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Comparative research on Greek operating model and Nordic operating model

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Comparative study on return of Greek and Nordic operating mode in shipping

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DECLARATION

Hereby, I certify that all the materials and opinions in this research paper which is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this article reflect my own personal opinions and thoughts, and are not necessarily endorsed by the University.

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ABSTRACT

The crazy fluctuation of freight rate from 2002 to 2009 has given a profound lesson to the investors in bulk shipping market. Investors start to realize the importance of the price of vessel in terms of newbuilding and second-hand market. But the lesson also leads to a bad result: so many vessels are ordered now when the market is low, which will make the freight rate in a low situation for a long period of time.

The paper focuses on the dry bulk Panamax vessel market and the thesis starts with proper introduction of the two different ship owner's operating modes: Greek operating mode and Nordic operating mode. As time goes on, the trend of each model and connection between each other are changing. And due to the dramatically fluctuation from 2002 to 2012 caused by 'China Factor', the decision on when to buy new vessel has become more and more important. So in this paper, I will analyze and compare these two operating modes by calculating ROI according to historical data, then get the result and best solution on when to buy and sell the vessel. Finally, when comparing with the reality, we will see whether it is a good decision in investing vessel now and get instruction from the comparison. And in this process, regression model will be used.

The aim of this essay is to find the difference of Greek and Nordic operating modes and see the future of operating strategy in terms of bulk market through the comparisons of profit of each operating mode.

Keywords: Greek and Nordic operating mode, price of secondhand-hand and newbuilding vessel, Panamax vessel, ROI, investment strategy, shipping cycle

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1. Introduction

1.1 Backgrounds

As we all know, shipping is an adventure industry with a lot of risk and unknown. During the long history of shipping industry, the determination of timing of investing or divesting ships has been the most tough and difficult question to the shipowner or other investors in shipping market. And the high fluctuation from 2002 caused by China entering WTO has given rise to the high fluctuation of ship price. Then people start to know about the benefit of buying and selling ships instead of buying ships only for operation during the whole life of one vessel.

So many newbuilding vessels have been ordered from 2009 till now and more and more vessels will be delivered in the future due to the low price of new vessel, which will lead to the depressed situation in shipping market for a long period of time.

In this article, I am going to analyze two operating modes of shipping strategy; Greek operating mode and Nordic operating mode. The aim is to conclude which operating mode is better in terms of return and the scale of shipping company. After comparison, I will focus on the current situation of shipping market and give instruction of development of each two operating modes in the future.

1.2 Literature review

Investors in shipping industry have always been faced with difficult decisions on investment and divestment timing because of the complex and volatile nature of the market. It is not surprising that many famous studies have paid a lot of attention on the huge fluctuation of freight rates and ship prices in maritime economics literature. According to the articles of different scholars, different aspects of shipping economics such as efficient market of the shipping market, shipping cycle and implication of price of second-hand vessel have been set foot in a lot.

Manolis G. Kavussanos & Amir H. Alizadeh were analyzing the Efficient Market Hypothesis (EMH) in the formation of newbuilding and second-hand vessel prices in the dry bulk sector of shipping industry through VAR model. Their article

was concerned with vessels as real assets with limited economic life and concluded that the efficient market hypothesis in the market for newbuilding and second-hand dry bulk vessels is rejected.

And in terms of EMH of ship prices, we have to mention two pioneers in this aspect Strandenes and Beenstock, who both regarded ships as capital assets and used a present value model for ship price determination. The difference is that Beenstock assumed rational expectations of investors in the formation of ship prices, while Strandenes assumed semi-rational expectations.

In the aspect of structure of ship price, traditional approaches for modeling price of vessel are mainly based on general and partial equilibrium models by establishing relationships between a number of variables such as deliveries of newbuilding vessel, price of new vessel and scrap vessel, freight rates, bunker prices and so on. But recently, real options have been applied more often to analyze the factors for determining ship prices.

Amir H. Alizadeh and Nikos K. Nomikos considered ships as real capital assets which can, not only generate income through operation but also capital gain (loss) through price appreciation (depreciation). In their study they proposed a new way for the decision of timing of investment in shipping market, especially for the timing for buy and sale of vessels. They chose the P/E ratio, which is the relationship between price of vessel and TC earnings to find the timing of buying and selling vessel on the basic of discounted present value model. For considering long-term market, they also used moving average trading rules to reveal promising results of sales and purchase strategy when compared with static buy and hold strategies.

In conclusion, they found that the relationship between price and earnings in shipping markets contains important information about future behavior of ship prices, which can be very useful for determining the timing of investment. They also showed that investors in shipping markets can benefit from applying sale and purchase strategy.

In the shipping cycle aspect, the famous book <Maritime Economics> from Martin Stopford has told us the development of shipping history. Shipping is a

cyclical industry with too many risks and be determined by a lot of factors. And in terms of strategy in accordance with the shipping cycle, Martin Stopford also found that there may exists chance to get good profit by using sales and purchase way, but this kind of strategy is not following the original goal of shipping industry.

If we look at the aspect connecting shipping cycle with price of vessel, the first researcher paying attention on the cyclicality of the shipbuilding market was Tinbergen, who supported that the condition of the shipbuilding market is connected with the amount of freight offered for shipping very closely. And freight rate is then in its turn dependent on the shipping tonnage present in the market. This leads to an endogenous shipbuilding market cycle, which is caused by the time lag between the demand for shipping capacity and the actual availability of this capacity.

Furthermore, recent analysis on the shipping finance such as shipping funds and derivative market instead of actual operation in shipping market also reflected that the appreciation of price of vessel is more valued in the eyes of investors. And the liquidity and efficiency of such market will accelerate the tendency of strategy.

1.3 The framework of this paper

Generally, this paper is roughly divided into 6 parts.

(1). Background and Literature review.

