%	65.27%	23.52%
SCORPIO TANKERS	-	-	-	-	120.10%	-72.93%	470.87%	248.46%	-84.42%	-2.04%
TSAKOS ENERGY NAVIGATION	-	4.12%	-14.75%	-25.69%	-18.61%	-41.05%	-1.87%	16.90%	31.11%	45.44%
FRONTLINE LTD	-	47.84%	-31.77%	8.78%	-18.19%	-74.38%	-4.72%	122.12%	-13.08%	-24.80%
TEEKAY TANKERS	-	150.73%	-43.98%	-3.30%	-13.45%	-29.20%	-143.37%	318.32%	45.90%	-4.39%
CONCORDIA MARITIME	-	-	-	-	-	-3.77%	-69.06%	110.94%	2.02%	39.84%
TORM	-	-58.52%	-55.78%	-34.85%	-49.69%	-281.50%	111.15%	487.76%	53.63%	-64.02%
FIRST SHIP LEASE	-	-	6.28%	22.42%	-33.37%	-46.75%	37.55%	-1432.49%	116.13%	52.40%

Table 10. Difference Altman Z-score from year to year from 2006 to 2015

1st period: 2008-2010

COMPANY	difference 2009-2008	difference 2010-2008
NAVIOS MARITIME	-	-
CAPITAL PRODUCT PARTNERS	-0.96%	3.53%
DHT HOLDINGS	-1.88%	39.22%
NORDIC AMERICAN TANKERS	132.42%	-69.93%
SCORPIO TANKERS	-	-
TSAKOS ENERGY NAVIGATION	-25.69%	-39.52%
FRONTLINE LTD	8.78%	-11.01%
TEEKAY TANKERS	-3.30%	-16.31%
CONCORDIA MARITIME	-	-
TORM	-34.85%	-67.22%
FIRST SHIP LEASE	22.42%	-18.43%

Table 11. Z-score fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
NAVIOS MARITIME	-	-	10
CAPITAL PRODUCT PARTNERS	7	5	5
DHT HOLDINGS	3	3	3
NORDIC AMERICAN TANKERS	1	1	2
SCORPIO TANKERS	-	8	6
TSAKOS ENERGY NAVIGATION	5	6	8
FRONTLINE LTD	2	2	1
TEEKAY TANKERS	4	4	4
CONCORDIA MARITIME	-	-	7
TORM	6	7	9
FIRST SHIP LEASE	8	9	11

Table 12. Company rankings according to Z-score from 2008 to 2010

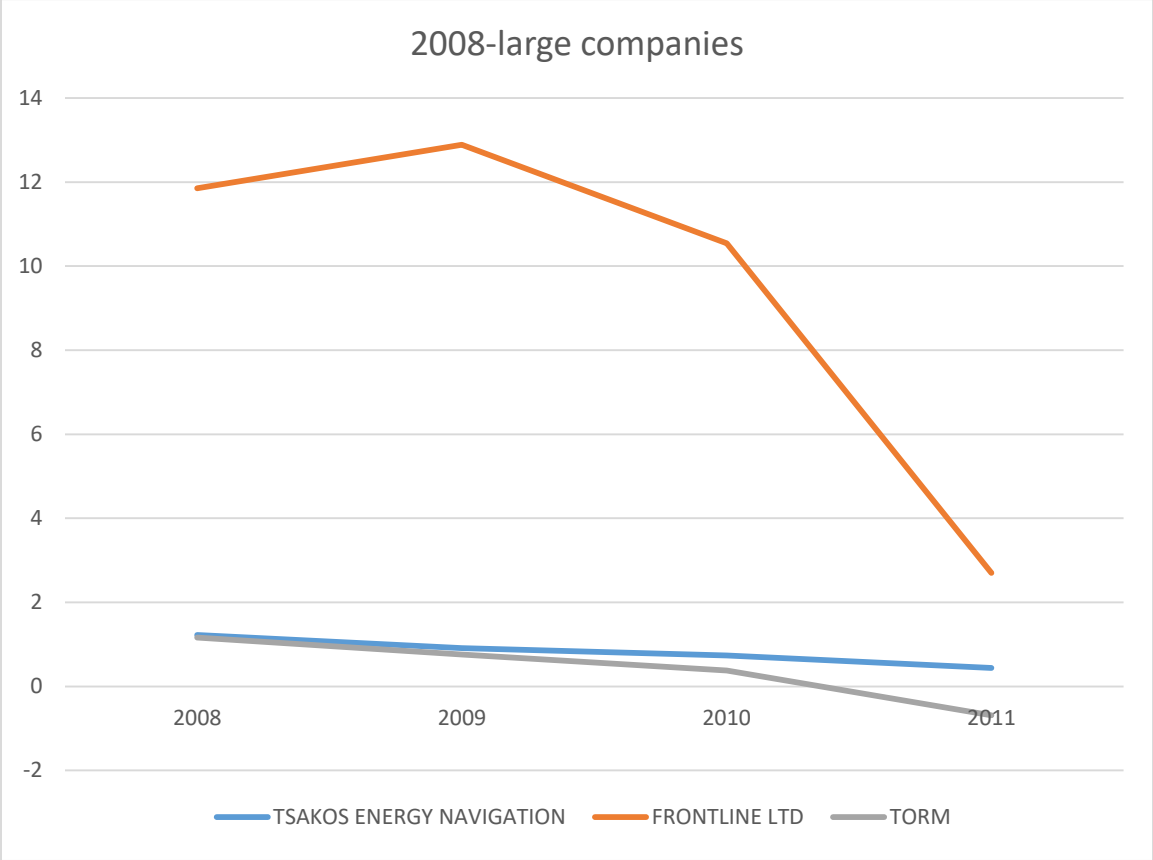

Chart 5. Z-score from 2008 to 2011-Large companies

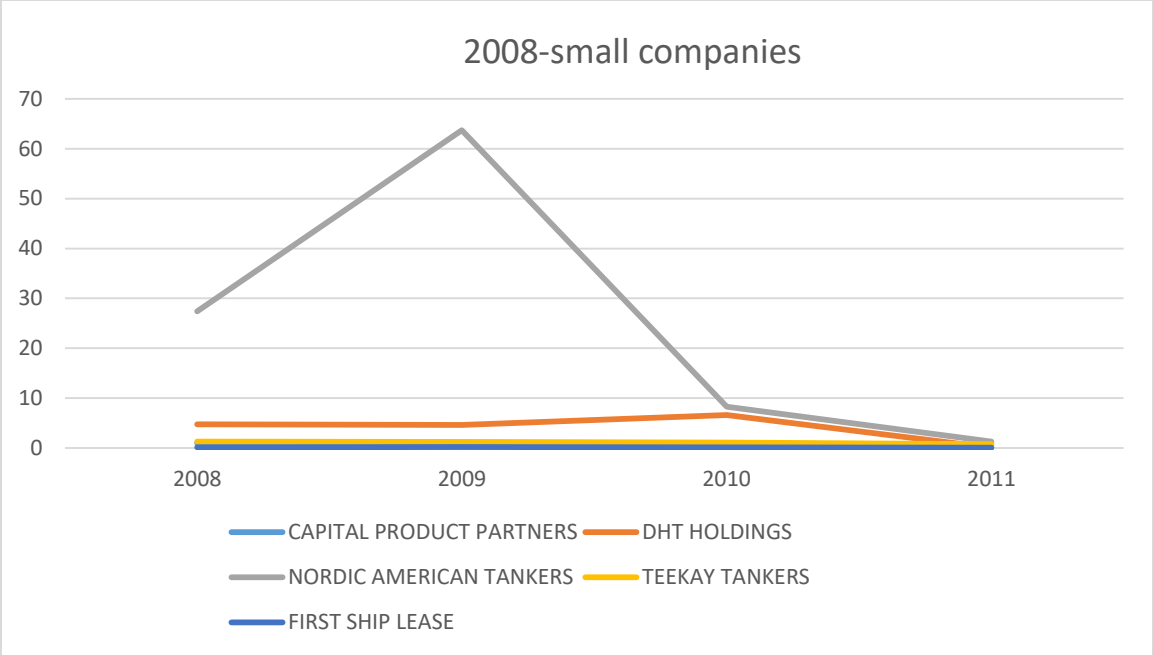

Chart 6. Z-score from 2008 to 2011-Small companies

2nd period: 2011-2013

COMPANY	difference 2012-2011	difference 2013-2011
NAVIOS MARITIME	7.12%	51.51%
CAPITAL PRODUCT PARTNERS	97.59%	146.50%
DHT HOLDINGS	-340.26%	1107.41%
NORDIC AMERICAN TANKERS	-27.94%	5.41%
SCORPIO TANKERS	470.87%	1889.25%
TSAKOS ENERGY NAVIGATION	-1.87%	14.71%
FRONTLINE LTD	-4.72%	111.63%
TEEKAY TANKERS	-143.37%	-5.32%
CONCORDIA MARITIME	-69.06%	-34.74%
TORM	111.15%	165.51%
FIRST SHIP LEASE	37.55%	-1932.84%

Table 13. Z-score fluctuations from 2011 to 2013

COMPANY	2011	2012	2013
NAVIOS MARITIME	7	6	7
CAPITAL PRODUCT PARTNERS	5	3	4
DHT HOLDINGS	9	10	5
NORDIC AMERICAN TANKERS	2	4	3
SCORPIO TANKERS	8	2	2
TSAKOS ENERGY NAVIGATION	6	5	8
FRONTLINE LTD	1	1	1
TEEKAY TANKERS	3	11	6
CONCORDIA MARITIME	4	7	9
TORM	11	8	10
FIRST SHIP LEASE	10	9	11

Table 14. Company rankings according to Z-score from 2011 to 2013

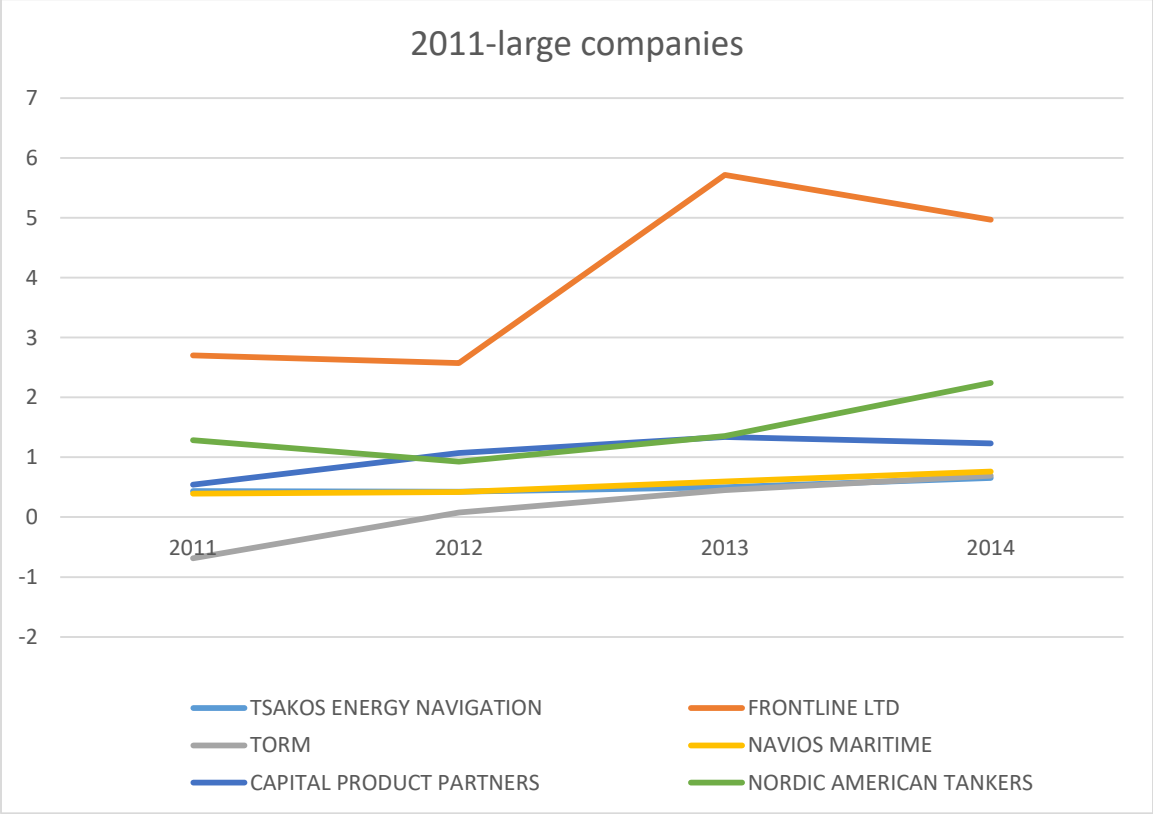

Chart 7. Z-score from 2011 to 2014-Large companies

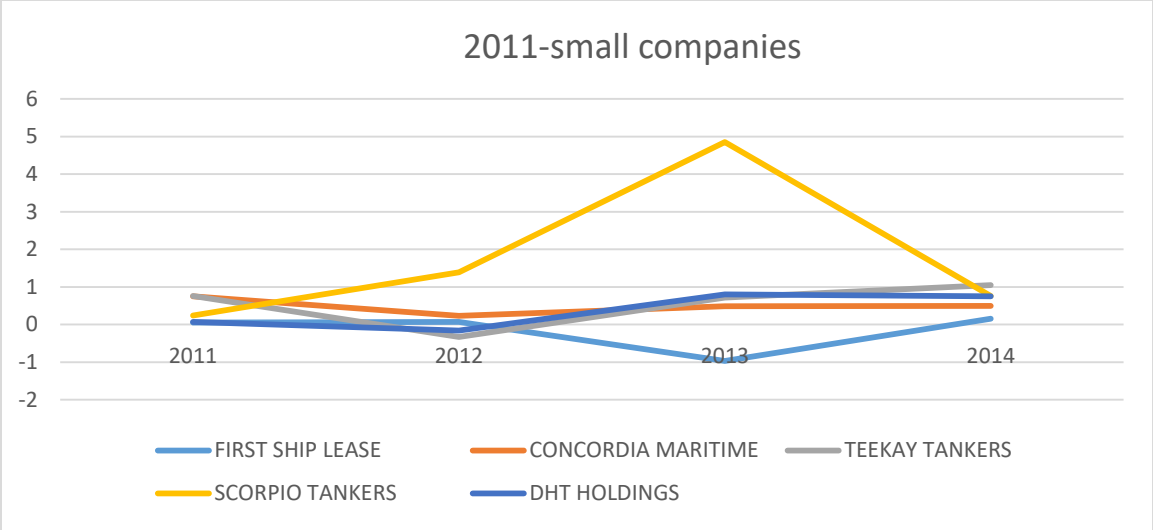

Chart 8. Z-score from 2011 to 2014-Small companies

6.1.3 Results of 1st model of DEA

As explained during the DEA valuation we used two models. The first model is an input-oriented model that focuses on how much inputs of a company can be reduced without affecting the outputs. Its target is to examine the efficiency of the shipping companies as far as the income creation is concerned.

During the analysis we used three items from the balance sheet. As input units we used "assets" and "operating cost" as they are defined in the balance sheet and the income statement respectively. On the other hand, as output we used the "revenues". As has been explained from the beginning of this project we evaluate the strictly shipping procedures of each company, which means that each value refers to shipping business. To elaborate, as "assets", we used the "fixed assets" as reported by each company and as "revenues" we used only the revenues that came from chartering. Revenues is the first item reported by each company in the beginning of the income statement, however, it should be mentioned that shipping companies might have revenues from other sources that should be excluded for the purpose of this project. For example, all shipping companies use derivative products, such as swaps, that, in case it is profitable, they are sold. Any profit or revenue coming from this activity should not be added in the "revenues" used as an output during this study. As far as the operating cost is concerned we used the value as reported in income statement for each company without any adjustments.

For the results obtained by this method we calculated the *standard deviation*, a measure that we did not include in the analysis of the results obtained by the previous methods. This measure is used to quantify the amount of variation or dispersion of the results. In the results of the previous methods we could not use this measure to reach any conclusion as the size effect of each company influenced significantly the final result in both EVA and Z-score calculations for various reasons. As will explained in the next paragraphs the calculation of standard deviation led us to some safe conclusions.

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME					100.00%	100.00%	100.00%	100.00%	100.00%	97.16%
CAPITAL PRODUCT PARTNERS		100.00%	92.79%	88.51%	100.00%	74.10%	76.09%	71.42%	63.33%	53.74%
DHT HOLDINGS	100.00%	100.00%	100.00%	82.76%	94.54%	62.46%	51.61%	71.44%	53.12%	71.63%
NORDIC AMERICAN TANKERS	86.73%	81.21%	93.52%	48.19%	67.90%	34.96%	52.37%	100.00%	100.00%	100.00%
SCORPIO TANKERS				100.00%	66.13%	50.61%	72.76%	64.34%	55.97%	100.00%
TSAKOS ENERGY NAVIGATION	100.00%	100.00%	94.59%	79.06%	91.90%	68.69%	81.20%	69.91%	100.00%	78.00%
FRONTLINE LTD	100.00%	100.00%	100.00%	100.00%	100.00%	84.75%	86.97%	76.59%	100.00%	61.05%
TEEKAY TANKERS	100.00%	100.00%	94.20%	100.00%	89.66%	100.00%	37.69%	70.22%	67.51%	78.56%
CONCORDIA MARITIME					100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
TORM	52.91%	82.90%	100.00%	100.00%	95.87%	100.00%	100.00%	100.00%	96.41%	100.00%
FIRST SHIP LEASE		100.00%	83.93%	72.91%	80.49%	56.62%	84.98%	49.00%	54.45%	53.41%
AVERAGE	89.94%	95.51%	94.88%	85.71%	89.68%	75.65%	76.70%	79.36%	80.98%	81.23%
STANDARD DEVIATION	17.25%	7.78%	5.07%	16.50%	12.08%	22.00%	20.41%	16.94%	20.55%	18.36%
DIFFERENCE FROM ONE YEAR BEFORE		6.20%	-0.66%	-9.66%	4.63%	-15.64%	1.38%	3.47%	2.05%	0.31%

Table 16. Efficiency scores for each company separately and relevant statistics for all the companies together from 2006 to 2015

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME		-	-	-	-	0.00%	0.00%	0.00%	0.00%	-2.84%
CAPITAL PRODUCT PARTNERS		-	-7.21%	-4.61%	12.98%	-25.90%	2.69%	-6.14%	-11.33%	-15.14%
DHT HOLDINGS		0.00%	0.00%	-17.24%	14.23%	-33.93%	-17.37%	38.42%	-25.64%	34.85%
NORDIC AMERICAN TANKERS		-6.36%	15.16%	-48.47%	40.90%	-48.51%	49.80%	90.95%	0.00%	0.00%
SCORPIO TANKERS		-	-	-	-33.87%	-23.47%	43.77%	-11.57%	-13.01%	78.67%
TSAKOS ENERGY NAVIGATION		0.00%	-5.41%	-16.42%	16.24%	-25.26%	18.21%	-13.90%	43.04%	-22.00%
FRONTLINE LTD		0.00%	0.00%	0.00%	0.00%	-15.25%	2.62%	-11.94%	30.57%	-38.95%
TEEKAY TANKERS		0.00%	-5.80%	6.16%	-10.34%	11.53%	-62.31%	86.31%	-3.86%	16.37%
CONCORDIA MARITIME		-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%
TORM		56.68%	20.63%	0.00%	-4.13%	4.31%	0.00%	0.00%	-3.59%	3.72%
FIRST SHIP LEASE		-	-16.07%	-13.13%	10.40%	-29.66%	50.09%	-42.34%	11.12%	-1.91%

Table 17. Efficiency scores' fluctuations from year to year from 2006 to 2015

1st period: 2008-2010

Starting from the first 3-year period, the industry average performance has obviously decreased from 94.88% in 2008 to 85.71% in 2009 before recover a bit in 2010 to reach 89.68%. That's the second biggest decrease during the 10-year period we examined [2].

Another interesting fact is the change in the calculated standard deviation. For fiscal year 2008 the standard deviation was 5.07%, the lowest during the period 2006-2015. From 2011, however, the standard deviation is always over 10%, depicting the dispersion of the results of DEA. For 2008 there was no company with result under 80% while in 2009 3 shipping companies achieved result under 80%. One of them, Nordic American Tankers, reported a record low of 48.19%, too. For 2010 the performance was clearly improved as from the enhanced sample of 11 companies only two were under the 80% and the industry average increased by 4.63% to reach 89.68%. Overall, we can say that with the exception of Torm and Teekay Tankers, all companies bounced back during 2010. This is clearly illustrated in table 18 as well as in charts 7, 8.

COMPANY	difference 2009-2008	difference 2010-2008
NAVIOS MARITIME	-	-
CAPITAL PRODUCT PARTNERS	-4.61%	7.77%
DHT HOLDINGS	-17.24%	-5.46%
NORDIC AMERICAN TANKERS	-48.47%	-27.40%
SCORPIO TANKERS	-	-
TSAKOS ENERGY NAVIGATION	-16.42%	-2.84%
FRONTLINE LTD	0.00%	0.00%
TEEKAY TANKERS	6.16%	-4.82%
CONCORDIA MARITIME	-	-
TORM	0.00%	-4.13%
FIRST SHIP LEASE	-13.13%	-4.10%

Table 18. 1st DEA model fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
NAVIOS MARITIME	-	-	1
CAPITAL PRODUCT PARTNERS	7	5	2
DHT HOLDINGS	1	6	6
NORDIC AMERICAN TANKERS	6	9	10
SCORPIO TANKERS	-	1	11
TSAKOS ENERGY NAVIGATION	4	7	7
FRONTLINE LTD	2	2	3
TEEKAY TANKERS	5	3	8
CONCORDIA MARITIME	-	-	4
TORM	3	4	5
FIRST SHIP LEASE	8	8	9

Table 19. Company rankings according to 1st DEA model from 2008 to 2010

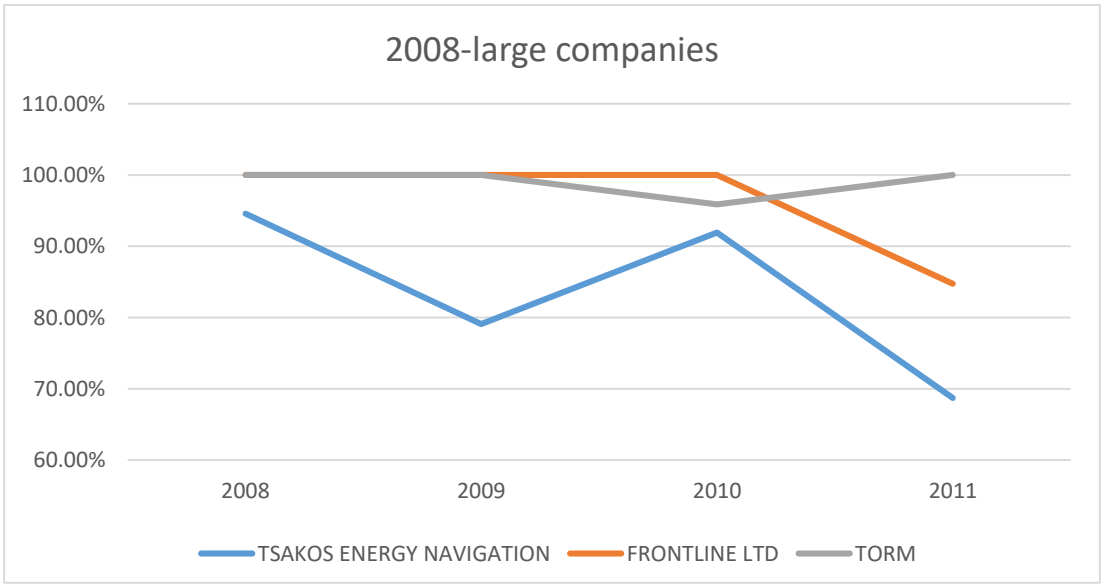

Chart 7. 1st DEA model from 2008 to 2011-Large companies

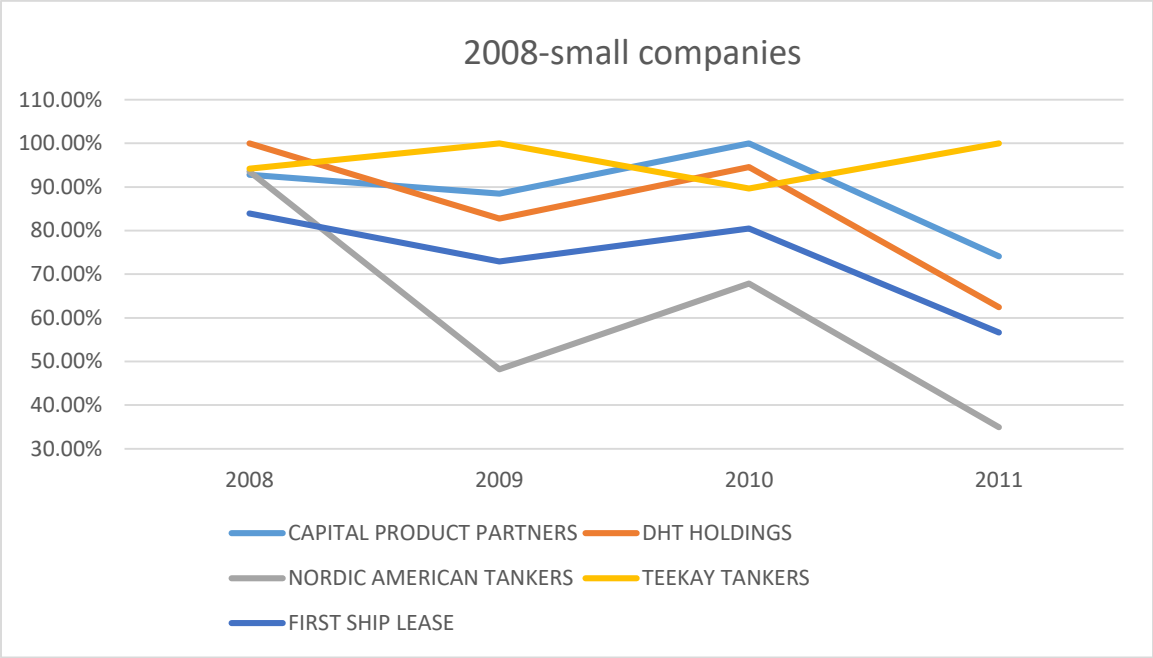

Chart 8. 1st DEA model from 2008 to 2011-Small companies

2nd period: 2011-2013

Unlike other methods, the 1st model of DEA did not give the excepted results for the second 3-year period we examined. To be more specific, the outcomes for 2012 and 2013 were not lower than these for 2011, a phenomenon that we had not detected when used EVA as valuation method (or Z-score). As indicated by table 16 the industry average was almost the same in 2011 and 2012 (75.65 % and 76.7 % respectively) as well as the calculated standard deviation for each year. Table 20 illustrates mixed movements for each one of the 11 companies we have concluded in the sample. Many companies seem to have delivered steady positive results (Concordia Maritime, Torm, Navios Maritime), but the rest of the companies experienced either positive or negative movements in their efficiency scores.

After further research about the low scores for 2011, we reached the conclusion that this distortion in our data was created by the increased operating costs that all shipping companies reported for 2011. These data can be found in table A.8 of appendix. It is obvious that in 2011 and 2012 all companies reported increased operating costs compared to the costs of 2009 and 2010. Moreover, the average operating cost for both 2011 and 2012 just surpassed the 300,000. That had not happened for 3 years; since 2008, just before the first big fall of freight rates. Of course the difference is that back then in 2008 the indexes fluctuated around 1500 points, while now the indexes hovered around 600 points, so the revenues are significantly lower and the companies cannot be as effective as they were in 2008. That's the reason DEA has not performed for this period. Of course, it is important to mention that the previous methods could not detect that phenomenon. Here, in the first model of DEA where we use operating costs as input, it is easier to see the impact of the high operating costs. According to sources found in the Internet (mostly articles and interviews with shipping experts) the basic reasons for this rise were the increased crew cost, the rising cost of lubricants, maintenance and spare parts and increased cost of insurance. The modifications that many propulsion systems had to undergo during this period might have had an impact as well.

COMPANY	difference 2012-2011	difference 2013-2011
NAVIOS MARITIME	0.00%	0.00%
CAPITAL PRODUCT PARTNERS	2.69%	-3.62%
DHT HOLDINGS	-17.37%	14.38%
NORDIC AMERICAN TANKERS	49.80%	186.04%
SCORPIO TANKERS	43.77%	27.13%
TSAKOS ENERGY NAVIGATION	18.21%	1.78%
FRONTLINE LTD	2.62%	-9.63%
TEEKAY TANKERS	-62.31%	-29.78%
CONCORDIA MARITIME	0.00%	0.00%
TORM	0.00%	0.00%
FIRST SHIP LEASE	50.09%	-13.46%

Table 20. 1st DEA model fluctuations from 2011 to 2013

COMPANY	2011	2012	2013
NAVIOS MARITIME	1	1	1
CAPITAL PRODUCT PARTNERS	6	7	7
DHT HOLDINGS	8	10	6
NORDIC AMERICAN TANKERS	11	9	2
SCORPIO TANKERS	10	8	10
TSAKOS ENERGY NAVIGATION	7	6	9
FRONTLINE LTD	5	4	5
TEEKAY TANKERS	2	11	8
CONCORDIA MARITIME	3	2	3
TORM	4	3	4
FIRST SHIP LEASE	9	5	11

Table 21. Company rankings according to 1st DEA model from 2011 to 2013

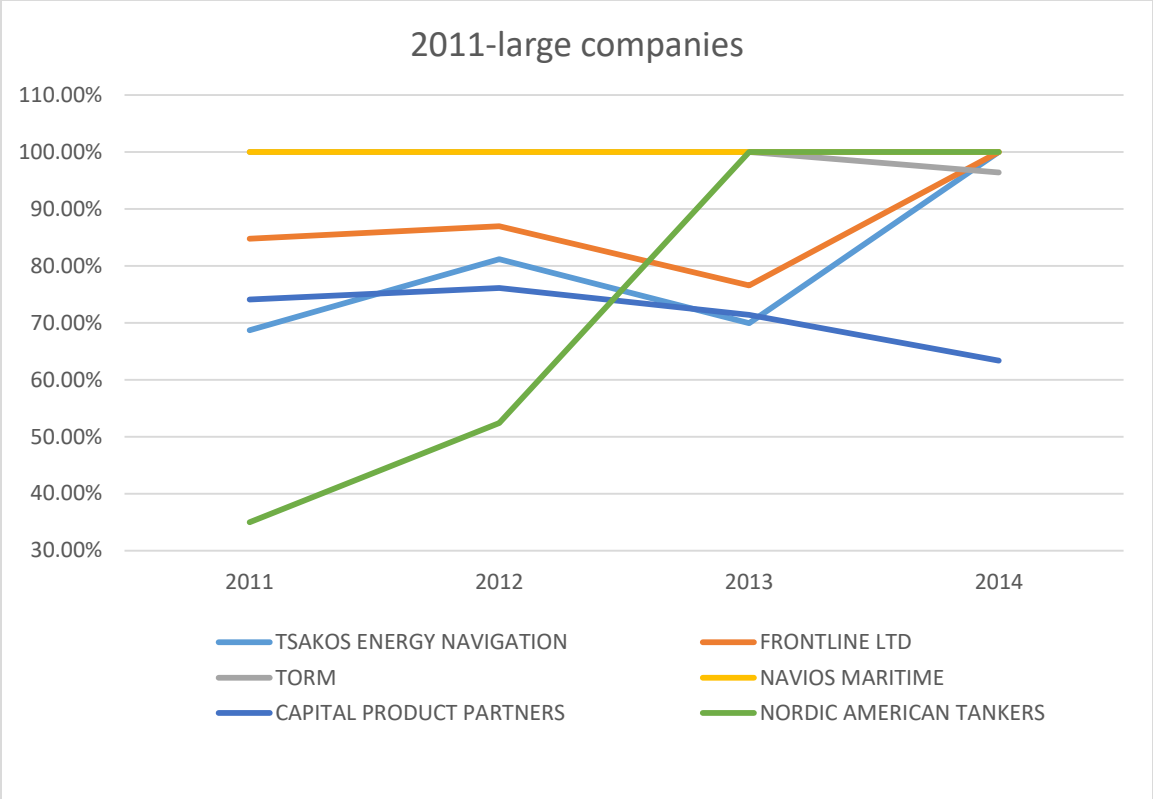

Chart 9. 1st DEA model from 2011 to 2014-Large companies

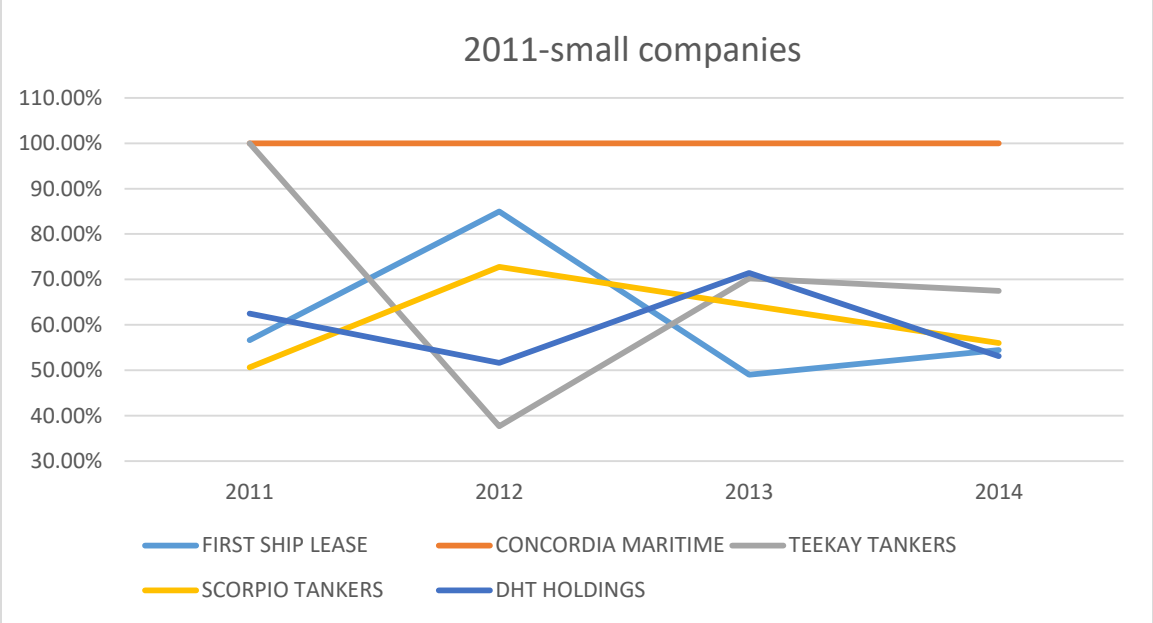

Chart 10. 1st DEA model from 2011to 2014 - Small companies

6.1.4 Results of 2nd model of DEA

The second model of DEA we used was similar to the first model in terms of orientation and number of data used. We used again an input-oriented model where we had two input units and one output unit. However, this model was more specific than the previous and examined the efficiency of shipping companies by evaluating the ability to make profit as a result of the utilization of the ships.

To be more specific, we used as input the value of the vessels and the operating cost of the vessels, while the output unit for this model was the gross profit created. All the units used in this model are subunits of the units used in the first DEA model. In order to obtain the necessary data we used the balance sheet and the income statement published by each company for the 10-year period 2006-2015, as we have done for the rest of the project. In this model, however, there were some occasions where we should make some adjustments or further calculations before we obtained the necessary values.

As far as the results are concerned, in some cases this model produced results of almost 0% efficiency because some companies reported losses instead of profit for a number of years.

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME					99.65%	100.00%	100.00%	100.00%	75.66%	68.75%
CAPITAL PRODUCT PARTNERS		100.00%	69.26%	77.69%	100.00%	43.45%	6.09%	41.26%	31.54%	24.47%
DHT HOLDINGS	100.00%	84.45%	100.00%	68.40%	73.89%	0.72%	0.99%	4.89%	13.22%	46.39%
NORDIC AMERICAN TANKERS	83.38%	57.24%	76.76%	16.74%	1.46%	0.33%	0.32%	100.00%	100.00%	100.00%
SCORPIO TANKERS				24.29%	5.35%	1.02%	0.77%	38.33%	26.48%	100.00%
TSAKOS ENERGY NAVIGATION	100.00%	100.00%	50.56%	20.30%	34.31%	0.15%	1.10%	2.53%	14.96%	26.09%
FRONTLINE LTD	100.00%	98.98%	100.00%	78.34%	100.00%	0.25%	0.26%	0.29%	0.22%	58.34%
TEEKAY TANKERS	84.64%	100.00%	75.67%	100.00%	65.58%	100.00%	0.35%	17.31%	32.55%	35.61%
CONCORDIA MARITIME					100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
TORM	45.69%	81.90%	100.00%	58.30%	100.00%	25.43%	100.00%	100.00%	42.56%	50.19%
FIRST SHIP LEASE		43.79%	55.83%	100.00%	73.34%	6.43%	56.05%	0.66%	22.87%	19.67%
AVERAGE	85.62%	83.30%	78.51%	60.45%	68.51%	34.34%	33.27%	45.93%	41.82%	57.23%
Standard Deviation	19.24%	20.39%	18.63%	30.99%	36.50%	42.22%	43.70%	42.95%	32.99%	29.71%
DIFFERENCE FROM ONE YEAR BEFORE		-2.71%	-5.74%	-23.00%	13.33%	-49.87%	-3.14%	38.08%	-8.95%	36.83%

Table 22. Efficiency scores for each company separately and aggregated for all the companies together from 2006 to 2015

COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME		-	-	-	-	0.35%	0.00%	0.00%	-24.34%	-9.13%
CAPITAL PRODUCT PARTNERS		-	-30.74%	12.17%	28.72%	-56.55%	-85.98%	577.50%	-23.56%	-22.42%
DHT HOLDINGS		-15.55%	18.41%	-31.60%	8.03%	-99.03%	37.50%	393.94%	170.35%	250.92%
NORDIC AMERICAN TANKERS		-31.35%	34.10%	-78.19%	-91.28%	-77.40%	-3.03%	31150.00%	0.00%	0.00%
SCORPIO TANKERS		-	-	-	-77.97%	-80.93%	-24.51%	4877.92%	-30.92%	277.64%
TSAKOS ENERGY NAVIGATION		0.00%	-49.44%	-59.85%	69.01%	-99.56%	633.33%	130.00%	491.30%	74.38%
FRONTLINE LTD		-1.02%	1.03%	-21.66%	27.65%	-99.75%	4.00%	11.54%	-24.14%	26419.01%
TEEKAY TANKERS		18.15%	-24.33%	32.15%	-34.42%	52.49%	-99.65%	4845.71%	88.04%	9.40%
CONCORDIA MARITIME		-	-	-	-	0.00%	0.00%	0.00%	0.00%	0.00%
TORM		79.25%	22.10%	-41.70%	71.53%	-74.57%	293.24%	0.00%	-57.44%	17.93%
FIRST SHIP LEASE		-	27.49%	79.12%	-26.66%	-91.23%	771.70%	-98.82%	3365.15%	-13.99%

Table 23. Efficiency scores' fluctuations from year to year from 2006 to 2015

1st period: 2008-2010

The table 22 indicates the obvious reduction in the efficiency of the companies and the industry as a whole. Compared to 2008, in 2009 the industry performed poorly as its efficiency score fell 60.45 % from 78.51%. All companies saw a fall in their efficiency scores except from Capital Product Tankers, Teekay Tankers and First Ship Lease that managed to deliver efficient results. The following year, in 2010, the average score of the industry increased to 68%, as most companies managed to recover partially and achieved efficient results. There were, however, some companies, such as Nordic American Tankers and Scorpio Tankers, which delivered single figure results for the first time. Of course, we should mention that Scorpio Tankers had been a "new" public company at the time as its initial public offering took place the same year. Usually companies that have just gone public and get access to more funding struggle for a period of time, before they manage to deliver solid results.