(2). Introduction of shipping cycle and two operating modes

(3). Actual experience of two different modes

(4). Analyzing two operating modes by calculating the ROI in terms of Panamax vessel on the basis of data price of vessel, freight rate and so on.

(5). Instruction for current and future development of each operating mode according to the result of calculation.

(6) Get conclusion of return of each operating mode and sum up the basic problem of implementing way of each mode.

2. Introduction of Greek and Nordic operating mode

2.1 Historical shipping cycle

Just as Martin Stopford said in his famous book Maritime Economics, the market cycle pervades the shipping industry. There are numerous peaks and low ebbs during the long history of shipping market, which reflects the development of world trade from another point of view. The different shipping cycles are mainly caused by the fluctuation of world economy as well as particular events such as world war. But due to these shipping cycles, the shipping industry has been in the sustainable process of development from history to future. The long cycles of the world economy have profound consequences on the shipping market and on the economy as a whole. During each stage of shipping cycle, there has to be a story, even lesson waiting for shipowners or investors, who have absorbed valuable experience from each stage. But no one is sure that what will happen in the future, that is also the most attractive point of shipping industry.

Generally, the shipping cycle, which accords with the economic cycle, are mainly divided into three parts. The longest part lasts nearly sixty years, which is called a "long cycle". And the medium cycle lasts from five to ten years while seasonal cycle does not last more than one year. In the article, I just focus on the medium cycle. Under normal circumstances, each vessel will meet two or three medium shipping cycles during the whole life of vessel.

In the shipping market, the container and bulk are the two main parts. But in particular, the bulk market is extremely volatile. The bulk market is a global business, which is closely connected with the basic infrastructure and development of countries and subjected to the falls and rises of economics.

In bulk market, it is raw materials for heavy industry such as iron ore, coal or grain that account for a large proportion. The demand for transportation in bulk shipping, which is one kind of derivative demand, is influenced by changes of world consumption of bulk commodities as well as the geographical location. The raw materials demand rises when the world economy grows while the demand decreases

during economic downturns. The supply of bulk shipping is concerning the number of vessel to be ordered and delivered. Normally, the demand of bulk shipping is changed tremendously while there is a lack between demand and supply during period of time, which will affect the trend of freight rate directly. Despite the lack between demand and supply, the bulk shipping market still follows a typical cyclic pattern in the short and medium period, which forms the shipping cycle.

In his book <Maritime Economics>, Stopford defines the shipping short cycles as the mechanism co-ordinating supply and demand in the shipping market, which has four stages during short period.[1]

(1) trough--- a surplus of shipping capacity pulls down freights near operating costs

Shipowners are forced to sell ship.

Decommissions and sales increase while the shipbuilding order book reduces.

(2) recovery--- supply and demand move towards balance

Freight rates increase above operating costs.

(3) peak--- freight rates are high, even several times operating costs

Owners become very liquid and the shipbuilding order book expands.

(4) collapse--- supply overtakes demand

Freight rates fall again.
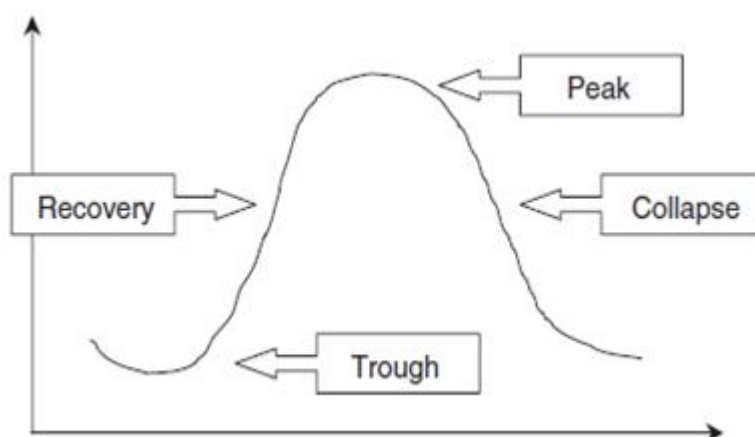
Figure 1 The typical course of a shipping cycle.
*Source***: <Maritime Economics>**

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[1] Martin Stopford，Maritime Economics(second edition)[M]．Me Graw Hill，2004．

So during the long history of many cycles, the shipowners or investors are dealing with volatility with market cycles all the time. This is why shipowners have to take tough decisions all the way on ship selling and purchasing (asset play) or ship chartering (operating). The right moment to buy or sell ships regarding the direct correlation between freight rates and ship prices is so important for them to examine the return of the investment. There exist some choices for them: newbuilding market, second-hand market or even chartering market. But each decision is affect the profit of next 10 years and fate of the company.

Shipping is different from other industries in terms of balance of supply and demand. It is the time lag of ship building that give rise to the interspaces between demand and supply, further influencing the huge fluctuation of freight rates, thus forming shipping cycle. Generally, ships are ordered based on current market conditions but they are delivered with a time lag of 2–4 years. In the current situation, the time lag is shorted within 2 years, but that is enough for the volatility of freight rates. With reference of operation, shipowners also need to consider the choice between time charter and voyage charter on the basis of trend of market in short period. That is why after a hundred of years' history two operating strategies in respective of the medium shipping cycle with have come into our eyes.

2.2 Greek and Nordic operating modes

After knowing a little about the shipping cycle, we are going to analyze the operating mode which has been implemented in the shipping cycle. Since the importance of the timing of investment or disinvestment on shipping has been the key point to the return on shipping industry, there have formed different operating modes focusing on the sales and purchase of vessel.

In terms of the medium shipping cycle considered according to the whole life of one vessel, there are two main different operating modes: Greek operating model and Nordic operating model. These two operating modes has been used for a long time, but along with the huge fluctuation of freight rates and price of vessel, the change and conversion between each mode is creeping up on.