COMPANY	difference 2009-2008	difference 2010-2008
NAVIOS MARITIME		
CAPITAL PRODUCT PARTNERS	12.17%	44.38%
DHT HOLDINGS	-31.60%	-26.11%
NORDIC AMERICAN TANKERS	-78.19%	-98.10%
SCORPIO TANKERS		
TSAKOS ENERGY NAVIGATION	-59.85%	-32.14%
FRONTLINE LTD	-21.66%	0.00%
TEEKAY TANKERS	32.15%	-13.33%
CONCORDIA MARITIME		
TORM	-41.70%	0.00%
FIRST SHIP LEASE	79.12%	31.36%

Table 24. 2nd DEA model fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
NAVIOS MARITIME	-	-	5
CAPITAL PRODUCT PARTNERS	6	4	1
DHT HOLDINGS	1	5	6
NORDIC AMERICAN TANKERS	4	9	11
SCORPIO TANKERS	-	7	10
TSAKOS ENERGY NAVIGATION	8	8	9
FRONTLINE LTD	2	3	2
TEEKAY TANKERS	5	1	8
CONCORDIA MARITIME	-	-	3
TORM	3	6	4
FIRST SHIP LEASE	7	2	7

Table 25. Company rankings according to 2nd DEA model from 2008 to 2010

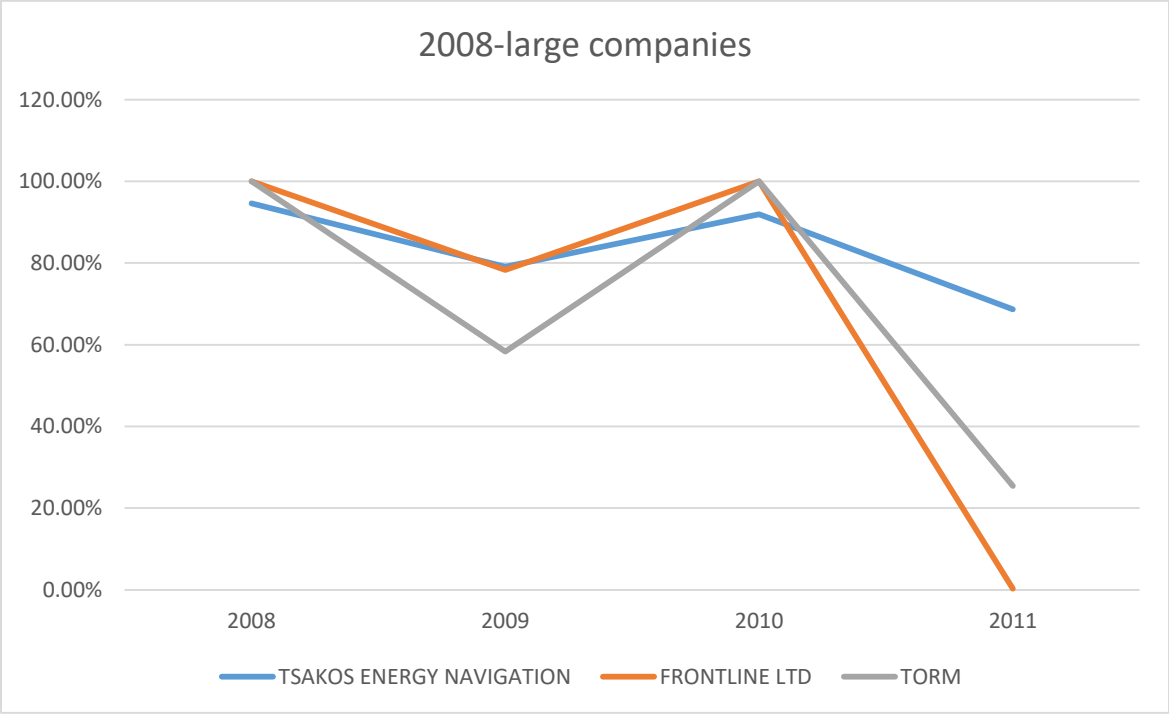

Chart 11. 2nd DEA model from 2008 to 2011-Large companies

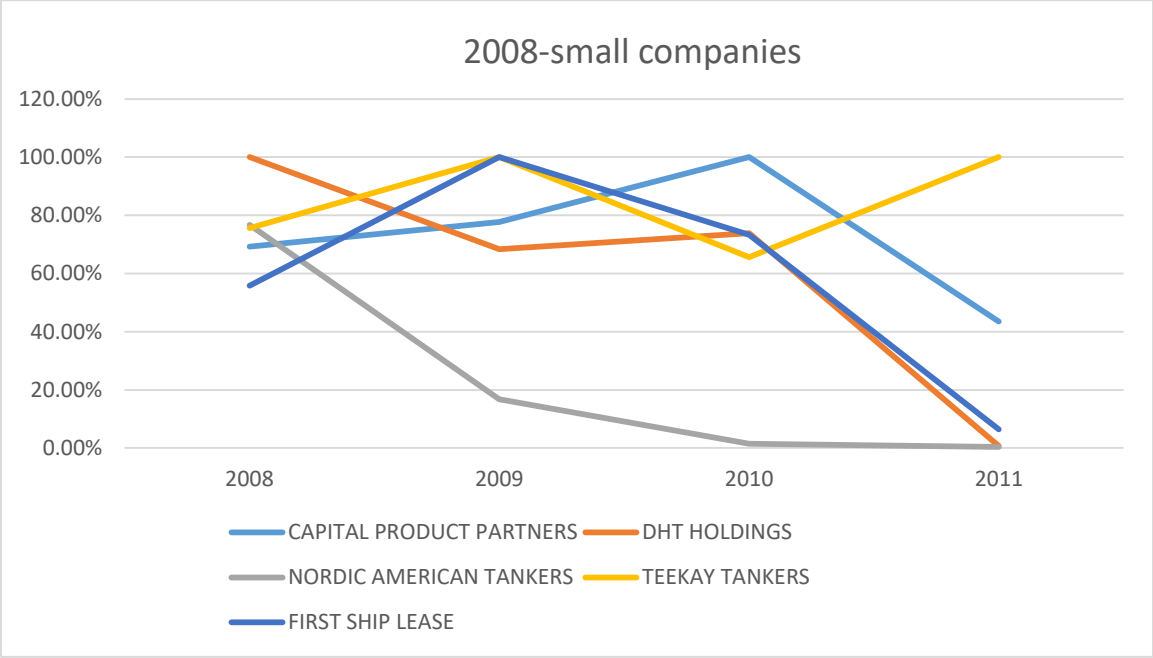

Chart 12. 2nd DEA model from 2008 to 2011-Small companies

2nd period: 2011-2013

As happened in the first DEA model the results for the second three-year period are ambiguous. For both years, 2011 and 2012, we obtained many single digit results compared to the first period 2008-2011. Besides, the industry average for both 2011 and 2012 was significantly lower than that of the previous period we examined. To be more precise, while the lowest outcome for 2008, 2009 and 2010 was 60.45%, for 2011 and 2012 we receive results close to 34% and 33% respectively before the companies bounce back and achieve results of 45% in 2013.

As it is clearly illustrated in table 22 almost all the companies that had single digit results in 2011 maintained these results in 2012. The only excepmption was First Ship Lease that managed to achieve a significant growth and rise its efficiency score from 6.43% to 56.05%. The biggest decline was noted by Teekay Tankers as its efficiency fell from 100% to 0.35%, while Torm Shipping achieved the largest turnaround as from 25.43% managed

to reach 100% in 2012. Navios Maritime and Concordia Maritime where the only companies that delivered perfect results (100%) for both years.

For 2013, we saw mixed results. Although the number of companies with scores close to 0% declined and the number of companies with perfect score increased, the majority of the companies delivered inefficient scores as none of the not-perfect scores was over 50%. Again Navios Maritime and Concordia Maritime maintained perfect scores as they had since 2011, while Nordic American Tankers was the last company to enter the perfect team after Torm did in 2012. First Ship Lease was the only company to see decline in its efficiency score as it fell from 56.05% to 0.66%.

COMPANY	difference 2012-2011	difference 2013-2011
NAVIOS MARITIME	0.00%	0.00%
CAPITAL PRODUCT PARTNERS	-85.98%	-5.04%
DHT HOLDINGS	37.50%	579.17%
NORDIC AMERICAN TANKERS	-3.03%	30203.03%
SCORPIO TANKERS	-24.51%	3657.84%
TSAKOS ENERGY NAVIGATION	633.33%	1586.67%
FRONTLINE LTD	4.00%	16.00%
TEEKAY TANKERS	-99.65%	-82.69%
CONCORDIA MARITIME	0.00%	0.00%
TORM	293.24%	293.24%
FIRST SHIP LEASE	771.70%	-89.74%

Table 26. 2nd DEA model fluctuations from 2011 to 2013

COMPANY	2011	2012	2013
NAVIOS MARITIME	1	1	1
CAPITAL PRODUCT PARTNERS	4	5	5
DHT HOLDINGS	8	7	8
NORDIC AMERICAN TANKERS	9	10	2
SCORPIO TANKERS	7	8	6
TSAKOS ENERGY NAVIGATION	11	6	9
FRONTLINE LTD	10	11	11
TEEKAY TANKERS	2	9	7
CONCORDIA MARITIME	3	2	3
TORM	5	3	4
FIRST SHIP LEASE	6	4	10

Table 27. Company rankings according to 2nd DEA model from 2011 to 2013

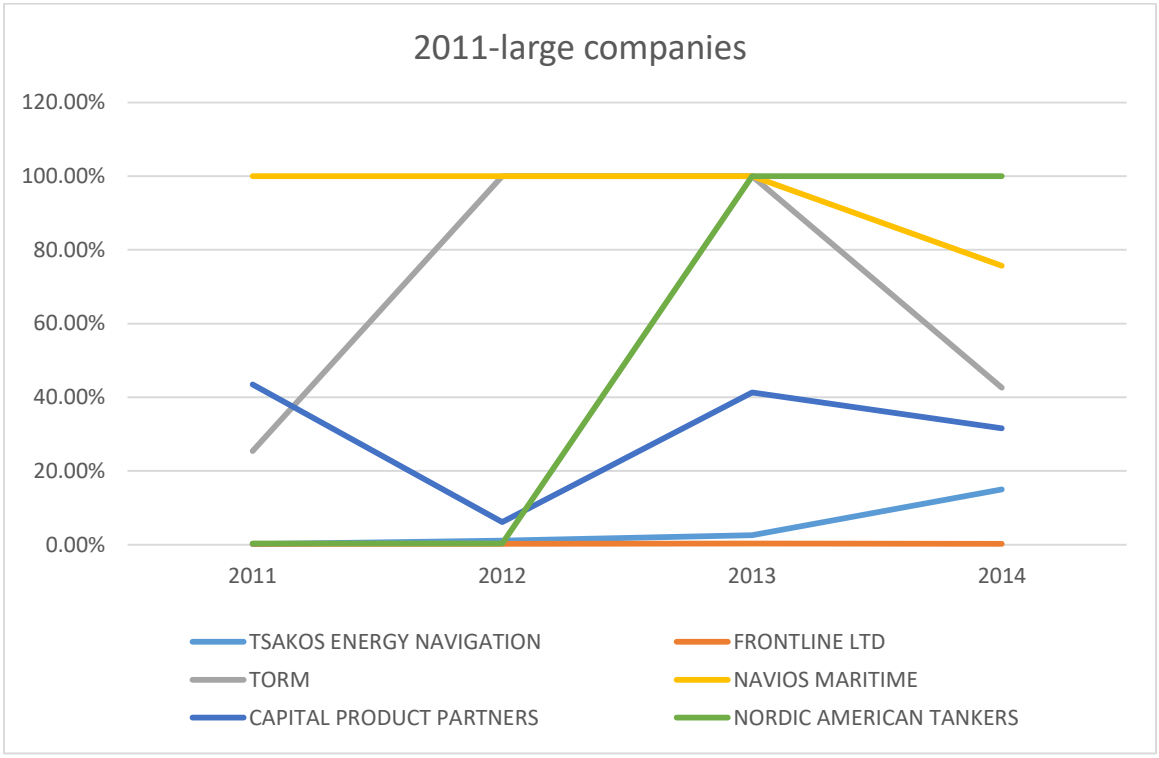

Chart 13. 2nd DEA model from 2011 to 2014-Large companies

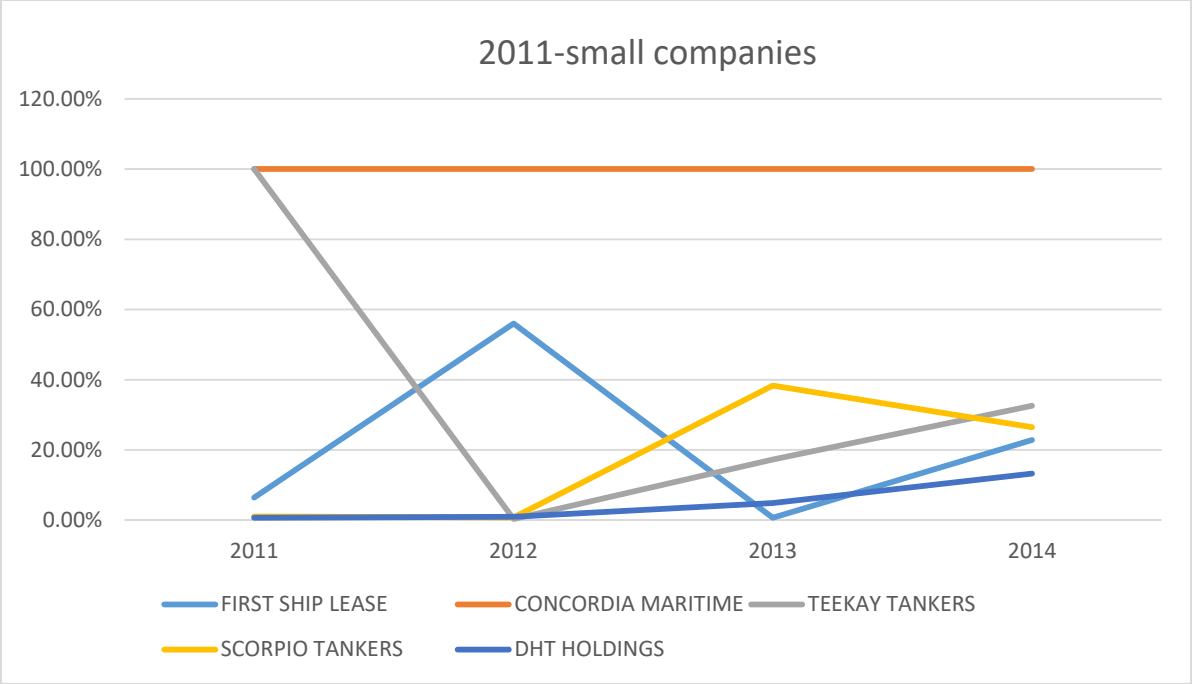

Chart 14. 2nd DEA model from 2011 to 2014-Small companies

6.2 Results of dry bulk market

6.2.1 Results of EVA

In this section we present the outcomes obtained by the "Economic Value Added" method for dry bulk market. For each company we used the official documents published by the companies, which is the 20-F form. According to SEC (Securities and Exchange Commission), each foreign private issuer with listed equity shares on exchanges in USA is required to submit this form at the end of each year so that investors can evaluate these investments. The information requirements for 20-F form are not as strict as the requirements for domestic U.S. companies that make regular filings, but the essential information for the calculation of EVA are included in this form either it issued by a domestic U.S public company or a foreign public company. In previous chapter we explained in detail what information is needed for the implementation of EVA method. The goal of the mandatory use of 20-F forms is to standardize the form of the info provided, so that any potential bias among the calculations is eliminated. Of course, the full elimination is not possible, so further adjustments and changes during our research were necessary.

During our research we calculated the EVA for each dry bulk company from 2007 to 2015. As we explained we have expanded the range of our research in a longer period in order to observe, if possible, other fluctuations in the performance of shipping companies. So before we focus on periods where the market experienced a heavy downturn we have included two tables that show the calculated EVA for each company for each year and the difference from year to year.

For one more time we decided to calculate the aggregated EVA for the whole industry from 2007 to 2015 in order to observe the overall performance from year to year and see if indeed the years when freight rates experienced the largest declines, companies delivered their poorest performances.

The empty cells indicate that no data was found for the company either because the company provided no data for the year or because the company was still private at the time and consequently had no obligation to publish its financial statements. Contrary to what

we did during the research for the tanker market, here we start our research from 2007 and not from 2006. We decided to do so as the data for year 2006 were poor and sometimes distorted due to the fact the many bulk carriers were about just execute their IPO or their had just executed their IPO and they had not established themselves commercially yet.

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	227,042	167,779	150,564	86,209	56,180	55,699	27,949	-50,905	-108,533
DIANA	63,504	212,304	64,848	61,394	75,592	26,375	-87,568	-94,895	-105,069
CMB	229,991	232,240	98,797	86,034	-17,637	-106,581	-141,934	-161,613	-
EAGLE BULK	23,297	-24,542	-77,224	-122,217	-52,969	-115,997	-47,596	-92,629	-194,175
MALAYSIAN BULK CARRIERS BHD	505,703	234,068	205,361	204,625	-34,605	-33,842	-32,949	-19,421	-98,204
GENCO SHIPPING	70,127	218,418	36,996	18,911	-	-	-	-	-
STARBULK	-	58,700	-116,897	-63,328	-120,571	-318,131	-25,237	-161,301	-580,150
NAVIOS MARITIME HOLDINGS	14,194	228,046	-19,039	21,998	-117,213	15,087	-271,925	-236,893	-300,345
DRYSHIPS	256,517	-640,533	-430,044	-313,015	-744,638	-1,020,818	-1,498,693	-1,275,024	-2,815,604
SEANERGY	-	-59,465	10,588	-12,049	-212,659	-194,706	10,907	80,345	-16,710
PACIFIC BASIN	-	-	-	-	40,633	30,284	-18,873	-118,097	-84,056
TOTAL	1,390,376	627,016	-76,051	-31,438	-1,127,888	-1,662,630	-2,085,918	-2,130,432	-4,302,846
DIFFERENCE FROM ONE YEAR BEFORE	-	-54.90%	-112.13%	58.66%	-3487.69%	-47.41%	-25.46%	-2.13%	-101.97%

Table 1. Economic Value Added for each company separately and aggregated for all the companies together from 2007 to 2015

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	-	-26%	-10%	-43%	-35%	-1%	-50%	-282%	-113%
DIANA	-	234%	-69%	-5%	23%	-65%	-432%	-8%	-11%
CMB	-	1%	-57%	-13%	-120%	-504%	-33%	-14%	-
EAGLE BULK	-	-205%	-215%	-58%	57%	-119%	59%	-95%	-110%
MALAYSIAN BULK CARRIERS BHD	-	-54%	-12%	0%	-117%	2%	3%	41%	-406%
GENCO SHIPPING	-	211%	-83%	-49%	-100%	-	-	-	-
STARBULK	-	-	-299%	46%	-90%	-164%	92%	-539%	-260%
NAVIOS MARITIME HOLDINGS	-	1507%	-108%	216%	-633%	113%	-1902%	13%	-27%
DRYSHIPS	-	-350%	33%	27%	-138%	-37%	-47%	15%	-121%
SEANERGY	-	-	118%	-214%	-1665%	8%	106%	637%	-121%
PACIFIC BASIN	-	-	-	-	-	-25%	-162%	-526%	29%

Table 2. Difference of Economic Value Added from year to year from 2007 to 2015

1st period: 2008-2010

As has been explained in previous chapter, the first big fall in freight rates of bulk carriers took place during the last months of 2008 as a consequence of the global crisis. However, the average value of BDI (Baltic Dry Index) for year 2008 was not much lower than that of 2009, as it decreased by 16% from 7252 to 6069 points. The impact of the crisis did not became obvious before 2009 when the BDI fell to 2641 points experiencing a fall of 56%. Although we discussed only the BDI, it is important to point out that similar fluctuations were observed the in each one of the indexes that detect the freight rates for each type of bulk carrier separately (Baltic Capesize Index, Baltic Panamax Index, Baltic Supramax Index).

The table 4 shows the fluctuations of the calculated EVA for the companies we evaluated for a 3 year-period. We have calculated the percent difference of EVA for the first year of low freight rates and one year after. In this way we try to show the impact of low spot prices to future revenues. To be more precise, the low spot prices influence the price of time-charter contracts in a negative for the shipping company way, because the term-charter contracts fall. As a result, the companies report low revenues and the calculated EVA fall. This phenomenon is obvious not only in table 4, but also in the first table of our presentation (table 1), where lower value of aggregated EVA is noted not only in the year of the sharp decrease, but also one year, or in some occasions two years afterwards.