There is no denying that investors in the shipping industry can be divided into two main groups depending upon their investment strategies. The first group is the traditional players, who acquire ships just for operating the vessel for a long period of time. Normally, most of these players who care about the profit of operating vessel are larger public or state-owned shipping companies with relatively long horizon investment strategies.[2] People regard this strategy as Nordic operating mode.

On the other hand, the second group is more caring for the capital gain from the S&P market rather than operational profits of vessels. This kind of players is called as speculators or asset players, most of who are private investors or small shipping companies with a relatively short term investment horizon. And this strategy is regarded as Greek operating mode.

2.2.1 Nordic operating mode

At first, I want to introduce the Nordic operating model, which always follows up the tendency of market. When shipping market is rising, the shipowner or other investors will buy or charter in the vessel to operate to earn the margin of freight rates. When market is low, they do not sell their own vessel, only sticking to maintain the operating vessel while losing money. Just like the current moment, Nordic mode players are waiting for booming market so that they are going to earn the money at first when market is rising while others need time to build vessel. So it is the freight rates that Nordic mode players care about a lot because freight rate affect on the profit of operation in a direct way.

The famous example of Nordic operating mode happened in the container market, which is known by everyone in shipping industry and difficult to happen again. Maersk Line acquired P&O in 2005 when the market is on the doubtless way of growth. Maersk Line was a good example of Nordic operating mode player, who increased investment in shipping when market was growing despite the increasing price of vessel.

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[2] Zhang Rongzhon．2007(5) Trends of international ship recycling market【J】．*Ship Economics & Trade, 23-25*

2.2.2 Greek operating mode

Next strategy is the Greek operating mode, which can also be called as go anti-cyclical mode or "buying low and selling high" strategy. Greek operating mode often used by the Greek shipping companies is totally different from traditional Nordic operating mode. Generally, the Greek operating mode suggests investor to consider the expected profit of capital gain on the price of vessel instead of operational profit. So this mode is always used by buying low, selling high, spot chartering on a rising market and taking a time charter when the peak is reached. That is why the investor using Greek operating model are asset players instead of vessel operators.

Buying low means that the shipowner should buy ships when the market reaches its bottom level. During that period of time, the shipyard is empty caused by the low freight rates and low price of newbuilding vessel, which will give the investors a chance to acquire vessel quickly and at a convenient price. A vessel with a low price has a lower break-even point, which also means a better profitability during market ups and lower losses during market downs. Selling high means that the shipowner is supposed to sell his ships on the second-hand market when the freight rates are supposed to have reached the maximum level and a collapse is expected. The timing of selling vessel on the second-hand market is crucial, which will determine whether shipowner can make a significant capital gain or not.

The Greek operating mode is always implemented by Greek shipping companies. Beyond question, Greece has a strong tradition in the shipping business and has the fourth largest merchant fleet in the world. In this country, shipping companies are mainly family companies, which mean that it is suitable to be the asset player because they are more flexible than the operation players.

The best example of Greek operating mode is when the market is reaching its bottom level such as from the year of 2009 until now. Everyone knows that the key reason leading to the current shipping crisis is that more and more vessels are ordered and will be delivered in the future. The investors investing in new vessel now do not care a lot about the specific time when the market is going to rise and they believe

market will grow one day in the future. By then hey will make money on the price of vessel when the price increases along with the freight rates.

Generally, in the secondhand market, Greek operating mode player and Nordic operating mode player are always closely connected with each other. The Greek mode player often sells their vessel to Nordic mode player. The only and most important thing connecting them is the price of second-hand ship, which also makes a profound influence on each profit in the long–term strategy. So in this essay, I will pay more attention on the price of second-hand vessel in terms of both Greek and Nordic operating modes.
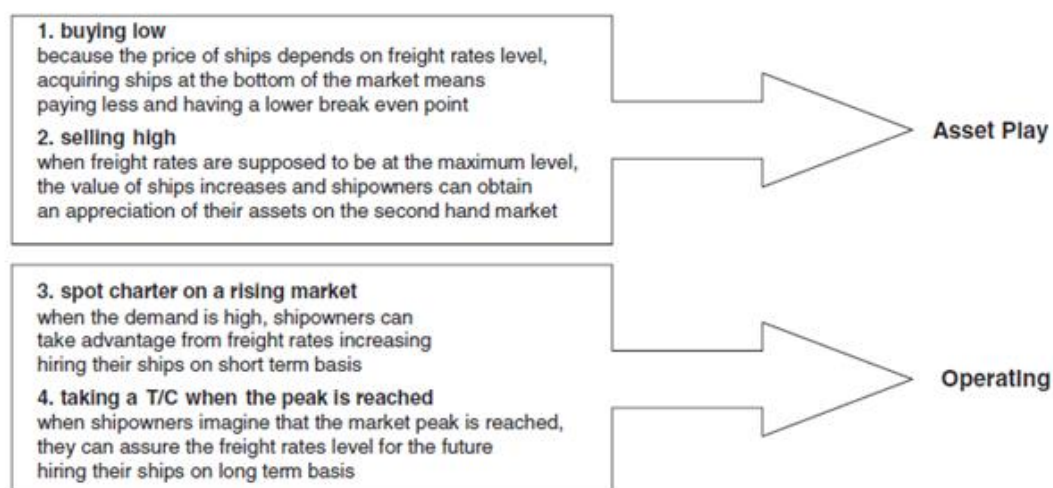
Figure 2 The hypothetical behavior of a shipowner
Source: *<Maritime Economics>*

2.3 The importance of timing and a low break-even point

Now we know that the investment decision is a crucial moment of the shipping company's life. And break-even point is the direct key elements that will determine the return of investment in the next five to ten years.