The companies in green shade are the three largest companies in our sample for the period 2008-2010. We classify the companies by "size" by calculating the fixed assets of each company. We decided to use the fixed assets and not the total assets of each company because the value of fixed assets is a better indicator of the fleet employed by the company to produce the revenues reported. That happens because the total assets includes the value of the current assets that might distort the real value of the company if the managers of the company has accumulated too much cash compared to other companies. Since this project focuses on evaluating companies according to their operational activities and considers all the operational values such as operational profit, operational revenues, fixed assets, it would be wrong to compare other measures than the strictly operational. In addition, maritime companies do invest usually in derivative products to manage their financial risk

and, as a result, the value of these products is usually calculated in current assets. Fixed assets, on the other hand, represent in most cases the closest value to the value of the vessels and for our purpose, which is the operational evaluation of the companies, this value is more useful. The value of fixed assets as obtained by the 20-F forms is given in table 3.

COMPANY	difference 2009-2008	difference 2010-2008
SAFEBULKERS	-10.26%	-48.62%
DIANA	-69.45%	-71.08%
CMB	-57.46%	-62.95%
EAGLE BULK	-214.67%	-397.99%
MALAYSIAN BULK CARRIERS BHD	-12.26%	-12.58%
GENCO SHIPPING	-83.06%	-91.34%
STARBULK	-299.14%	-207.88%
NAVIOS MARITIME HOLDINGS	-108.35%	-90.35%
DRYSHIPS	32.86%	51.13%
SEANERGY	117.80%	79.74%
PACIFIC BASIN	-	-

Table 3. Economic Value Added fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
SAFEBULKERS	6	2	2
DIANA	5	4	4
CMB	2	3	3
EAGLE BULK	8	8	9
MALAYSIAN BULK CARRIERS BHD	1	1	1
GENCO SHIPPING	4	5	6
STARBULK	7	9	8
NAVIOS MARITIME HOLDINGS	3	7	5
DRYSHIPS	10	10	10
SEANERGY	9	6	7
PACIFIC BASIN	-	-	

Table 4. Company rankings according to EVA from 2008 to 2010

As can be illustrated in table 3 and charts 1, 2, even big companies reported significantly lower results during periods of low freight rates, despite the size of their fleet. The so-called "economy of scale" did not prevent large companies to report very low – near to zero-calculated EVAs for 2009. Extreme falls, however were reported by two small companies for both years of 2009 and 2010. These companies were Eagle Bulk Shipping and Starbulk. Starbulk and Seanergy present ambiguous results due to the fact that back then they were relatively new companies with a small fleet. While in some occasions this might be a disadvantage, it can turn to huge advantage if the management has been wise enough to tie their ships with long-term contracts in a favorable freight rates. That's seems to be the occasion with Seanergy. On the other hand, Starbulk, which was in a phase of expansion at the time, seems to experience a big hit at the time from the crisis. All in all, the industry experienced an unprecedented fall for year 2009 as every company reported significantly lower results, a conclusion that be also drawn from table 1 as the industry's accumulated EVA reduced by more than 100% and fell for the first time in negative region. As far as year 2010 is concerned, the majority of the companies hovered around the level they reached during the 2009 crisis or managed to improve slightly their numbers.

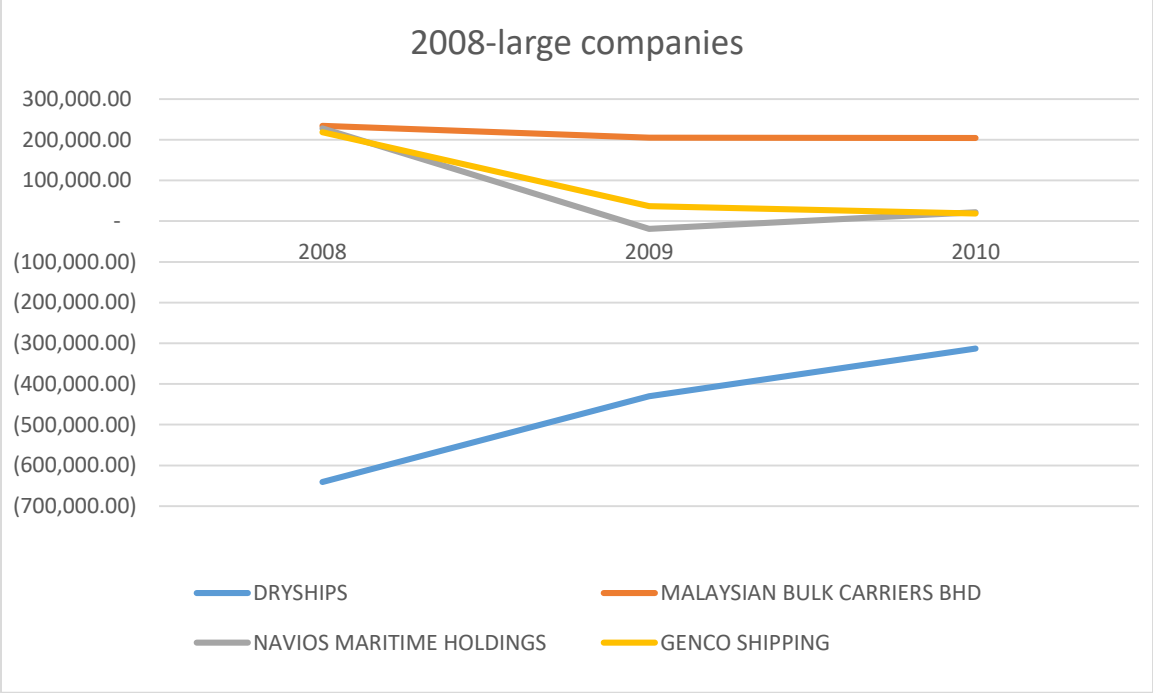

Chart 1. EVA from 2008 to 2010-Large companies

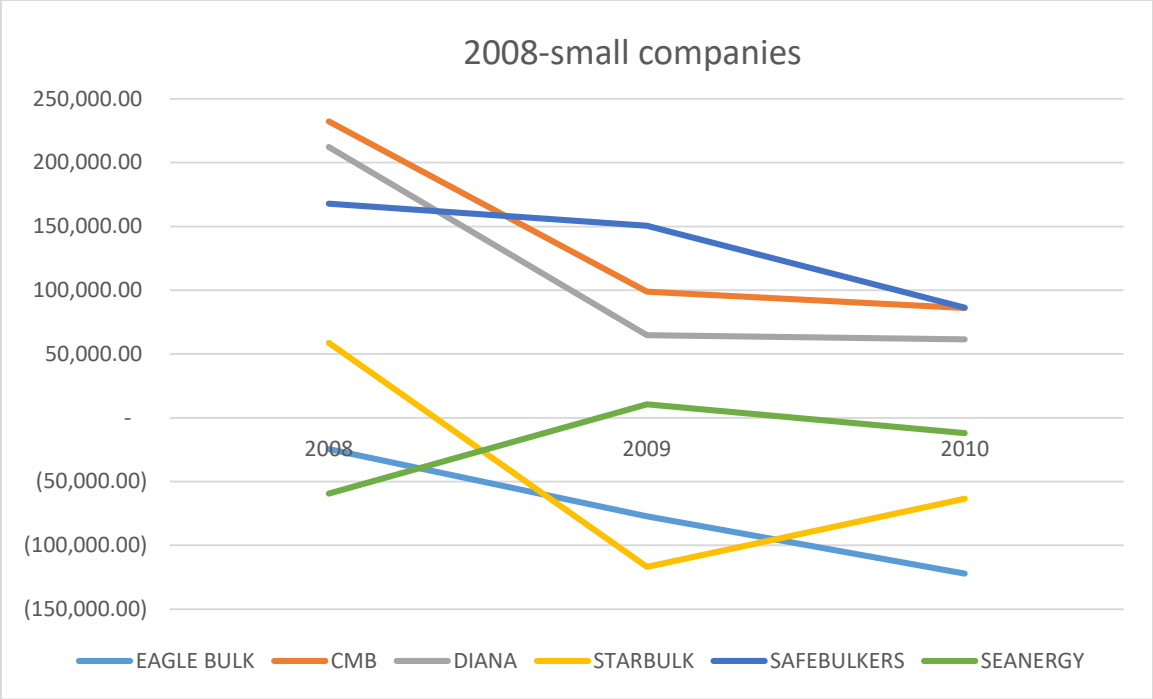

Chart 2. EVA from 2008 to 2010-Small companies

2nd period: 2010-2012

As has been explained in previous chapter the BDI hovered around 2600 points in 2009 and 2010. The next big fluctuation was also a fall and took place during 2011 when the average price for BDI was 1531 points. What is special, however, about this period, is that BDI experienced an equally big fall the following year, in 2012. In more detail, after noting a 43% decrease in its average price, BDI experienced a fall of 42% during 2012 and it landed at 885 points, which was at the time the lowest value ever seen. As can be illustrated in table 1, this is the case for the rest of the following years as dry bulk market never really recovered; actually period 2011-2012 was the first time that the sample of companies selected reported accumulated EVA that was lower than negative one billion for two years in a row.

As happened in the examination of period 2008-2010 we separated again the companies in two groups according to the value of fixed assets that each company reported in its balance sheet for 2010: a group of large companies and a group of small companies. Again the cells that are shaded with green color represent the large companies.

Genco Shipping and Seanergy were not examined for this period because during the research some problems came up regarding the information that should be obtained. The problem with Genco shipping was that no info was provided for year 2011 and afterwards while Seanergy maritime changed its strategy many times in order to improve its financial position. The company was already from 2011 in contact with its lenders in order to prepare the capital restructuring that took place in 2014. As a result there were many fluctuations regarding its owned fleet and the added value, which has distorted the results obtained not only from EVA but from the other valuation methods as well. As far as Pacific Basin is concerned, we have included the firm in our calculations but we did not make any comparison as prior to 2011 its operations were not exclusively in dry bulk sector .

COMPANY	difference 2011-2010	difference 2012-2010
SAFEBULKERS	-34.83%	-35.39%
DIANA	23.13%	-57.04%
CMB	-120.50%	-223.88%
EAGLE BULK	56.66%	5.09%
MALAYSIAN BULK CARRIERS BHD	-116.91%	-116.54%
GENCO SHIPPING	-	-
STARBULK	-90.39%	-402.36%
NAVIOS MARITIME HOLDINGS	-632.82%	-31.42%
DRYSHIPS	-137.89%	-226.12%
SEANERGY	-1664.94%	-1515.94%
PACIFIC BASIN	-	-

Table 5. Economic Value Added fluctuations from 2010 to 2012

COMPANY	2010	2011	2012
SAFEBULKERS	2	2	1
DIANA	4	1	3
CMB	3	4	6
EAGLE BULK	9	6	7
MALAYSIAN BULK CARRIERS BHD	1	5	5
GENCO SHIPPING	6	-	-
STARBULK	8	8	9
NAVIOS MARITIME HOLDINGS	5	7	4
DRYSHIPS	10	10	10
SEANERGY	7	9	8
PACIFIC BASIN		3	2

Table 6. Company rankings according to EVA from 2010 to 2012

As it is indicated from table 1 only three companies managed to report positive EVA for 2011, Diana, Safebulkers and Pacific Basin. Compared to the previous recession this number is extremely low given the fact that the sample of companies we have consists of 10-11 companies. For 2010 more than 5 companies reported positive results similar to what was the case for 2009. For 2012, the second consecutive year of significant decrease in the freight rates, the number of companies reported positive EVA might have increased in 4, but the majority of these companies had lower positive than in 2011, which indicates that companies still struggle to deliver positive results. The last claim is also reinforced by the fact that the accumulated EVA for 2012 also decreased significantly as it fell from -1.2 billion to -1.6 billion. For once again there were no clear results regarding the two groups of small and big companies and their rankings.

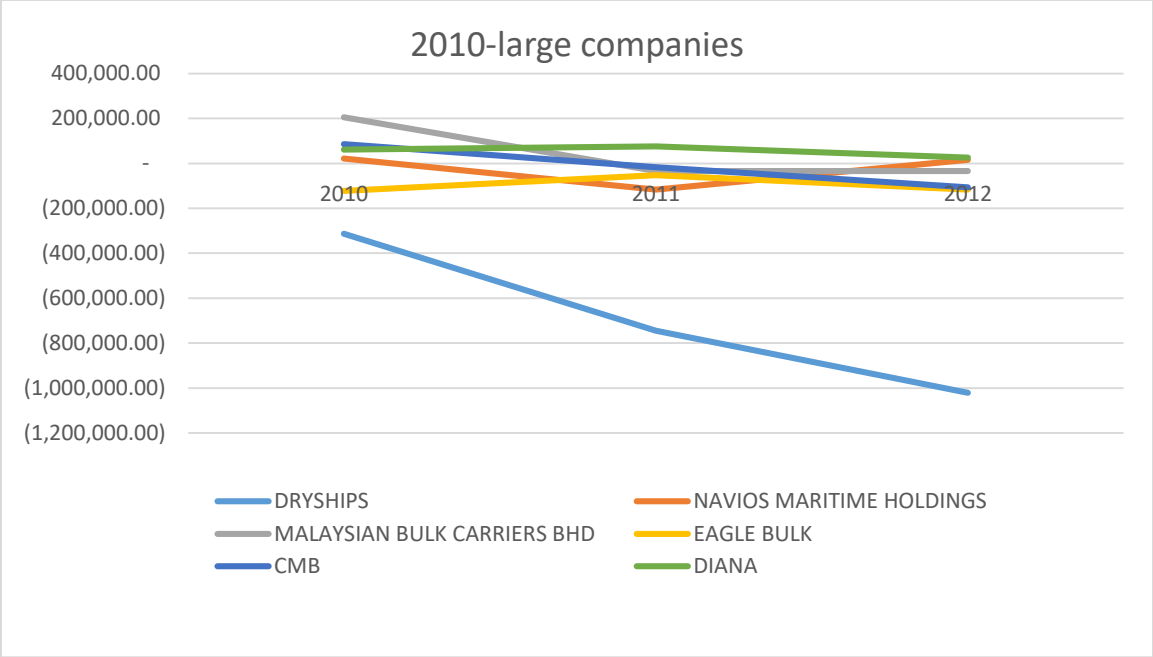

Chart 3. EVA from 2010 to 2012-Large companies

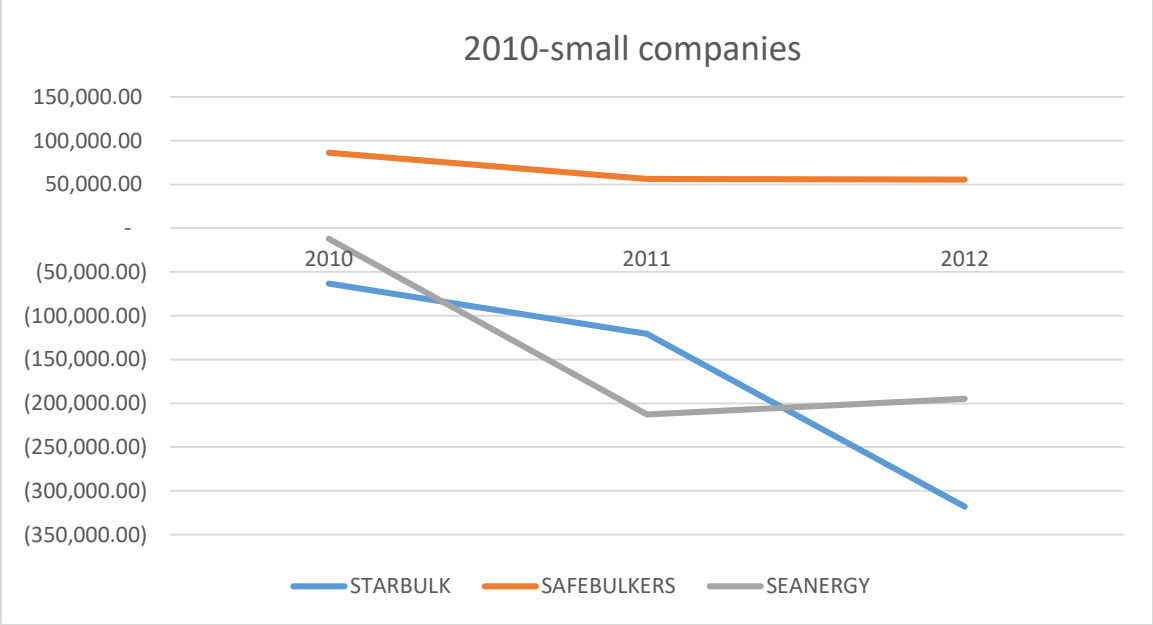

Chart 4. EVA from 2010to 2012-Small companies

6.2.2 Results of Altman Z - Score

As explained during the results for the tanker market Altman Z-score could not depict the fluctuations in companies' performance during periods when the freight rates take a hard fall. The reasons for this phenomenon have been extensively described during the presentation and in this market the consequences are even more obvious. First of all, during the research we spotted extreme calculations not only among different companies for the same year, while according to EVA the same companies delivered similar results, but there were occasions when for the same company the outcome was substantially higher for a year of recession than a year before. Returning to form 20-F for the company of the example, made it clear that this claim had no grounds as the earnings were lower while the fleet and the assets of the company had even increased. Secondly, the results are easily distorted by the ratio of Market Cap/Liabilities which is another reason we see so big differences among all companies in table 1.Take for example Seanergy Maritime, which had to undergo a restructuring in order to improve its financial position and the Market Cap had significant fluctuations during a period reaching extremely high levels despite the fact that Seanergy was relatively one the smallest listed companies.

All in all, as happened in the research of wet market Z-score cannot serve its purpose on predicting bankruptcy or financial distress for the near future. The strategy and the decision-making in the industry are of such nature that the Z-score cannot detect and therefore depict the real financial situation of the shipping companies examined. The patience that investors and creditors have showed during harsh times has in a way made the Altman Z-score useless, as they prefer to keep their positions and wait for the market to bounce back, despite the fact that they could act differently and take extreme measures.