Going back to Greek operating mode, we can conclude that these asset players pay more attention on the capital cost of each vessel. Given the freight rate level, a fleet with a low break-even point needs a minor sales volume to cover the full cost and to begin to generate profit than a fleet with a higher break even point. It will mean that investment with a low break-even point will survive longer when the market is

not good. Furthermore, while considering operating strategy, the investment with a low break-even point does not need as much operating profit as that with a high break-even point, which means that in operating period, break-even point will determine the position of the market.

So the decision timing is the key to success for a shipowner. Particularly in bulk shipping business, the real profits made from asset plays is bigger than those from operating on the charter market. So from shipowners' point of view, we can even assert that capital profits rather than operating profits are often in the forefront of must bulk shipowners' thoughts.

But in fact, we always see shipowners buying new ships while freight rates are close to the peak. Again a large number of vessels are disposed of by their shipowners at the bottom of the market mainly due to the financial problem, thus incurring capital losses. In short, we often see shipowners acting exactly like inexpert investors.

2.4 Basic problem in implementing two different operating modes in terms of different shipping cycles

There is no doubt that the application is so difficult though acknowledging the shipping cycle. So this also tell us why two different operating modes appeared according the development of shipping industry. The main difficulty is still on the shipping cycle. Although we have known about the scheme of shipping cycle, there are no rules about the regularity of cycle and difference and connection between each stage at all.

First of all, shipping cycles are random but not regular. Although we can analyze shipping cycles from both demand and supply aspect, there still exists a large amount of uncertainty between the connections which can not be removed. Then forecasts become extremely difficult because of highly volatile market caused by information asymmetry. So this will increase the risk of shipping investments.

In fact, it is true that through high information circulation, we are able to analyze the supply side of bulk market. According to the data of number of vessel delivered, ordered or to be delivered as well as the age of every existing ship, we can more or

less know the situation of supply side from now to a few years in the future. However, on the demand side the issue is very different. Too many factors such as trade, politics and economics, which are hard to be forecasted should be considered by shipowners.

The second problem is the time lag between order and delivery of vessel. It has been mentioned in the above and during this period of time from 1 to 3 years, anything can happen and market may have changed totally. So the time lag of building new vessel is also an important factor for the decision of investment. So in this aspect, shipowners or investors can reduce the risk on the second-hand market.

Thirdly, the 'Herd Behavior' still becomes the key reason which leads to the current situation. Although shipowners and investors have enough experience on the shipping market and known shipping as a cycle industry. But sometimes when some strong information comes into our eyes, such experts will ignore the basic theory of shipping and follow the blind. Some decisions seem to rely on emotional or affective elements more than on market analysis and forecasts. From 2002 to 2008, so many ships were delivered due to the 'China Factor'. And nowadays, when investors have started to know the importance of price of vessel, another wave of peak in investing vessel have arrived.

It is true that during market ups, companies owning a fleet with a lower break even point will gain greater profits. Vice versa, companies owning a fleet with a higher break even point are facing greater difficulties during market downs, and usually they can't take advantage of the shipbuilding price reduction. But in now situation, the fact that too many vessels are ordered will delay the booming of shipping industry, thus influencing the situation of bulk market totally.

And the bulk shipping market is close to perfect competition. It means that every decision is based on the information. And while compared to container market, the transparency of bulk market is good. But it also brings one disadvantage, which will aggravate the 'Herd Behavior'. Because every investor's expectations are normally moving in the same direction, it has more risk in the development of bulk market. Once the tendency of this market is close to the balance, investors will still insist on their decisions, thus influencing other competitors in a negative way to some extent.

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2.5 Analysis of recent shipping cycle and current market situation

As we all know, nowadays we are suffering the worst situation from the history of shipping industry. Due to the dramatically fluctuation from 2002 to 2009 and serious oversupply, we have seen the lowest index in the history. Each shipowner and investor is thinking about the best decision on the timing of investing new vessel or second-hand vessel. But the lesson of low break-even point ahs leaded to the facts that in current situation, the number of vessel is increasing rather than decreasing. More and more new vessels will be delivered in the coming years. So we may stack in this situation for a relatively long time.[3]

But in my opinion, one of the reasons which caused serious oversupply directly is the potential number of Greek operating mode players is increasing sharply. There is no denying that the shock number of order of newbuilding vessel in 2009 and 2010 has made a profound effect on the development and booming of bulk market. More and more investors are willing to care about paying less capital cost while considering this volatile shipping market. No matter whether the shipowners are willing to sell their vessels or not when the market is the peak in the future, or whether there will have opportunity for them to sell or not, it has formed a tendency that more new ships will be ordered when the market is bad.

Investors always learn a lot from the experience, but according to the history, they will make another mistake sooner or later. If more vessels are ordered due to low break-even point, the length of recession will be longer, thus affecting the profit of each vessel. Everyone is expecting another factor which will bring shipping out of bottom. But if there is no such factor, the bulk market will continues in this way for a long time. So from my point of view, the crazy number of order of new vessel is not sensitive in terms of short-term and long-term strategy.

So these phenomena will make a profound effect on the rise and operating regularity of shipping market, thus changing the price of newbuilding or second-hand vessel fundamentally.

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[3] Li Qiang．(2003) Research on dry bulk market analysis and managerial decision, *Dalian Maritime University Press*

3. Actual strategy in Panamax market

After knowing about the shipping cycle and two operating modes, next job is to focus on the specific aspect to compare these two modes. Although I have decided to implement in bulk shipping market, the dry bulk market is still disaggregated into several major sub-markets due to the transportation needs and characteristics of vessels: Capesize, Panamax, Handymax and Handysize.

Considering the comprehensive effect of the result, finally I choose the Panamax market to conduct calculation process. There are main two reasons for this choice. First of all, Panamax is the suitable type of vessel which can go all over the world. Secondly, compared to Panamax vessel, Capesize market is not complete any more because more cargo owners have involved in this market.

So before the calculation process, we need know about the Panamax market in detail so as to appreciate Greek and Nordic operating modes really.

3.1 Demand of cargoes

At first, we need to know what kind of cargo the Panamax vessel is carrying and its transportation routes, which affect the potential demand of this market from another point of view. Due to its type, Panamax vessel carries low-value cargo, which can be mainly divided into three parts: iron ore, coal, grain, Bauxite & Alumina and Phosphate Rock.[4]

Major Routes:

Panamax (50,000-79,999 dwt)

Iron Ore--- Brazil to West Europe and Japan

         Australia to West Europe and Japan

Coal------- North America to Japan and West Europe

         East Australia to Far East, Japan and West Europe

Grain------ North America to Far East, West Europe and Near East

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[4] Kavussanos, M.G. and Visvikis, I. (2006) Derivatives and Risk Management in shipping

Class of	Commodities (percentages of total shipments)				
Bulk Carriers	Ire Ore	Coal	Grain	Bauxite & Alumina	Phosphate Rock
Panamax	22%	40%	43%	45%	20%

Table 1 Commodities of Panamax vessel

Source: **<Derivatives and Risk Management in shipping>**

Baltic Exchange Panamax Index (BPI) – 20 May			
Route No.	Description	Weighting	Average in USD
P1A_03	74000mt Transatlantic RV	25%	7923
P2A_03	74000mt SKAW-GIB/FAR EAST	25%	14422
P3A_03	74000mt Japan-SK/Pacific/RV	25%	6711
P4_03	74000mt FAR EAST/NOPAC-AUST/SK-PASS	25%	208

Table 2 Routes of Panamax vessel

Source: **Baltic Exchange**

3.2 Supply of vessels

Next we are going to talk about the supply side. Just as I have mentioned before, the supply of vessel is relatively quite easy for us to know through the information of orders and deliveries of newbuilding vessel and number of second-hand vessel deal.[5]
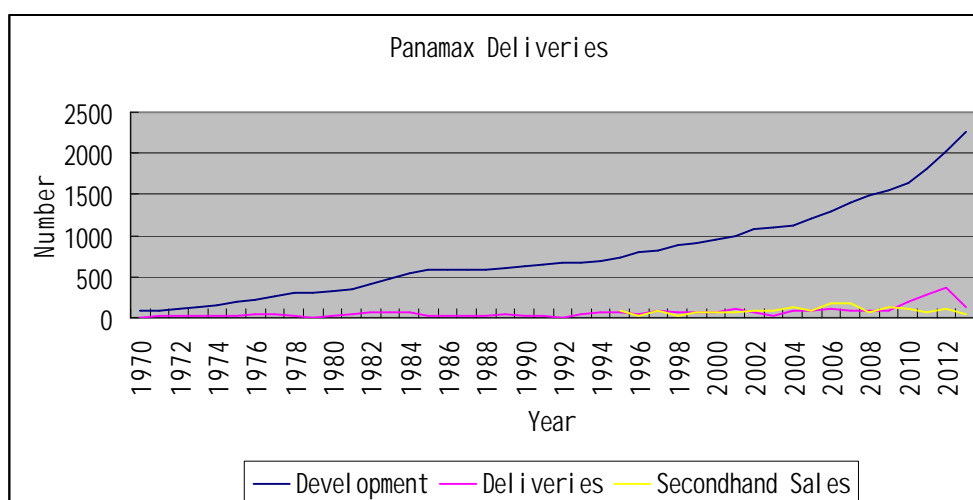
Figure 3 Panamax deliveries

Source: **Clarkson's Shipping Intelligence Network**

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[5] Guan Hao, (2011) Research on dry bulk market and cycle fluctuation. *Fudan University Press*

Year	Panamax Bulkcarrier Fleet Development	Panamax Bulkcarrier Deliveries	Panamax Bulker Sales
	Number	Number	Number
1970	87	9	
1971	96	15	
1972	111	22	
1973	133	27	
1974	160	25	
1975	185	27	
1976	212	38	
1977	248	42	
1978	291	23	
1979	310	9	
1980	318	14	
1981	338	53	
1982	406	70	
1983	479	55	
1984	536	58	
1985	582	18	
1986	582	22	
1987	574	28	
1988	587	16	
1989	596	33	
1990	627	30	
1991	651	18	
1992	665	6	
1993	660	34	
1994	687	59	
1995	738	63	93
1996	798	45	22
1997	828	76	88
1998	885	59	30
1999	904	64	73
2000	938	63	59
2001	995	115	59
2002	1075	59	84
2003	1108	24	95
2004	1122	82	119
2005	1204	93	96
2006	1298	107	172
2007	1397	83	166
2008	1477	82	61
2009	1557	85	129

2010	1630	186	102
2011	1815	289	67
2012	2029	370	117
2013	2270	121	42

Table 3 Panamax deliveries

Source: **Clarkson's Shipping Intelligence Network**

3.3 Prices of newbuilding and second-hand vessel

If we see the price of newbuilding and second-hand vessel, it is necessary for us to find the tendency of vessel's price and the relationship between price of vessel and delivery or sales volume.