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	3.70	1.93	1.90	1.54	2.49	2.26	2.72	2.26	0.87
DIANA	11.94	3.96	2.91	2.28	1.90	1.55	1.82	1.13	0.74
CMB	4.44	2.42	1.66	1.28	0.55	0.21	0.09	-0.09	-
EAGLE BULK	1.70	0.75	1.08	0.93	0.26	0.06	-0.57	1.26	0.22
MALAYSIAN BULK CARRIERS BHD	9.19	5.68	0.81	0.85	0.91	0.55	24.00	0.03	0.78
GENCO SHIPPING	12.95	0.87	0.84	0.72	-	-	-	-	-
STARBULK	-	4.05	0.77	2.41	0.12	-2.55	1.10	0.59	0.27
NAVIOS MARITIME HOLDINGS	1.31	1.10	0.85	0.72	0.71	0.96	0.73	0.51	0.35
DRYSHIPS	0.92	-0.41	0.61	0.36	0.29	0.03	0.13	0.26	1.84
SEANERGY	-	0.15	15.36	9.89	-0.99	-4.58	0.71	-	0.08
PACIFIC BASIN	-	-	-	-	1.78	1.90	1.43	1.25	0.75

Table 7. Altman Z-score for each company from 2007 to 2015

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	-	-47.84%	-1.55%	-18.95%	61.69%	-9.24%	20.35%	-16.91%	-61.50%
DIANA	-	-66.83%	-26.52%	-21.65%	-16.67%	-18.42%	17.42%	-37.91%	-34.51%
CMB	-	-45.50%	-31.40%	-22.89%	-57.03%	-61.82%	-57.14%	-200.00%	-
EAGLE BULK	-	-55.88%	44.00%	-13.89%	-72.04%	-76.92%	-1050.00%	321.05%	-82.54%
MALAYSIAN BULK CARRIERS BHD	-	-38.19%	-85.74%	4.94%	7.06%	-39.56%	4263.64%	-99.88%	2500.00%
GENCO SHIPPING	-	-93.28%	-3.45%	-14.29%	-	-	-	-	-
STARBULK	-	-	-80.99%	212.99%	-95.02%	-2225.00%	143.14%	-46.36%	-54.24%
NAVIOS MARITIME HOLDINGS	-	-16.03%	-22.73%	-15.29%	-1.39%	35.21%	-23.96%	-30.14%	-31.37%
DRYSHIPS	-	-144.57%	248.78%	-40.98%	-19.44%	-89.66%	333.33%	100.00%	607.69%
SEANERGY	-	-	10140.00%	-35.61%	-110.01%	-362.63%	115.50%	-	-
PACIFIC BASIN	-	-	-	-	-	6.74%	-24.74%	-12.59%	-40.00%

Table 8. Difference Altman Z-score from year to year from 2007 to 2015

1st period: 2008-2010

COMPANY	difference 2009-2008	difference 2010-2008
SAFEBULKERS	-1.55%	-20.21%
DIANA	-26.52%	-42.42%
CMB	-31.40%	-47.11%
EAGLE BULK	44.00%	24.00%
MALAYSIAN BULK CARRIERS BHD	-85.74%	-85.04%
GENCO SHIPPING	-3.45%	-17.24%
STARBULK	-80.99%	-40.49%
NAVIOS MARITIME HOLDINGS	-22.73%	-34.55%
DRYSHIPS	248.78%	187.80%
SEANERGY	10140.00%	6493.33%
PACIFIC BASIN	-	-

Table 9. Z-score fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
SAFEBULKERS	5	3	4
DIANA	3	2	3
CMB	4	4	5
EAGLE BULK	8	5	6
MALAYSIAN BULK CARRIERS BHD	1	8	7
GENCO SHIPPING	7	7	8
STARBULK	2	9	2
NAVIOS MARITIME HOLDINGS	6	6	9
DRYSHIPS	10	10	10
SEANERGY	9	1	1
PACIFIC BASIN	-	-	

Table 10. Company rankings according to Z-score from 2008 to 2010

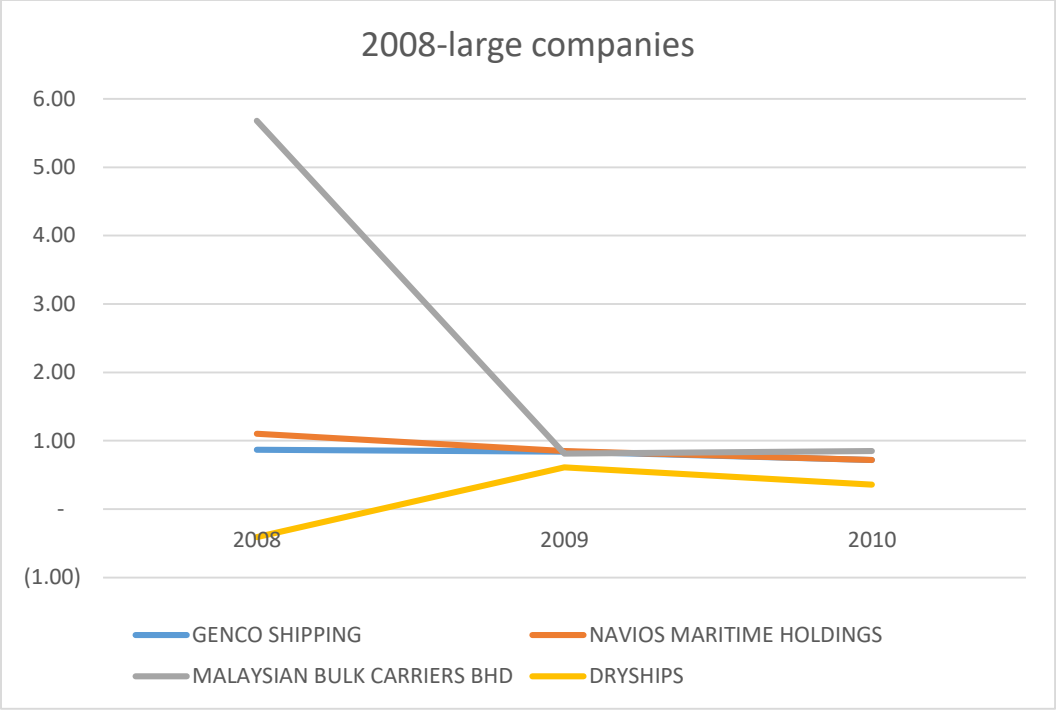

Chart 5. Z-score from 2008 to 2010-Large companies

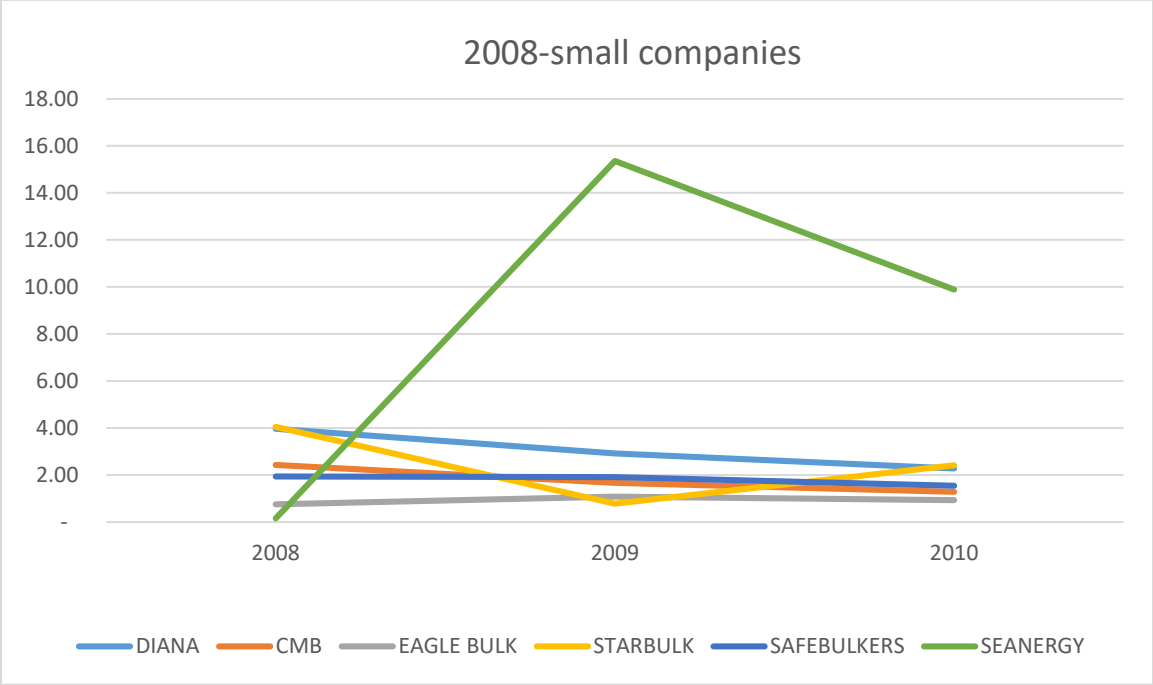

Chart 6. Z-score from 2008 to 2010-Small companies

2nd period: 2010-2012

COMPANY	difference 2011-2010	difference 2012-2010
SAFEBULKERS	61.69%	46.75%
DIANA	-16.67%	-32.02%
CMB	-57.03%	-83.59%
EAGLE BULK	-72.04%	-93.55%
MALAYSIAN BULK CARRIERS BHD	7.06%	-35.29%
GENCO SHIPPING	-	-
STARBULK	-95.02%	-205.81%
NAVIOS MARITIME HOLDINGS	-1.39%	33.33%
DRYSHIPS	-19.44%	-91.67%
SEANERGY	-110.01%	-146.31%
PACIFIC BASIN	-	-

Table 11. Z-score fluctuations from 2010 to 2012

COMPANY	2010	2011	2012
SAFEBULKERS	4	1	1
DIANA	3	2	3
CMB	5	6	6
EAGLE BULK	6	8	7
MALAYSIAN BULK CARRIERS BHD	7	4	5
GENCO SHIPPING	8	-	-
STARBULK	2	9	9
NAVIOS MARITIME HOLDINGS	9	5	4
DRYSHIPS	10	7	8
SEANERGY	1	10	10
PACIFIC BASIN		3	2

Table 12. Company rankings according to Z-score from 2010 to 2012

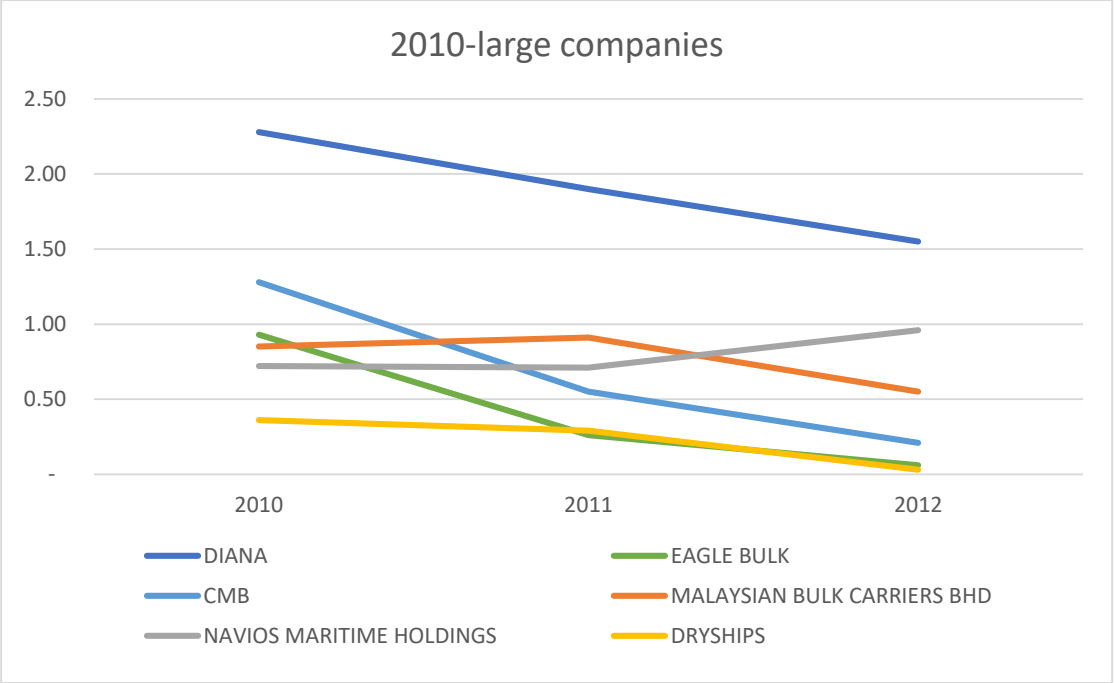

Chart 7. Z-score from 2010 to 2012-Large companies

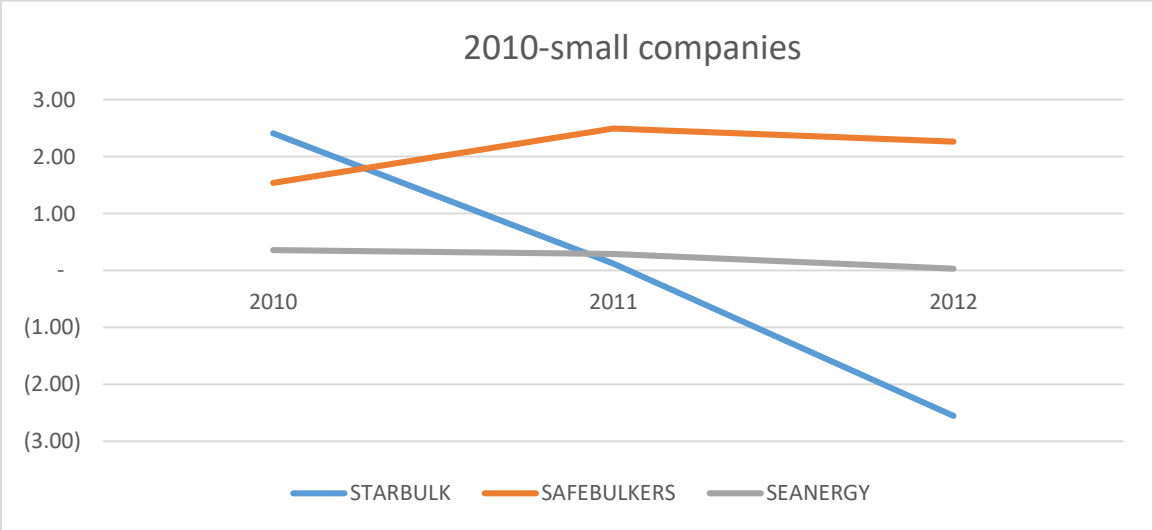

Chart 8. Z-score from 2011 to 2014-Small companies

6.2.3 Results of 1st model of DEA

As explained, during the DEA valuation we used two models. The first model is an input-oriented model that focuses on how much inputs of a company can be reduced without affecting the outputs. Its target is to examine the efficiency of the shipping companies as far as the income creation is concerned.

For both models we followed the same procedure as we did during the research on wet market. It is important to point out that DEA provides info that cannot be used to in an analysis that includes companies of both markets, dry baulk and tanker market. Implementation of DEA creates separate frontiers that are created according the sample studied. So, while in the case of dry market we have companies that achieve scores of 100%, these scores represent relative efficiency among the companies of the sample. If we used the same companies in the sample of wet market, the same companies would deliver much lower efficiency scores. Unlike DEA, EVA allows the comparison of all companies, because it is not a relative measure of efficiency, which depends on the sample studied, but an absolute measure. As a result, when investors, current or potential, or analysts are indifferent to the market each company operates in, they ought to use EVA and not DEA as the valuation method that will determine which company is worth its money. In addition, this tactic can be expanded to companies of other industries as well, where DEA cannot be implemented, as it essential that the units of the sample that are evaluated during a DEA are all of the same industry.

As happened during the first part of our research, for the results obtained by both DEA models we calculated the *standard deviation*, a measure that we did not include in the analysis of the results obtained by the previous methods. This measure is used to quantify the amount of variation or dispersion of the results. In the results of the previous methods we could not use this measure to reach any conclusion as the size effect of each company influenced significantly the final result in both EVA and Z-score calculations for various reasons. As it will be explained in the next paragraphs the calculation of standard deviation led us to some safe conclusions.

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	60.12%	84.92%
DIANA	96.13%	100.00%	86.53%	85.23%	68.85%	65.44%	76.39%	52.76%	88.30%
CMB	100.00%	100.00%	100.00%	100.00%	48.74%	55.28%	61.77%	61.83%	-
EAGLE BULK	76.25%	33.81%	56.52%	63.70%	54.46%	46.94%	62.28%	39.02%	72.45%
MALAYSIAN BULK CARRIERS BHD	100.00%	100.00%	65.63%	100.00%	100.00%	70.76%	50.85%	70.55%	90.70%
GENCO SHIPPING	90.70%	75.27%	100.00%	98.97%	-	-	-	-	-
STARBULK	-	63.83%	54.32%	100.00%	91.44%	57.44%	53.27%	42.23%	86.98%
NAVIOS MARITIME HOLDINGS	100.00%	100.00%	95.46%	100.00%	65.64%	100.00%	53.40%	49.77%	95.52%
DRYSHIPS	64.07%	65.99%	100.00%	100.00%	100.00%	59.44%	100.00%	100.00%	100.00%
SEANERGY	-	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	35.36%
PACIFIC BASIN	-	-	-	-	100.00%	100.00%	100.00%	100.00%	100.00%
AVERAGE	90.89%	83.89%	86.30%	94.79%	82.91%	75.53%	75.80%	67.63%	83.80%
STANDARD DEVIATION	12.71%	22.05%	18.61%	11.25%	20.02%	20.82%	20.87%	22.90%	18.90%
DIFFERENCE FROM ONE YEAR BEFORE	-	-7.71%	2.87%	9.84%	-12.53%	-8.91%	0.35%	-10.78%	23.92%

Table 13. Efficiency scores for each company separately and relevant statistics for all the companies from 2007 to 2015

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-39.88%	41.26%
DIANA	-	4.02%	-13.47%	-1.50%	-19.22%	-4.95%	16.74%	-30.93%	67.37%
CMB	-	0.00%	0.00%	0.00%	-51.26%	13.41%	11.74%	0.10%	-
EAGLE BULK	-	-55.66%	67.20%	12.70%	-14.52%	-13.80%	32.67%	-37.34%	85.68%
MALAYSIAN BULK CARRIERS BHD	-	0.00%	-34.37%	52.36%	0.00%	-29.24%	-28.13%	38.74%	28.56%
GENCO SHIPPING	-	-17.00%	32.85%	-1.03%	-	-	-	-	-
STARBULK	-	-	-14.89%	84.08%	-8.56%	-37.19%	-7.26%	-20.72%	105.95%
NAVIOS MARITIME HOLDINGS	-	0.00%	0.00%	0.00%	-34.36%	52.35%	-46.60%	-6.80%	91.94%
DRYSHIPS	-	2.99%	51.54%	0.00%	0.00%	-40.56%	68.24%	0.00%	0.00%
SEANERGY	-	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-64.64%
PACIFIC BASIN	-	-	-	-	-	0.00%	0.00%	0.00%	0.00%

Table 14. Efficiency scores fluctuations from year to year from 2007 to 2015

1st period: 2008-2010

Unlike the results that the 1st model of DEA gave us during the research of companies that operate in wet market, the results obtained in this case are a bit ambiguous. More companies than expected received a score of 100% or a score near to 100%, which indicates that they remained efficient for the years 2009 and 2010. While, according to DEA, 6 companies appeared to be efficient for 2008, the number of companies reduced slightly to 5 companies for 2009, before it jumped to 6 companies for 2010.

In more detail, the model spotted small fluctuations that in some cases were even positive. That comes to contradiction to what the previous methods had indicated for year 2009 and 2010. The average score and the standard deviation did not depict any crucial information about the industry as a whole the efficiency score decreased temporarily to 65.84% before it bounced back to 80.91% surpassing the score of 2008. An interesting feature of the results is that Safebulkers managed to remain efficient for the three years achieving scores of 100%, Seanergy almost did the same thing with the exception of year 2010 when it returned an efficiency score of 90.60%. Overall, the poorest performance was noted by Eagle Bulk and Dryships, as the former hovered around 35% for all three years, while the latter returned results under 20% for the two first years, before it scores a perfect 100% for year 2010.

COMPANY	difference 2009-2008	difference 2010-2008
SAFEBULKERS	0.00%	0.00%
DIANA	-13.47%	-14.77%
CMB	0.00%	0.00%
EAGLE BULK	67.20%	88.43%
MALAYSIAN BULK CARRIERS BHD	-34.37%	0.00%
GENCO SHIPPING	32.85%	31.48%
STARBULK	-14.89%	56.68%
NAVIOS MARITIME HOLDINGS	0.00%	0.00%
DRYSHIPS	51.54%	51.54%
SEANERGY	0.00%	0.00%
PACIFIC BASIN	-	-

Table 15. 1st DEA model fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
SAFEBULKERS	1	1	1
DIANA	2	7	9
CMB	3	2	2
EAGLE BULK	10	9	10
MALAYSIAN BULK CARRIERS BHD	4	8	3
GENCO SHIPPING	7	3	8
STARBULK	8	10	4
NAVIOS MARITIME HOLDINGS	5	4	5
DRYSHIPS	8	5	6
SEANERGY	6	6	7
PACIFIC BASIN	-	-	-

Table 16. Company rankings according to 1st DEA model from 2008 to 2010

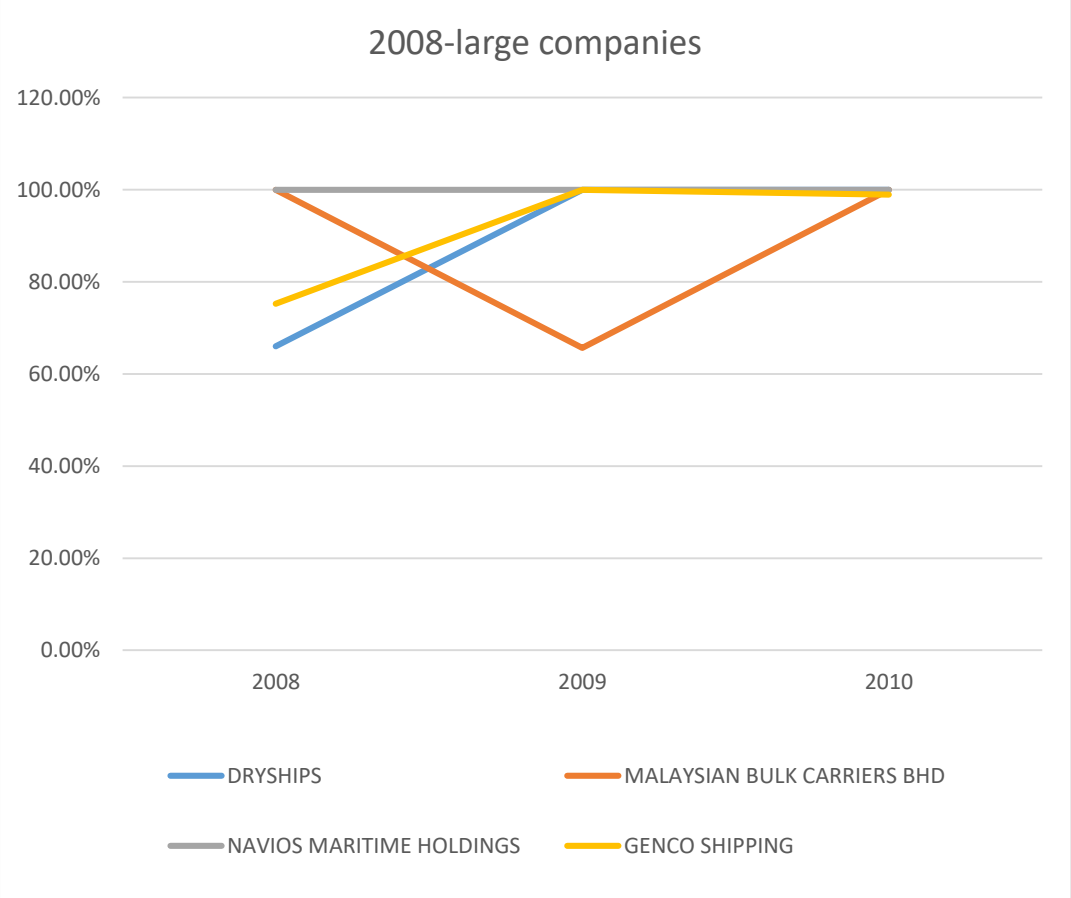

Chart 7. 1st DEA model from 2008 to 2010-Large companies

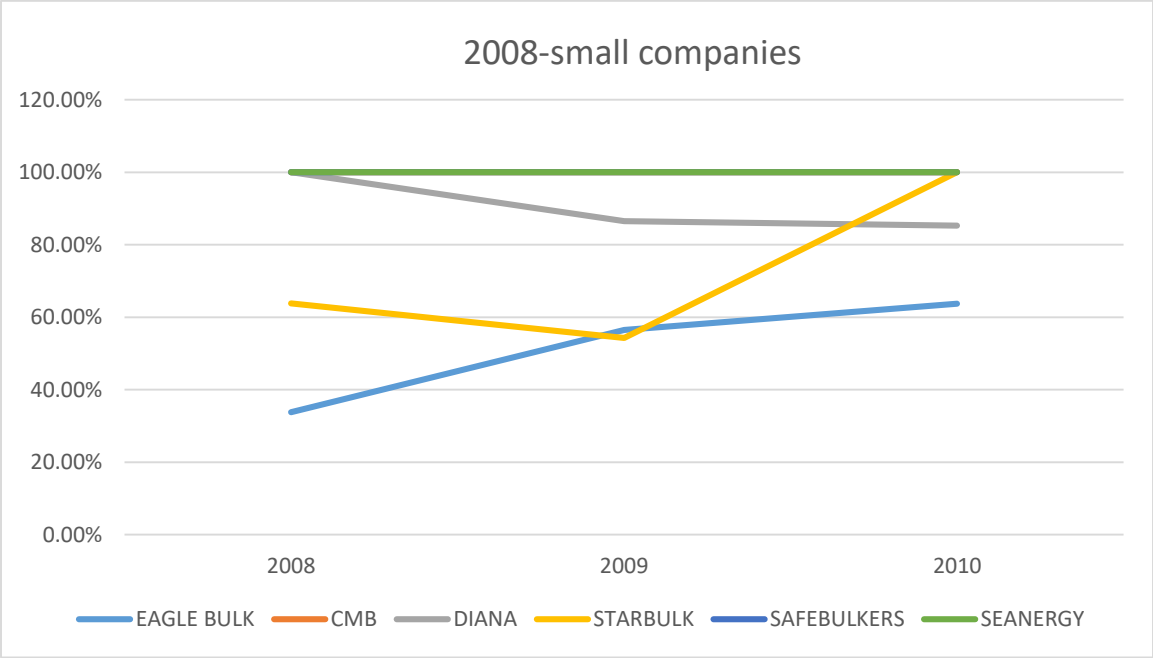

Chart 8. 1st DEA model from 2008 to 2010-Small companies

2nd period: 2010-2012

The implementation of the 1st model of DEA for the second 3-year term gave us more or less similar results to those of the first 3-year term. For once again, we could not spotted significant fluctuations due to low freight rates while the number of the companies that achieved score of 100% remained high for both years.

If it was to point out to one fact, it would be that companies showed notable poorer performance not in 2011, the first year of the crisis, but in 2012, when we had the second straight year of low freight rates in the market. This fact is clearly illustrated by table 17. For once again, however, more companies than expected received a score of 100%, with Safebulkers and Seanergy standing out for their efficient performance. Although, a score of 100% indicates a superior performance towards the other units of the sample, it does not necessarily mean that the companies operate efficiently. The fact that so many companies appear to operate efficiently in a so distressed market is peculiar, though.

COMPANY	difference 2011-2010	difference 2012-2010
SAFEBULKERS	0.00%	0.00%
DIANA	-19.22%	-23.22%
CMB	-51.26%	-44.72%
EAGLE BULK	-14.52%	-26.31%
MALAYSIAN BULK CARRIERS BHD	0.00%	-29.24%
GENCO SHIPPING	-	-
STARBULK	-8.56%	-42.56%
NAVIOS MARITIME HOLDINGS	-34.36%	0.00%
DRYSHIPS	0.00%	-40.56%
SEANERGY	0.00%	0.00%
PACIFIC BASIN	-	-

Table 17. 1st DEA model fluctuations from 2010 to 2012

COMPANY	2010	2011	2012
SAFEBULKERS	1	1	1
DIANA	9	7	6
CMB	2	10	9
EAGLE BULK	10	9	10
MALAYSIAN BULK CARRIERS BHD	3	2	5
GENCO SHIPPING	8	-	-
STARBULK	4	6	8
NAVIOS MARITIME HOLDINGS	5	8	2
DRYSHIPS	6	3	7
SEANERGY	7	4	3
PACIFIC BASIN	-	5	4

Table 18. Company rankings according to 1st DEA model from 2010 to 2012

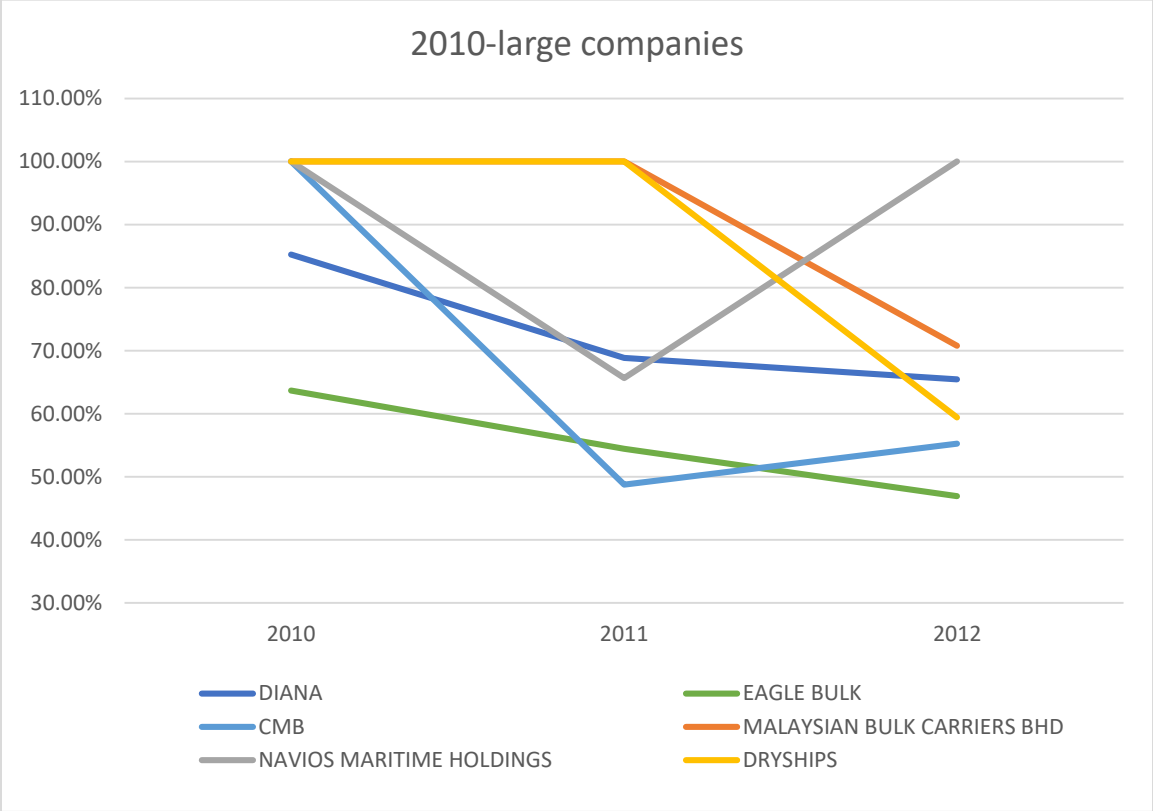

Chart 9. 1st DEA model from 2010 to 2012-Large companies

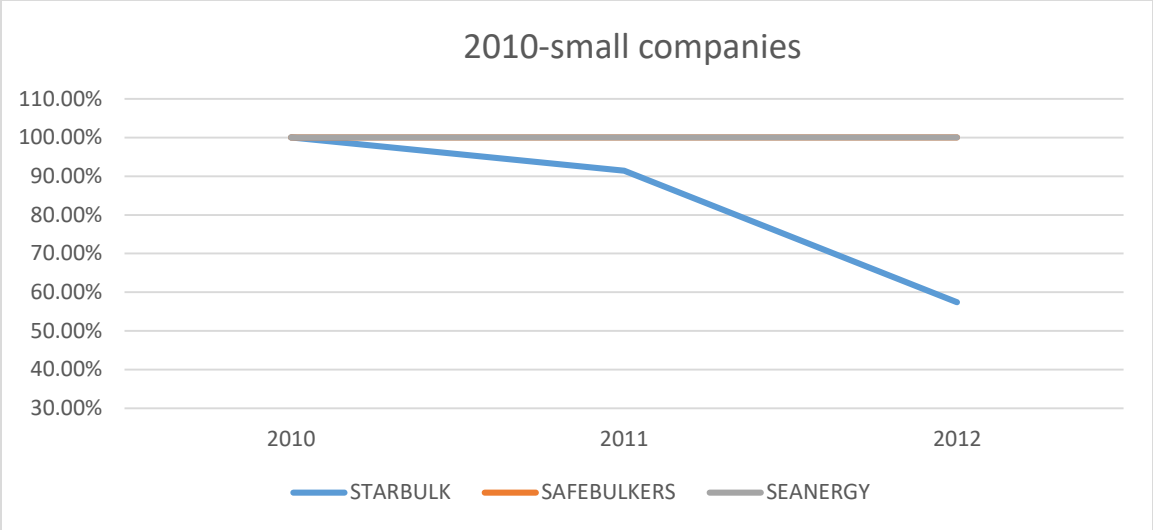

Chart 10. 1st DEA model from 2010 to 2012 - Small companies

6.2.4 Results of 2nd model of DEA

The second model of DEA we used was similar to the first model in terms of orientation and number of data used. We used again an input-oriented model where we had two input units and one output unit. However, this model was more specific than the previous as it examined the ability of each company to make profit as a result of the utilization of the ships. So, companies that had higher operating costs than revenues, and therefore negative net income, obtain low efficient scores, while in the previous model those companies will not take so low scores.

To be more specific, we used as input the value of the vessels and the operating cost of the vessels, while the output unit for this model was the gross profit created. All the units used in this model are subunits of the units used in the first DEA model. In order to obtain the necessary data we used the balance sheet and the income statement published by each company for the 9-year period 2007-2015, as we have done for the rest of the project. In this model, however, there were some occasions where we should make some adjustments or further calculations before we obtained the necessary values.

Unlike to what happened during the research of companies that operate in the wet market, where we had scores close to 0%, here in dry bulk market we do not see such scores because even the companies that are efficient and determine the efficient frontier have poor performances and the "efficiency distance" between the best ones and the bad ones is diminished. This phenomenon is similar to the phenomenon described during the presentation of the results of the 1st DEA model, when outcome entailed many perfect scores of 100%, while it was known that companies had occurred many damages in their financial positions due to the decrease in their cash flows. Overall, we can say the dry market appears to be more homogenous than the wet market. While in the wet market, there were some companies that managed to distinguish and "push" the efficient frontier further out, here in the dry bulk market companies move similarly, so the DEA cannot show clearly which companies have managed to stand out.

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	1.99%	20.07%
DIANA	42.37%	100.00%	44.25%	58.46%	67.51%	55.77%	14.36%	1.16%	13.74%
CMB	65.93%	74.86%	86.44%	75.33%	86.84%	27.01%	3.03%	0.23%	-
EAGLE BULK	45.79%	35.08%	38.08%	35.85%	32.91%	33.85%	19.03%	1.06%	26.50%
MALAYSIAN BULK CARRIERS BHD	100.00%	100.00%	59.58%	100.00%	100.00%	100.00%	59.21%	1.20%	100.00%
GENCO SHIPPING	45.00%	97.10%	100.00%	100.00%	100.00%	-	-	-	-
STARBULK	-	61.34%	60.35%	100.00%	31.25%	96.95%	40.93%	1.89%	11. 26%
NAVIOS MARITIME HOLDINGS	87.77%	42.42%	51.57%	48.87%	100.00%	100.00%	9.72%	0.77%	10. 83%
DRYSHIPS	100.00%	14.58%	18.17%	100.00%	100.00%	19.05%	100.00%	100.00%	100. 00%
SEANERGY	-	100.00%	100.00%	90.60%	42.89%	100.00%	100.00%	100.00%	100. 00%
PACIFIC BASIN	-	-	-	-		100.00%	25.67%	0.07%	26. 40%
AVERAGE	73.36%	72.54%	65.84%	80.91%	76.14%	73.26%	47.19%	20.84%	45.42%
Standard Deviation	24.79%	30.69%	27.76%	23.47%	28.33%	33.28%	37.73%	39.59%	38.97%
DIFFERENCE FROM ONE YEAR BEFORE	-	-1.12%	-9.23%	22.88%	-5.90%	-3.78%	-35.58%	-55.85%	117.98%

Table 19. Efficiency scores for each company separately and relevant statistics for all the companies from 2007 to 2015

COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	-	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-98.01%	909.97%
DIANA	-	136.00%	-55.75%	32.12%	15.48%	-17.39%	-74.26%	-91.94%	1087.42%
CMB	-	13.55%	15.47%	-12.85%	15.28%	-68.90%	-88.79%	-92.51%	-
EAGLE BULK	-	-23.39%	8.56%	-5.86%	-8.20%	2.85%	-43.77%	-94.44%	2402.54%
MALAYSIAN BULK CARRIERS BHD	-	0.00%	-40.42%	67.83%	0.00%	0.00%	-40.79%	-97.98%	8253.68%
GENCO SHIPPING	-	115.78%	2.98%	0.00%	0.00%	-	-	-	-
STARBULK	-	-	-1.61%	65.71%	-68.75%	210.22%	-57.78%	-95.37%	494.12%
NAVIOS MARITIME HOLDINGS	-	-51.67%	21.59%	-5.25%	104.64%	0.00%	-90.28%	-92.04%	1300.00%
DRYSHIPS	-	-85.42%	24.56%	450.47%	0.00%	-80.95%	424.94%	0.00%	0.00%
SEANERGY	-	-	0.00%	-9.40%	-52.67%	133.18%	0.00%	0.00%	0.00%
PACIFIC BASIN	-	-	-	-	-	-	-74.33%	-99.71%	35322.20%

Table 20. Efficiency scores' fluctuations from year to year from 2007 to 2015

1st period: 2008-2010

As happened with the results of the 1st DEA model, the results of the 2nd DEA model for the period 2008-2010 are not clear. Of course, the average efficiency score has decreased by 7% reaching a score of 65%, but again the downturn that was expected was not eventually depicted in the individual result of each company. Most of the companies delivered results that were similar to those of the 2008, while instead of receiving scores that were decreased compared to those of 2008, there were many scores that was significantly increased.

COMPANY	difference 2009-2008	difference 2010-2008
SAFEBULKERS	0.00%	0.00%
DIANA	-55.75%	-41.54%
CMB	15.47%	0.63%
EAGLE BULK	8.56%	2.19%
MALAYSIAN BULK CARRIERS BHD	-40.42%	0.00%
GENCO SHIPPING	2.98%	2.98%
STARBULK	-1.61%	63.04%
NAVIOS MARITIME HOLDINGS	21.59%	15.20%
DRYSHIPS	24.56%	585.66%
SEANERGY	0.00%	-9.40%
PACIFIC BASIN	-	-

Table 21. 2nd DEA model fluctuations from 2008 to 2010

COMPANY	2008	2009	2010
SAFEBULKERS	2	2	4
DIANA	1	8	8
CMB	6	4	7
EAGLE BULK	9	9	10
MALAYSIAN BULK CARRIERS BHD	4	6	2
GENCO SHIPPING	5	3	3
STARBULK	7	5	1
NAVIOS MARITIME HOLDINGS	8	7	9
DRYSHIPS	10	10	5
SEANERGY	3	1	6
PACIFIC BASIN	-	-	-