Year	Panamax 75-77K DWT Bulkcarrier Newbuilding Prices	Deliveries/ Development	Panamax 76K Bulkcarrier 5 Year Old Secondhand Prices	Sales/ Development
	$ Million	% Percentage	$ Million	% Percentage
1976	13.50	17.92%	9.00	-
1977	15.60	16.94%	6.00	-
1978	18.00	7.90%	11.50	-
1979	22.50	2.90%	16.50	-
1980	28.00	4.40%	22.00	-
1981	25.50	15.68%	12.00	-
1982	18.50	17.24%	7.00	-
1983	17.50	11.48%	8.50	-
1984	15.50	10.82%	8.50	-
1985	13.50	3.09%	6.00	-
1986	16.50	3.78%	7.70	-
1987	20.00	4.88%	12.80	-
1988	25.00	2.73%	17.20	-
1989	27.50	5.54%	23.00	-
1990	30.00	4.78%	19.00	-
1991	34.00	2.76%	24.00	-
1992	28.00	0.90%	18.75	-
1993	28.50	5.15%	19.50	-
1994	28.00	8.59%	21.00	-
1995	28.50	8.54%	21.50	12.60%
1996	26.50	5.64%	19.50	2.76%
1997	27.00	9.18%	22.00	10.63%

1998	20.00	6.67%	14.00	3.39%
1999	22.00	7.08%	16.75	8.08%
2000	22.50	6.72%	16.00	6.29%
2001	20.50	11.56%	14.00	5.93%
2002	21.50	5.49%	17.00	7.81%
2003	27.00	2.17%	28.00	8.57%
2004	36.00	7.31%	40.00	10.61%
2005	36.00	7.72%	29.50	7.97%
2006	40.00	8.24%	45.50	13.25%
2007	55.00	5.94%	88.50	11.88%
2008	46.50	5.55%	26.00	4.13%
2009	33.75	5.46%	36.00	8.29%
2010	34.50	11.41%	36.00	6.26%
2011	29.00	15.92%	26.50	3.69%
2012	25.75	18.24%	18.00	5.77%

Table 4 Price of newbuilding and second-hand Panamax vessel

*Source***: Clarkson's Shipping Intelligence Network**
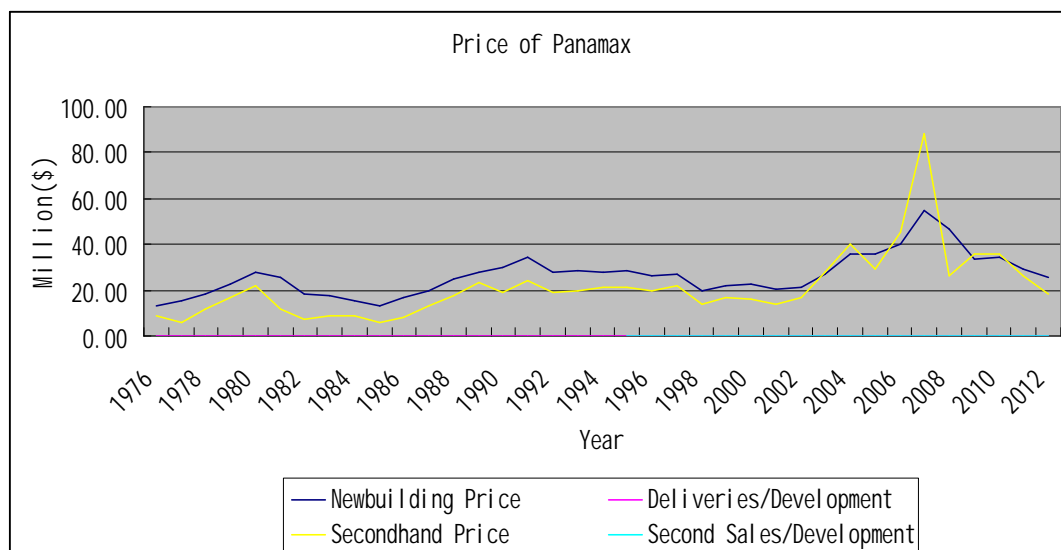
Figure 4 Price of newbuilding and second-hand Panamax vessel

*Source***: Clarkson's Shipping Intelligence Network**

3.4 Analyzing the relationship between volume and price

We can find some interesting rules from above price of ship and volume of deal.

In the delivery of vessel part, we can see that the number of delivery is bigger during bad market according to the percentage of delivery in the development of Panamax vessel. During the time when market was in a low level such as 1976-1977, 1981-1984, 2001-2002, 2009-2012, most of the percentage of deliveries in the

development was more than 10%, which means that more investors were paying attention on the low price of newbuilding vessel when they wanted to invest in shipping market. But there were some exceptional cases that a relatively big portion of newbuilding vessel is ordered when market is good such as the year of 2006.

But there is a tendency that nowadays the percentage of delivery in the development is higher than average level, which means that more and more investors have started noted that shipping is a cyclical industry. A low price of new vessel is more important than the freight rates of 20 years in the future. As a shipowner, whether implementing Greek or Nordic operating mode depends on the prices of secondhand vessel in the future. All these new orders will definitely make the dry bulk market in low situation for a long time.

In the second-hand market, the situation is totally different from the newbuilding market. Most investors are willing to invest secondhand vessel when market is booming from the bottom or collapsing from the peak. During the period of time when freight was fluctuating in a wide way from 2003 to 2007, the percentage of second-hand volume in the development is more than 10%. And the number of deal in the period of recovery is bigger than that in the period of collapse.

Especially in 2006 and 2007, when the market is very good, the percentage of deal of second-hand in the development was so high 13.25% and 11.88%, but the prices of second-hand vessel of those years were also very high. So I suppose that the price of second-hand vessel is not the only element which will affect the volume of second-hand deal. The confidence of market tendency is another important factor. It is the game theory between buyer and seller. So when specific information appears which will influence the confidence of market from the shipowner's point

If we just only look at the price of both newbuilding and second-hand vessel, we can see that the price of vessel is increasing sustainably during these nearly 40 years in view of both newbuilding and second-hand market. Although there were three bottoms when market was bad such as 1976, 1982-1985 and 2000-2002 during four decades, the price of vessel in different bottoms was still increasing. In terms of the price in the different peaks, the difference was crazier.

4. Comparison of two operating modes in terms of ROI

In this part, I will focus on the calculation process and compare Greek operating mode with Nordic operating mode through ROI calculated to get conclusion on which mode is better.

4.1 The source and preparation of data

In order to finish calculating the ROI of two different operating modes, data during the time from January 1976 to March 2013 are obtained from Clarkson's Shipping Intelligence Network.

(1) Operating revenue and expenses

First of all, I need the average revenue and expenses of Panamax vessel to calculate the profit and cash flow each year. Operating profits are calculated as the difference between monthly charter earnings and operating expenses for each month.

And in shipping, time-charter rates or the time-charter equivalent of spot rates are mostly used as the operating revenue. In this article, I use time-charter rates as a proxy for earnings. Because in time-charter rates voyage costs are not included. So I can get net earnings from chartering and operation directly. And time-charter rates also contain the potential information of future, which represents the objective situation of market better. (See Kavussanos and Alizadeh, 2002b, for a detailed discussion of time-charter rates formation).

So I think time-charter rates (earnings) are better than current spot rates as operational revenue. In this article, monthly time-charter rates for Panamax vessels over the period January 1976 to March 2013 are also obtained from Clarkson's Shipping Intelligence Network.

Secondly, monthly operating expenses for Panamax vessel are a little difficult to be collected. But in Lloyd's List I found the data from 1984 to 2012, but need a regression model to get the full data. Then we can get the operational profit of each vessel. The operational expenses are based on the regression model of data from Lloyd's List Economist. And the following is the formula:

$Oc_t = 29258 * e^{0.007044t}$

$R^2 = 0.91$ for a 60000 dwt dry bulk carrier

So operational cost for 75,000 dwt Panamax = 75/60 * OC_t of 60,000 dwt Panamax

	Spot Rates		1-Year T/C Rates		3-Year T/C Rates	
	Mean ($/ton)	Relative Volatility	Mean ($/day)	Relative Volatility	Mean ($/day)	Relative Volatility
Panamax	17.18	88	14,514	86	11,959	60

Table 5 Earnings of Panamax

Source: **Clarkson's Shipping Intelligence Network**

(2) Price of newbuilding, secondhand and scrap vessel

Secondly, monthly prices for 5-year-old ships, 10-year-old ships, newbuilding ships and scrap ships of Panamax vessel are also collected from Clarkson's Shipping Intelligence Network.

And all the prices which are equal to the average value of Panamax vessel in any particular month are quoted in million dollars. These data is necessary for me to calculate the ROI of both Greek and Nordic operating modes because both strategies are based on price of vessels. Especially Greek strategy, the aim of this mode is making money through the difference of price of vessel between newbuilding and second-hand market.

	Panamax vessel	
	Mean	Relative Volatility
Newbuilding Prices	26.42	16
Second-hand Prices	20.57	28
Scrap Prices	2.30	37
Earnings	11,388	65

Table 6 Average and variance data of Panamax

Source: **<Derivatives and Risk Management in shipping>**

(3) Interest & Brokerage

Thirdly, while assessing the performance of Greek operating model, transaction costs and the depreciation in the value of the vessel have to be considered. Generally, the transaction costs of S&P market is mostly made up of brokerage commission for the sale and purchase shipbrokers who arrange the deals.

Also while in the process of this calculation, I also need interest rate, which also can be defined as LIBOR. And all these data are also obtained from Clarkson's Shipping Intelligence Network. And the following is the annual rate of return on various investments since 1975 from Ibbotson Associates.

	Period	ROI (%)	Standard deviation (%)
Inflation	1975-2001	4.6	3.1
Treasury bills	1975-2001	6.6	2.7
LIBOR (6 months)	1975-2004	8.5	3.9
Long-term gov bonds	1975-2001	9.6	12.8
Corporate bonds	1975-2001	9.6	11.7
S&P 500	1975-2001	14.1	15.1
Bulk shipping	1975-2004	7.2	40
Tanker shipping	1975-2002	4.9	70.4

Table 7 Annual rate of return on various investments since 1975
Source: **Ibbotson Associates**

According to above data and Clarkson data, I have calculated the average ROI of LIBOR from 1976 to 2012 is 7.2%.

4.2 The basic theory of calculation process

Theoretically, the price of a vessel is connected with the expected operational earnings of the vessel which are determined by current and expected conditions in the shipping market and the world economy in turn. Both in newbuilding and second-hand market, this rule is suitable. And generally the price of second-hand

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market is influenced by the price of newbuilding market at the same time.

In other words, investment decisions at any point in time are decided on the basis of information that is available to investors at that specific point in time. This way we provide a more realistic and accurate representation regarding to the performance of the trading strategies in terms of two operating models.
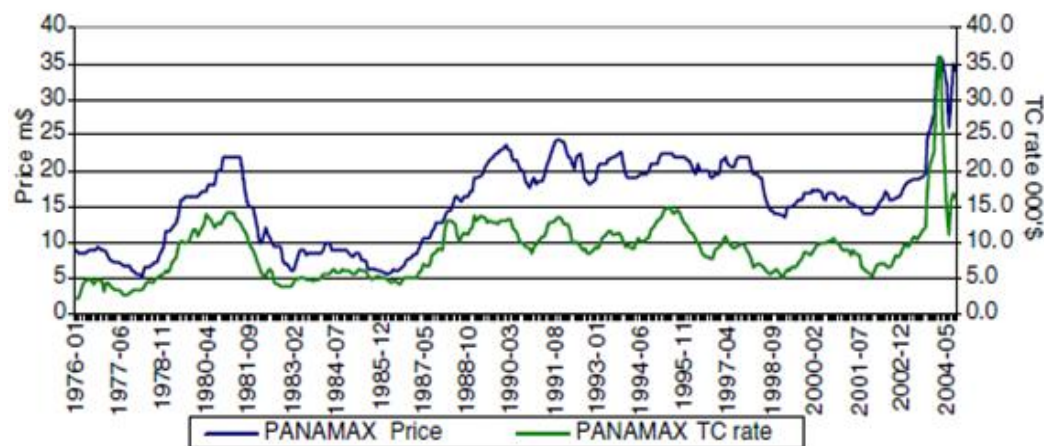
Figure 5 Historical prices and time-charter rates for Panamax dry bulk carriers
Source: **Clarkson's Shipping Intelligence Network**

The above picture is the connection and relationship between second-hand Panamax price and Panamax TC rate. I have mentioned that the price of newbuilding or second-hand vessel is linked to the expected operating profit, which is determined by current and expected operating revenue and expenses. And the expected operational profit is also affected by the current operating revenue. So price of second-hand vessel has relationship with current TC rate.