Table 22. Company rankings according to 2nd DEA model from 2008 to 2010

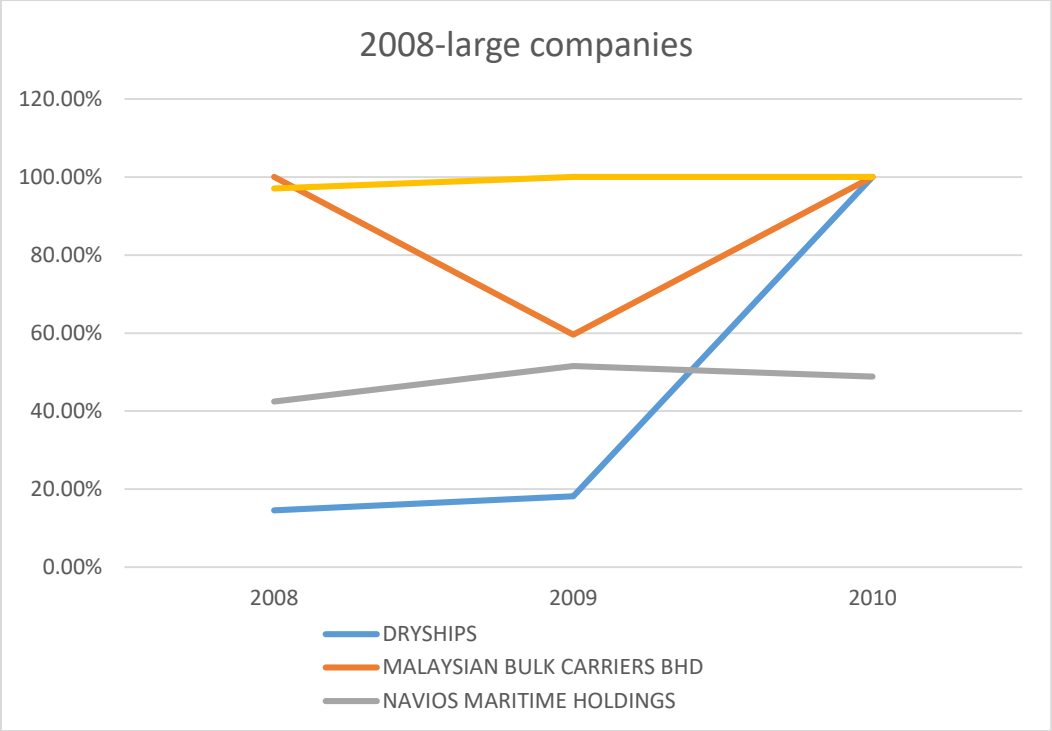

Chart 11. 2nd DEA model from 2008 to 2010-Large companies

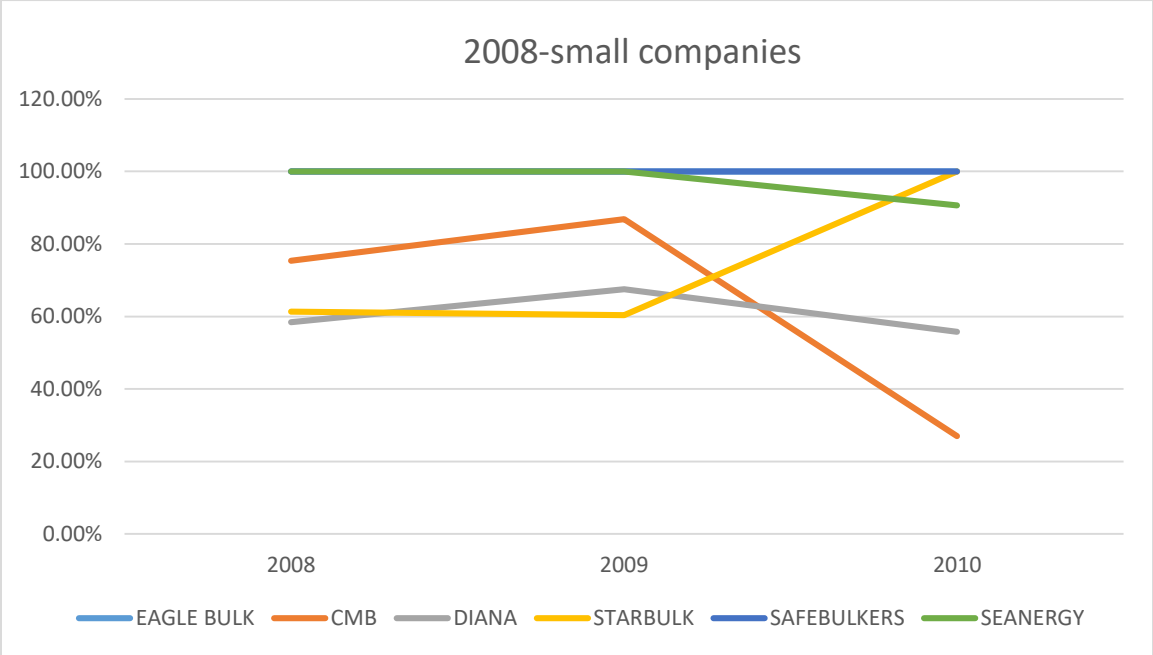

Chart 12. 2nd DEA model from 2008 to 2010-Small companies

2nd period: 2010-2012

For the second 3-year term the 2nd model of DEA returned results similar to those of the first term. Again we observe a slight fall in the average efficiency score but most of the companies remain stable. The only companies that saw a significant fall was CMB and Dryships whose scores fell to under 30% for the 2nd year of the crisis in the dry bulk market.

COMPANY	difference 2011-2010	difference 2012-2010
SAFEBULKERS	0.00%	0.00%
DIANA	15.48%	-4.59%
CMB	15.28%	-64.15%
EAGLE BULK	-8.20%	-5.58%
MALAYSIAN BULK CARRIERS BHD	0.00%	0.00%
GENCO SHIPPING	-	-
STARBULK	-68.75%	-3.05%
NAVIOS MARITIME HOLDINGS	104.64%	104.64%
DRYSHIPS	0.00%	-80.95%
SEANERGY	-52.67%	10.37%
PACIFIC BASIN	-	-

Table 23. 2nd DEA model fluctuations from 2010 to 2012

COMPANY	2010	2011	2012
SAFEBULKERS	4	3	2
DIANA	8	7	7
CMB	7	6	9
EAGLE BULK	10	9	8
MALAYSIAN BULK CARRIERS BHD	2	5	4
GENCO SHIPPING	3	1	-
STARBULK	1	10	6
NAVIOS MARITIME HOLDINGS	9	4	5
DRYSHIPS	5	2	10
SEANERGY	6	8	1
PACIFIC BASIN	-	-	3

Table 24. Company rankings according to 2nd DEA model from 2010 to 2012

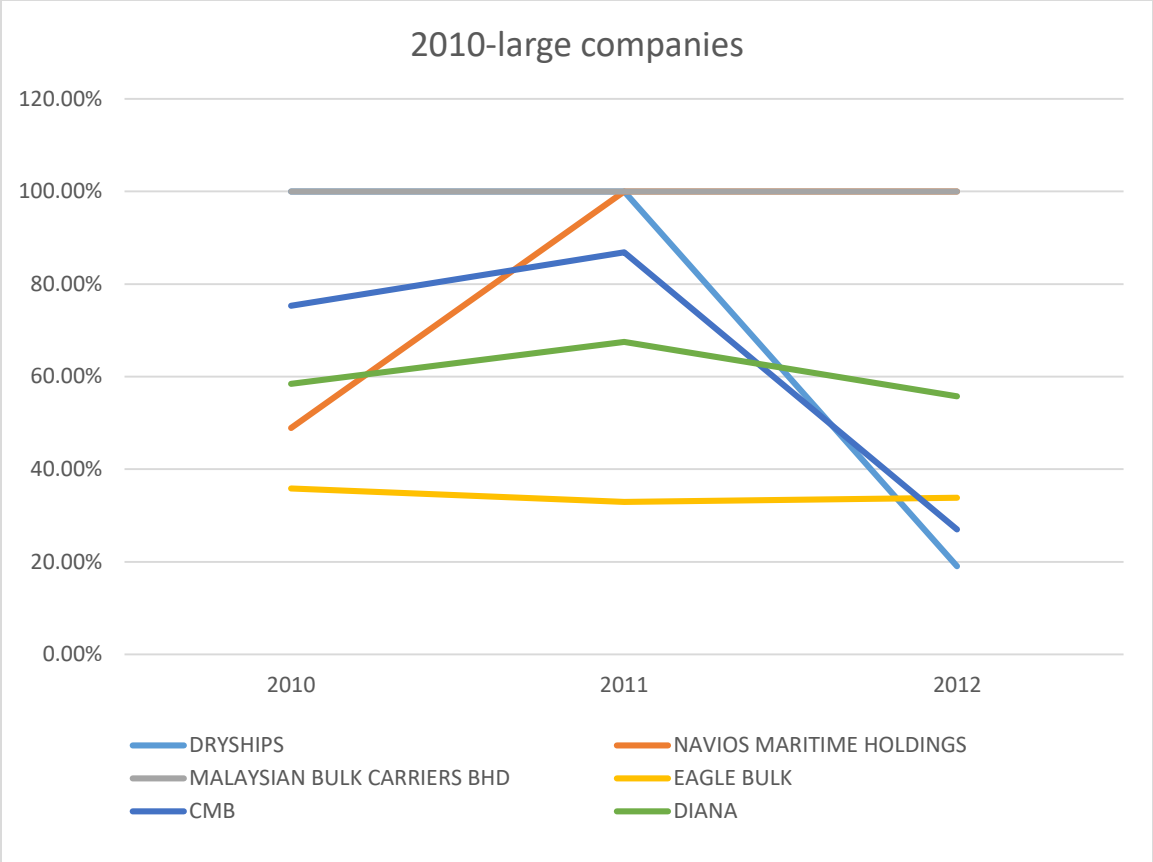

Chart 13. 2nd DEA model from 2010 to 2012-Large companies

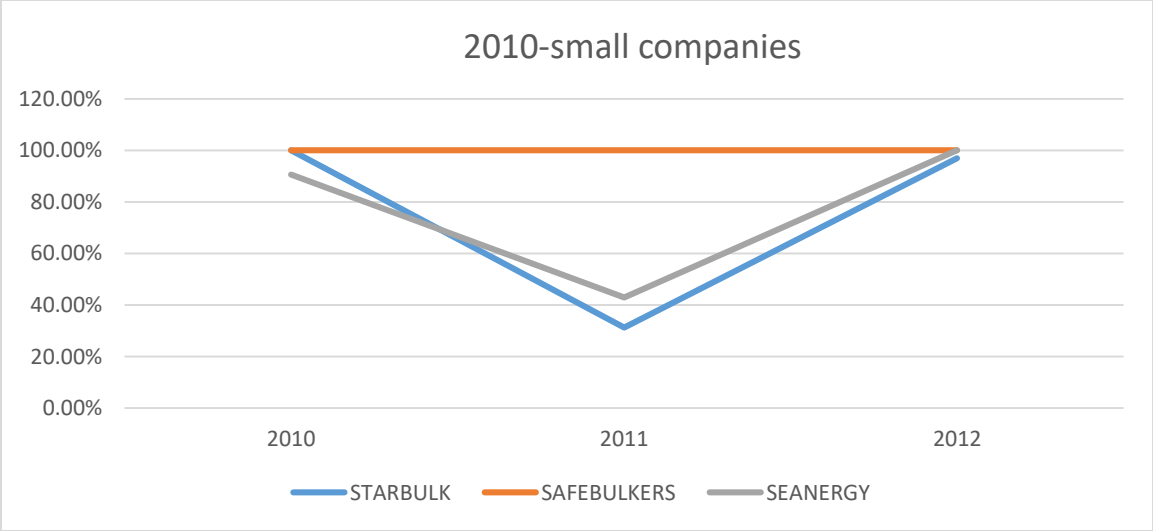

Chart 14. 2nd DEA model from 2010 to 2012-Small companies

6.3 Interpretation of results

The majority of the valuation methods that were implemented in the diploma thesis are used for decision-making purposes by potential investors and creditors. As it has been explained in previous chapter, each method has a different structure that focuses on different features of a shipping company and of its operation, leading to different results. The reason there have been created so many different valuation techniques is that each method functions differently depending on the circumstances, such the overall performance of equity markets, the trust that investors show in each industry depending rational or irrational expectations, the international agreements that favor or harm the trade etc.

Since we have studied past data during our research, the most appropriate benchmark that indicates how successful or unsuccessful each method has been can be the markets. The stock exchanges around the world act as "meeting points" where investors express their expectations about the public-traded companies by determining a price that they are willing to pay for a partial ownership in a company. A rise in the price of a stock company depicts the positive view the market has on the company, whereas a negative view depicts the opposite. Of course, this claim does not stand when the company executes practices such as an internal restructuring, stock split, secondary offering etc. The measure that is indicative of a company's value and fluctuates according to the price of its shares is the *market capitalization*. The market capitalization is calculated by multiplying the number of stocks issued by the price of a stock. It is indicative of what market thinks of the future prospects of a company as well as of the ranking of the company.

In our research we did not use the absolute value of market capitalization of each company but its fluctuations. For each company that we studied, we created time-series of the market capitalization and the results of each valuation method we used. Then we calculated the correlation coefficients for each one time-series created by the valuation methods and the time series created by the market capitalization values.

The first step of the statistical analysis was the calculation of the correlation coefficients for the whole period of valuation and then for each one of the 3-year period that we studied during the diploma thesis. Then we compare the fluctuations of each company and the average price of each case. In the next analysis cells with green color depicts the largest companies by fixed assets for the period studied.

6.3.1 Wet Market

EVA

COMPANY	correlation coefficient		
	2006-2015	2008-2010	2011-2013
NAVIOS MARITIME	-0.522	-	-0.991
CAPITAL PRODUCT PARTNERS	0.018	-0.953	0.409
DHT HOLDINGS	0.524	-0.221	0.771
NORDIC AMERICAN TANKERS	0.714	-0.788	-0.952
SCORPIO TANKERS	0.143	-	0.748
TSAKOS ENERGY NAVIGATION	0.753	0.838	-0.005
FRONTLINE LTD	0.384	-0.797	-0.276
TEEKAY TANKERS	0.299	-0.754	0.568
CONCORDIA MARITIME	-0.189	-	-0.489
TORM	0.165	0.379	-0.473
FIRST SHIP LEASE	0.465	-	0.186
AVERAGE	0.250	-0.328	-0.046

Table 25. Correlation coefficients for EVA results-market capitalization

According to the table 25 the results given by EVA method have a positive correlation with the market capitalization for 10-year period. 9 of 11 companies studied returned positive correlation coefficients. During the crisis periods, however, the case is much different. For both periods, all the companies returned mixed results independently of their size and the overall correlation that they had presented. The average values altered significantly as the

correlation was slightly negative for 2008-2010 period (-0.32) and almost zero for the 2011-2013 period (-0.04).

Altman Z-score

At this point we have to point out that market cap value is included in Z-score's formula with a coefficient of 0.6 which is the lowest among the five coefficients. We will assessed the results in the same way but we keep in mind that in some cases there might be distortions.

COMPANY	correlation coefficient		
	2006-2015	2008-2010	2011-2013
NAVIOS MARITIME	0.833	-	0.985
CAPITAL PRODUCT PARTNERS	0.791	0.787	0.868
DHT HOLDINGS	0.976	0.927	0.941
NORDIC AMERICAN TANKERS	0.551	0.698	0.989
SCORPIO TANKERS	0.589	-	0.989
TSAKOS ENERGY NAVIGATION	0.933	0.960	0.997
FRONTLINE LTD	0.989	0.985	0.953
TEEKAY TANKERS	0.167	-0.975	0.508
CONCORDIA MARITIME	0.656	-	0.998
TORM	0.968	0.652	0.801
FIRST SHIP LEASE	0.288	-	0.486
AVERAGE	0.704	0.576	0.865

Table 26. Correlation coefficients for Z-score results-market capitalization

As table 26 indicates the results derived by the implementation of Altman Z-score method have high positive correlation with the market capitalization. The only negative value we obtained was that of the Teekay Tankers for the first period of low freight rates. The most impressive statistic, however, is the correlation for period 2011-2013, when all the companies had a coefficient above 0.5, while the average price of the coefficients skyrocketed to 0.86. For once again, there are no noticeable differences between the results calculated for the "large" and the "small" companies.

Of course, after further research on the implementation of Z-score we reached the conclusion that the results are distorted not because of the coefficient 0.6 of Z – formula but because the value that ratio Market Cap/ Total Liabilities returns is the highest among all the values that are to be inserted into the Z-formula. So it is logical that there will be very high correlation between the Z-score results and market capitalization of the company.

1st model of DEA

Calculating the correlation coefficients for results obtained from DEA method is a bit tricky because when a company is characterized as efficient for a number of years in a row and "creates" the efficient frontier , its score stays stable at 100% without deviating at all. As a result there cannot be any calculation for correlation coefficients and the number of the data is limited. This phenomenon was expected as the DEA models that we created were structured in a way that they do not take into consideration those results reported by companies in annual or quarterly reports that market experts look at before pricing a company. In addition, DEA is a valuation that returns "relative results" as it detects the most efficient companies of the sample and distinguish them from the others without any other consideration such as profit or loss for a period, which, in any case, is crucial for the market.

COMPANY	correlation coefficient		
	2006-2015	2008-2010	2011-2013
NAVIOS MARITIME	-0.162	-	-
CAPITAL PRODUCT PARTNERS	-0.707	0.669	-0.806
DHT HOLDINGS	0.875	0.591	0.767
NORDIC AMERICAN TANKERS	0.230	-0.989	0.535
SCORPIO TANKERS	-0.214	-	0.229
TSAKOS ENERGY NAVIGATION	0.625	0.050	-0.574
FRONTLINE LTD	0.659	-	-0.991
TEEKAY TANKERS	-0.159	-0.845	0.068
CONCORDIA MARITIME	-	-	-
TORM	-0.955	0.951	-
FIRST SHIP LEASE	-0.658	-	-0.316
AVERAGE	-0.047	0.071	-0.136

Table 27. Correlation coefficients for 1st DEA model results-market capitalization

The correlation coefficients for the results of the 1st DEA model are the most clearly generated until this step. According to them, there is no correlation at all between the results generated by DEA and the prospects that market has for each company. The calculated average values hovered around zero (0), while most of the companies presented mixed trends in the correlation analysis. The only company that stood out was DHT Holdings as it returned high positive results during for the three periods of analysis.

2nd model of DEA

COMPANY	correlation coefficient		
	2006-2015	2008-2010	2011-2013
NAVIOS MARITIME	-0.615	-	-
CAPITAL PRODUCT PARTNERS	-0.486	0.981	0.274
DHT HOLDINGS	0.891	0.063	0.998
NORDIC AMERICAN TANKERS	0.138	-0.704	0.736
SCORPIO TANKERS	0.478	-	0.995
TSAKOS ENERGY NAVIGATION	0.944	0.437	0.834
FRONTLINE LTD	0.867	-0.723	0.834
TEEKAY TANKERS	-0.306	-0.746	-0.316
CONCORDIA MARITIME	0.170	-	-
TORM	-0.121	-0.743	0.951
FIRST SHIP LEASE	-0.417	-	-0.416
AVERAGE	0.140	-0.205	0.543

Table 28. Correlation coefficients for 2nd DEA model results-market capitalization

The 2nd model of DEA behaves better than the 1st one mainly because of the output that was the profit each company reported. As has been explained before, the profit or the loss is the most important feature a company has to give when it is public-traded, because investors' main concern is the maximization of the value in a sustainable way. The

interesting fact with this method is, however, that it depicts very different reactions from the investors depending on the period of crisis. More specifically, we see that during the first 3-year period there is no correlation at all, while during the second 3-year period there was highly positive correlation for the majority of the companies. As a result, the average price reached the 0.5, the highest value of the 6 average values we met during the analysis of DEA models.

6.3.2 Dry Bulk Market

In this section we do not assess only the results obtained for the dry bulk market, but we also try to spot differences that may exist between the dry bulk market and the wet market. For example, some methods may return more efficient results for one market that for the other. The reason for that issue is that the market has different views on the two sectors studied and different expectations regarding the capability of some companies to return efficient results.

EVA

COMPANY	correlation coefficient		
	2007-2015	2008-2010	2010-2012
SAFEBULKERS	0.237	-0.8983	0.722
DIANA	0.319	-0.494	0.351
CMB	0.530	-0.963	0.954
EAGLE BULK	0.333	-0.808	-0.542
MALAYSIAN BULK CARRIERS BHD	-0.444	0.999	0.574
GENCO SHIPPING	-0.122	-0.975	-
STARBULK	0.519	0.924	0.762
NAVIOS MARITIME HOLDINGS	-0.339	-0.928	0.438
DRYSHIPS	0.550	0.773	0.922
SEANERGY	0.138	0.201	0.998
PACIFIC BASIN	0.462	-	-
AVERAGE	0.199	-0.217	0.575

Table 29. Correlation coefficients for EVA results-market capitalization

The table 29 indicates that the market has different views on dry bulk companies than on tanker companies. We see that the EVA results agree with the market trend for the 9-year period with a low coefficient (0.199) and with a high coefficient (0.576) for the second 3-year period that we studied. On the other hand, during the same process for tanker companies we obtained correlation factors closer to zero (0).

During the crisis of 2008 the average was low negative (-0.2). However, the most interesting fact is that almost all the companies returned correlation coefficient with high absolute values, resulting to a sample of high standard deviation. In particular, 5 companies returned a correlation factor lower than -0.8, while, on the other hand, of the 4 companies that had a positive correlation, the 3 of them had a correlation coefficient higher than 0.75.

Altman Z-score

COMPANY	correlation coefficient		
	2007-2015	2008-2010	2010-2012
SAFEBULKERS	0.366	-0.832	-0.530
DIANA	0.970	-0.157	0.928
CMB	0.822	-1.000	0.990
EAGLE BULK	0.744	-0.008	0.982
MALAYSIAN BULK CARRIERS BHD	-0.163	1.000	0.970
GENCO SHIPPING	1.000	-0.544	-
STARBULK	0.760	0.818	0.905
NAVIOS MARITIME HOLDINGS	-0.266	-0.993	-0.567
DRYSHIPS	-0.091	0.282	0.664
SEANERGY	0.408	0.161	0.965
PACIFIC BASIN	0.711	-	-
AVERAGE	0.478	-0.127	0.590

Table 30. Correlation coefficients for Z-score results-market capitalization

As it was pointed out during the interpretation of the results for the wet market, this method is expected to high correlation as the market capitalization is included in the Z-formula and its weight appears to be high as well. For companies that operate in the dry bulk market we see that there is high positive correlation for the majority of the companies for the 9-year

period and the second 3-year period, but there is again low correlation of about -0.1 during the financial crisis of 2008. All in all, this method returned similar results to those of EVA method for the dry market.

1st model of DEA

COMPANY	correlation coefficient		
	2007-2015	2008-2010	2010-2012
SAFEBULKERS	0.325	-	-
DIANA	0.524	-0.442	0.999
CMB	0.472	-	0.957
EAGLE BULK	0.326	0.641	0.908
MALAYSIAN BULK CARRIERS BHD	0.292	0.500	0.996
GENCO SHIPPING	-0.027	0.995	-
STARBULK	-0.282	-0.403	0.746
NAVIOS MARITIME HOLDINGS	-0.499	-	0.398
DRYSHIPS	0.200	0.500	0.500
SEANERGY	0.173	-	-
PACIFIC BASIN	-	-	-
AVERAGE	0.150	0.258	0.786

Table 31. Correlation coefficients for 1st DEA model results-market capitalization

Unlike the results obtained for the wet market, the results obtained from 1st model of DEA for the dry bulk market show a clear positive correlation between the scores of DEA and the market capitalization. The average value of the results was low for the whole period, but during the shortest periods it increased considerably reaching a 0.25 during the financial crisis of 2008 and a 0.7 during the period 2010-2012.

2nd model of DEA

COMPANY	correlation coefficient		
	2007-2015	2008-2010	2010-2012
SAFEBULKERS	0.369	-0.647	-0.205
DIANA	0.115	-0.707	-0.183
CMB	0.152	0.209	0.496
EAGLE BULK	0.307	-0.329	0.940
MALAYSIAN BULK CARRIERS BHD	0.304	0.500	-0.229
GENCO SHIPPING	-0.999	0.990	-
STARBULK	-0.036	-0.557	0.422
NAVIOS MARITIME HOLDINGS	-0.278	0.870	-0.993
DRYSHIPS	0.200	0.999	0.500
SEANERGY	-0.020	-1.000	0.385
PACIFIC BASIN	0.265	-	-
AVERAGE	0.034	0.033	0.126

Table 32. Correlation coefficients for 2nd DEA model results-market capitalization

For one more time we see completely different behavior by the same method when applied to different markets. Unlike the results calculated for wet market, the results for dry market show high volatility for the majority of the companies. Only one company managed to maintain a stable sign for the 3 periods of research, while the other companies not only changed sign at least once, but they have big fluctuations on the absolute values of the coefficients that they returned. The result of that is also that the calculated average values are close to zero (0), indicating no correlation at all for this particular sample of companies.

CHAPTER 7

CONCLUSION

7.1 Conclusion

From the conducted research, it is confirmed that each method is suitable for use under specific circumstances. There is no valuation method that is dominant over other and the most important of all is that in a volatile market like that of shipping industry there is little room for reliable long-term predictions. All in all, when investors apply valuation methods, except the conditions in the shipping market, they should also consider the sector of shipping they are applying them to, as well as the overall sentiment of the worldwide market.

More specifically, the results indicated that the methods do not perform well during periods of global financial crisis, like that 2008, as during those periods the majority of the investors try to liquidate their assets which leads in rapid depreciation of the stocks' prices. This practice, however, makes the valuation process useless as the prices are not driven by investors' future expectations and views on the companies' performances but on their choice to sell fast in order to avoid another fall in the shares' prices. Depending the market the companies under research operate, the methods behave in a very different way. EVA method and the 1st model of DEA appear to perform much better when applied at dry bulk companies, while the second model of DEA appears to be more efficient when it is used for valuation of companies that operate mainly tankers. As far as Altman Z – Score is concerned, we pointed out that this is the only method, among the 4 we used, that uses the market capitalization as input in the valuation formula and consequently we receive high correlation coefficients. Even in this case, however, it should be noted that the results obtained for the most volatile market, dry bulk market, are lower than those of wet market. This does not change the fact that Altman's method need more modifications in its structure in order to be applied in a distressed industry, such as shipping industry. Generally, in a

highly leveraged industry, such as maritime, it is preferable to use valuation methods that are based on the performance of the companies.

7.2 Future research suggestions

It is obvious that in shipping market, which is very competitive and shows many ups and downs, it is difficult to find a traditional valuation method that can be used as a reliable tool for investors. In order to obtain better results it would be useful to focus on additional data that would allow investors to examine the strategy of a company thoroughly. A valuation method, for example, that would take into consideration not only the overall performance of a company but the areas where its fleet operates would be more reliable as the freight rates differ from region to region and from route to route. In addition, it would be interesting to analyze the companies' performance according to the size of the ships they operate and observe if there is a trend in their performance depending on what type of ships they operate during a specific period. The combination of these features could lead to a sustainable method and more reliable results than those calculated according to conventional methods that are structured to follow only the balance sheet data.

In our research we studied how valuation methods behave during recession periods, it would be also useful to do a similar research about how valuation methods work when the shipping market is in a rise. In this way, there might appear more modifications that would be useful to be considered during the creation of a valuation method for the shipping industry.

Last but not least, in a highly volatile market with many companies that have high ratios of debt to equity, many companies go bankrupt or deal with distressed situations such as difficulties to find extra funding or weakness to pay their debts on time. So a model, similar to that of Altman, would be useful for predicting distressed situations or even bankruptcy in a specific time horizon. Of course, a model like that requires an extensive research beforehand in order to determine the ratios that would be included in the formula as well as their respective coefficients.

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APPENDIX

DATA USED IN DEA:

Tables A1, A2, A3 - Dry sector – 1st model of DEA

Tables A4, A5, A6 - Dry sector – 2nd model of DEA

Tables A7, A8, A9 - Wet sector – 1st model of DEA

Tables A10, A11, A12 - Wet sector – 2nd model of DEA

TABLE A.1 - ASSETS (INPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	407657	482282	628724	805372	877721	1082214	1122216	1182329	1309631
DIANA	944342	1057206	1320425	1585389	1604471	1742802	1701981	1787122	1836965
CMB	989246	1175453	1250660	1672045	1771173	1876892	1762535	1607398	-
EAGLE BULK	1136008	1362175	1608202	1896572	1867256	1789144	1723414	913876	787038
MALAYSIAN BULK CARRIERS BHD	2187708	2483705	2296186	1997254	1162996	1107855	1172361	1545583	1544469
GENCO SHIPPING	1653272	1990006	2336802	3182708	-	-	-	-	-
STARBULK	-	891376	760461	891376	717928	354706	468088	2062084	2164883
NAVIOS MARITIME HOLDINGS	1971004	2253624	2935182	3676767	2913824	2941462	2919613	3159389	2958813
DRYSHIPS	2344432	4842680	5806995	6984494	8621689	8878491	10123692	10371603	476052
SEANERGY	-	378202	538452	696401	436476	120960	66350	3268	209352
PACIFIC BASIN	-	-	-	-	2431752	2470000.3	2537446	2307516	2145735

TABLE A.2 - OPERATING COST (INPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	46000	35000	60000	35098	59972	72345	93875	127378	159333
DIANA	52542	111554	115006	141809	144753	159669	172658	157372	204889
CMB	92269	223784	276095	375377	550887	612665	435314	547709	-
EAGLE BULK	60331	108669	127204	189376	281764	228029	171296	205000	239394
MALAYSIAN BULK CARRIERS BHD	228681	382389	203682	209463	172260	165054	177625	205804	261088
GENCO SHIPPING	54317	170993	169039	227396	-	-	-	-	-
STARBULK	-	96108	191658	120782	171834	393091	61460	148819	659860
NAVIOS MARITIME HOLDINGS	1971004	2253624	2935182	3676767	2913824	2941462	2919613	3159389	2958813
DRYSHIPS	2344432	4842680	5806995	6984494	8621689	8878491	10123692	10371603	476052
SEANERGY	-	378202	538452	696401	436476	120960	66350	3268	209352
PACIFIC BASIN	-	-	-	-	2431752	2470000.3	2537446	2307516	2145735

TABLE A.3 – REVENUES (OUTPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	172057	200772	164606	157020	172036	187557	186721	159900	127317
DIANA	190480	337391	239342	275448	255669	220785	240633	175576	157712
CMB	361068	482210	413514	485293	365967	368990	409104	485019	-
EAGLE BULK	124815	185425	196574	265036	313432	190811	202439	154000	103856
MALAYSIAN BULK CARRIERS BHD	608142	721158	303707	404250	363938	157395	161978	255724	241504
GENCO SHIPPING	185387	405370	379531	447438	-	-	-	-	-
STARBULK	-	238883	142351	238883	106912	85684	68296	145041	234286
NAVIOS MARITIME HOLDINGS	758420	1246062	598676	679918	689355	614494	569016	512279	480820
DRYSHIPS	582561	1080702	819834	859745	1077662	1210139	1492014	2185524	969825
SEANERGY	-	35333	87897	95856	104060	55616	23079	55616	11223
PACIFIC BASIN	-	-	-	-	1342535	1443086	1708792	1718500	1260291

TABLE A.4 - VESSEL EXPENSES (INPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	12429	17615	19628	23128	26066	34450	41964	50634	55469
DIANA	29332	39899	41369	52585	55375	66293	77211	86923	88272
CMB	208342	291157	246135	302711	426459	470716	366284	443790	-
EAGLE BULK	27143	36270	50161	72983	85049	90551	84424	95000	92439
MALAYSIAN BULK CARRIERS BHD	150000	250000	140000	105813	107629	104871	84766	84038	80559
GENCO SHIPPING	27620	47130	57311	78796	-	-	-	-	-
STARBULK	-	26198	30168	22349	25247	27832	27087	53096	112796
NAVIOS MARITIME HOLDINGS	27892	26621	31454	47109	117269	117790	114074	130064	128168
DRYSHIPS	63225	79662	165891	201887	373122	649722	649722	609765	371074
SEANERGY	-	3180	16222	30667	34227	26983	11086	1006	5639
PACIFIC BASIN	-	-	-	-	1000000	1100000	1300000	1350000	900000

TABLE A.5 - VESSELS VALUE (FIXED ASSETS) (INPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	254817	286955	373924	541244	655356	810001	855200	960423	988161
DIANA	867632	1060311	1123105	1160850	1046719	1211138	1320375	1373133	1440803
CMB	451125	484743	432589	718488	1259922	1631669	1448514	1305479	-
EAGLE BULK	605244	874674	1010669	1509798	1789381	1714307	1639555	834052	733960
MALAYSIAN BULK CARRIERS BHD	655175	581858	627554	562391	549743	486227	515018	750622	648422
GENCO SHIPPING	1224040	1726273	2023506	2783810	-	-	-	-	-
STARBULK	-	821284	668698	610817	638532	291207	394606	1441851	1757552
NAVIOS MARITIME HOLDINGS	425591	737094	1557741	2249677	1767946	1746493	1777457	1911143	1823961
DRYSHIPS	1643867	2134650	2058329	1917966	1956270	2059570	2249087	2141617	96428
SEANERGY	-	345622	444820	597372	381129	68511	0	0	199840
PACIFIC BASIN	-	-	-	-	1525185	270202	1622297	1584924	1611000

TABLE A.6 - GROSS PROFIT (OPERATING) (OUTPUT)									
COMPANY	2007	2008	2009	2010	2011	2012	2013	2014	2015
SAFEBULKERS	230925	163660	177714	121922	108936	111951	92846	26716	-32016
DIANA	137938	225837	124336	133369	110916	63116	-8653	-18204	-47177
CMB	268799	258426	137419	109916	129418	43724	4978	-51838	-
EAGLE BULK	64483	76755	65370	75569	31668	-37218	31143	-51600	-135537
MALAYSIAN BULK CARRIERS BHD	586845	531758	165256	212915	67162	66451	45506	18333	-1196
GENCO SHIPPING	131070	234377	210492	221291	-	-	-	-	-
STARBULK	-	142775	-49307	260	-64769	-306929	8434	-1432	-425574
NAVIOS MARITIME HOLDINGS	273523	46706	40177	105098	6030	127646	-128895	-119731	-190705
DRYSHIPS	531800	-14035	58314	367390	169660	15854	155576	543179	-881508
SEANERGY	-	-31320	40374	18424	-183607	-181117	19271	81810	-7055
PACIFIC BASIN	-	-	-	-	108437	81867	55097	-39624	-4111

TABLE A.7 – ASSETS (INPUT)										
COMPANY	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NAVIOS MARITIME	-	-	-	-	1005087	1195469	1364644	1644661	1685014	1767576
CAPITAL PRODUCT PARTNERS	-	556991	700154	760928	758256	1196289	1070128	1401772	1493095	1555875
DHT HOLDINGS	349040	422208	531348	517971	480855	504467	399759	446599	1378096	1423805
NORDIC AMERICAN TANKERS	800180	804628	813878	946578	1083083	1383267	1085624	1136437	1175860	1244626
SCORPIO TANKERS	-	-	-	104422	412268	448229	573280	1646676	2804643	3523455
TSAKOS ENERGY NAVIGATION	1966817	2359385	2602317	2549720	2702260	2535337	2450884	2483899	2699097	2900697
FRONTLINE LTD	4048815	3762091	4027728	3715218	3798803	1840569	1688221	1367605	2501768	2887281
TEEKAY TANKERS	298625	310324	599535	539963	936517	881926	1105656	1097529	1241172	2169476
CONCORDIA MARITIME	-	-	-	-	3460.8	3758.2	3480.7	3406.5	3715.8	4354.5
TORM	2089019	2966562	3317353	3227211	3286108	2779207	2355337	2007610	625914	1867441
FIRST SHIP LEASE	-	629234	932665	903239	836069	822415	774935	662627	594916	560206

TABLE A.8 - OPERATING COST (INPUT)										
COMPANY	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NAVIOS MARITIME	-	-	-	-	10300	64233	81877	80392	111789	115149
CAPITAL PRODUCT PRT	-	39368	58032	70588	73274	95018	150704	130171	132066	146538
DHT HOLDINGS	37994	40469	52123	61384	66482	133677	186698	86005	123381	229271
NORDIC AMERICAN TNK	103278	133741	106712	121952	125638	166000	198584	150049	156394	158989
SCORPIO TANKERS	-	-	-	23398	37637	157708	132556	189788	271800	448627
TSAKOS ENERGY NAV.	222408	250915	344202	372251	327311	432859	392699	413486	424965	399635
FRONTLINE LTD	967413	898904	1395831	896237	888238	849476	594212	641182	632908	280639
TEEKAY TANKERS	95941	97348	72644	71681	104105	113903	537624	166676	187944	326993
CONCORDIA MARITIME	-	-	-	-	413.2	452	465	467	474	600
TORM	602728	461200	646000	620000	676329	1224174	1028433	841979	131462	304536
FIRST SHIP LEASE	-	31325	62504	67771	80530	107310	86827	130621	76617	83235
AVERAGE	**338,293**	**244,158.7**	**342,256.00**	**256,140.22**	**217,296.11**	**304,073.64**	**308,243.55**	**257,346.91**	**204,527.27**	**226,746.55**

TABLE A.9 – REVENUES (OUTPUT)										
COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME	-	-	-	-	33568	121295	151097	202397	264877	313396
CAPITAL PRODUCT PARTNERS	-	86545	147617	134519	113562	130316	153950	171494	192777	220344
DHT HOLDINGS	86793	81427	144603	102576	89681	100123	97194	87012	150789	365114
NORDIC AMERICAN TANKERS	175520	186986	228000	124370	126419	94787	130682	243657	351049	445738
SCORPIO TANKERS	-	-	-	27619	38797	82109	115381	207580	342807	755711
TSAKOS ENERGY NAVIGATION	427654	500617	623040	444926	408006	395162	393989	418379	501013	587715
FRONTLINE LTD	1558369	1299927	2104018	1133286	1165215	810102	578361	517190	559688	458934
TEEKAY TANKERS	153093	146307	163327	159690	139479	215072	197429	180015	250002	514193
CONCORDIA MARITIME	-	-	-	-	513.4	559.6	543.4	467.8	531	810
TORM	455394	644965	1183594	862251	856095	1305208	1121215	992336	179873	540404
FIRST SHIP LEASE	-	40715	86621	98768	100494	110714	106107	89993	93414	106583

TABLE A.10 - VESSEL EXPENSES (INPUT)										
COMPANY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NAVIOS MARITIME	-	-	-	-	18000	35000	40000	42000	65000	67000
CAPITAL PRODUCT PARTNERS	-	22000	30500	33000	31000	45000	60000	55300	62029	70333
DHT HOLDINGS	35500	38500	21409	30034	30221	30811	41684	50500	92303	127000
NORDIC AMERICAN TANKERS	61274	79000	45593	52000	47113	69700	101200	234310	62500	66589
SCORPIO TANKERS	-	-	-	8562	20000	38200	52097	45000	86355	178994
TSAKOS ENERGY NAVIGATION	145160	180431	226000	221000	301000	143000	244251	247740	300000	273985
FRONTLINE LTD	599046	548000	705000	425000	482000	487000	404589	95300	153315	173063
TEEKAY TANKERS	68111	69210	36111	36327	47000	44753	100000	100000	109626	156980
CONCORDIA MARITIME	-	-	-	-	155	162.6	139.7	132.1	123	142
TORM	77700	127000	174000	1695000	152207	164949	168903	173367	50254	122867
FIRST SHIP LEASE	-	10000	10000	10000	21000	21000	20000	20000	24000	28000

TABLE A.11 - VESSELS VALUE (FIXED ASSETS) (INPUT)										
COMPANY	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NAVIOS MARITIME	-	-	-	-	884000	1019000	1211000	1453200	1540000	1641635
CAPITAL PRODUCT PARTNERS	-	525199	641607	703707	707339	1073986	959550	1176819	1186711	1333657
DHT HOLDINGS	322577	398005	462387	441036	412744	454542	310023	263142	988168	986597
NORDIC AMERICAN TANKERS	752702	740631	707853	825449	988263	1022793	964855	911429	909992	962685
SCORPIO TANKERS	-	-	-	99954	333425	322457	395412	530270	1971878	3087753
TSAKOS ENERGY NAVIGATION	1649928	2127704	2209317	2059720	2316947	2231996	2207842	2231589	2388108	2424524
FRONTLINE LTD	2446278	2324789	2100717	1740666	1427526	1334512	1175000	995000	1455000	1028000
TEEKAY TANKERS	282451	267729	522796	506309	757437	716567	885992	859308	897237	1767925
CONCORDIA MARITIME	-	-	-	-	2919.1	3289.5	3063.4	2914.8	3129.7	3809
TORM	1136408	2270064	2235863	2390391	2560079	2258550	1955664	1697423	536869	1578824
FIRST SHIP LEASE	-	609806	905604	845187	775023	784696	727517	630968	556019	526516

TABLE A.12 - GROSS PROFIT (OPERATING) (OUTPUT)										
COMPANY	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NAVIOS MARITIME	-	-	-	-	23268	57062	69220	122005	153088	198247
CAPITAL PRODUCT PARTNERS	-	47177	89585	63931	40288	35298	3246	41323	60711	73806
DHT HOLDINGS	48799	40958	92480	41192	23199	-33554	-89504	1007	27408	135843
NORDIC AMERICAN TANKERS	72242	53245	121288	2418	781	-71213	-67902	93608	194655	286749
SCORPIO TANKERS	-	-	-	4221	1160	-75599	-17175	17792	71007	307084
TSAKOS ENERGY NAVIGATION	205246	249702	278838	72675	80695	-37697	1290	4893	76048	188080
FRONTLINE LTD	590955.9	401023	708187	237049	276977	-39374	-15851	-123992	-73220	178295
TEEKAY TANKERS	57152	48959	90683	88009	35374	101169	-340195	13339	62058	187200
CONCORDIA MARITIME	-	-	-	-	100.2	107.6	78.4	0.8	57	210
TORM	-147335	183765	537594	242251	179766	81034	92782	150357	48411	235868
FIRST SHIP LEASE	-	9390	24117	30997	19964	3404	19280	-40628	16797	23348