From the picture, it can be observed that the spread between TC earnings and prices tends to narrow just before any shipping market recovery such as in 1978, 1987–1988, and 2002–2003. And the spread between TC earnings and prices tends to widen during market downturns like in 1980, 1990 and 1997.

In the former one, the actual price was below the theoretical price, which means that vessels were underpriced. So during this time, investors are supposed to buy vessel before the actual prices would go towards the proper prices. And latter one means that the actual price was above the theoretical price and vessels were

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overprices. During that period of time, investors should sell the vessel before the actual prices would decrease towards their theoretical levels.

The Shipping companies which are involved in above trading strategies to make money through the sale and purchase of vessels can be included in these two operating modes.

As a benchmark model, the Nordic operating mode, which is also called buy and hold strategy is always following the market and get benefits from a constant stream of income, arising from the operation of the vessel in the charter market. And the Greek operating model, which can be called buy and sell strategy is following the timely price of secondhand vessel, respective of comparativeness of future market with current price and get benefit mainly from the price margin from buying and selling.

There is no doubt that Greek operating mode is focusing on the irregular price of second-hand market. Investors with Greek mode always keep timely price of vessel in mind. But in Nordic operating mode, investors also can buy relatively cheaper vessel for operation, which will bring low capital cost. And Maersk just did it through this strategy. So the price of vessel is the key of both operating modes, which will affect the profit of each profit and determine whether each mode will be successful or not.

In this article, the main aim is to analyze the price of vessel and conclude the current situation and find the tendency in the future by making comparisons between two operating model through each ROI calculated.

4.3 The calculation process of ROI

During the process of calculation, I have divided the calculation into two parts: Greek operational model and Nordic operating model to get each result respectively and then compare each ROI so as to analyze the future trend.

Before implementing the calculation, it is necessary for me to complain some suppose in the process. And in the following aspect, detailed calculation of ROI in terms of Panamax vessel is stated in the following.

4.3.1 Assumption

(1) The whole life of each vessel is 20 years.

(2) Vessel will be on-hire 29 days per month or 348 days per year. The remaining 17 days per year represent time off-hire for repairs and maintenance.

(3) According to the report and data from Drewry, Clarkson and practical experiences

The maintenance cost = operational expenses * 4 / 14

And the total cost of operating a vessel = operating expenses + maintenance

(4) And in this calculation process, I suppose the transaction cost of S&P market is 1% of price of secondhand vessel. Whether you are a buyer or seller, you will pay this money.

(5) ROI (return on investment) is calculated through EBID (Earnings before interest and depreciation).

$$ROI_t = EVA_t / NAV_t = (EBID_t - DEP_t + CAPP_t) / NAV_t * 100$$

NAV --- the net asset value of the fleet at the end of accounting period

EVA --- the economic value added

EBID --- earnings before interest and depreciation, reflect the fact that during the year the company's ships age and the change in the company's asset value during the year.

DEP --- depreciation

CAPP --- capital appreciation,

$EVA = EBID - DEP + CAPP$

(6) In this process, I do not count the capital cost because each investor has totally different financial condition. This also means that each investor use his own cash to buy new vessel and operate the vessel 20 years to get benefit.

(7) I just calculate the average simple interest as ROI instead of compound interest of each Nordic operating model investment because I think average simple interest is able to convey the profit of the investment.

(8) For the Greek strategy to be implemented, a sell decision will be executed only if the investor has already bought a ship.

(9) The vessel chosen is Panamax vessel of 75,000 DWT

4.3.2 Nordic operating mode

While calculating 'buy and hold' strategy, I calculated the ROI of buy newbuilding, 5-year-old ships and 10-year-old vessels for operation.

(a) Revenue of each month =

1 Year Time charter Rate 75,000 dwt Bulk carrier ($/Day)*29

Revenue of each year= $Revenue_{JAN}$ + $Revenue_{FEB}$ + $Revenue_{MAR}$ + $Revenue_{APR}$ + $Revenue_{MAY}$ + $Revenue_{JUN}$ + $Revenue_{JUL}$ + $Revenue_{AUG}$ + $Revenue_{SEP}$ + $Revenue_{OCT}$ + $Revenue_{NOV}$ + $Revenue_{DEC}$

Revenue of 20 years = revenue1+revenue2+…+revenue20

(b) The operational expenses are based on the regression model of data from Lloyd's List Economist I have mentioned. And the following is the formula:

$Oc_t = 29258*e^{0.007044t}$

$R^2 = 0.91$ for a 60000 dwt dry bulk carrier

So operational cost for 75,000 dwt Panamax = 75/60 * OC_t of 60,000 dwt Panamax.[6]

T=1 means the January of 1987

(c) ROI = ($Revenue_{20 \ years}$ − $Expenses_{20 \ years}$ − Newbuilding price$_{first \ month}$ +

Scrap price $_{last \ month \ (240th \ month)}$) / (Newbuilding price$_{first \ month}$ * 20)

4.3.3 Greek operating mode

While calculating 'buy and sell' strategy, I have calculated the ROI of buy newbuilding and then sell 5-year-old ships and buy newbuilding and then sell 10-year-old vessels.

(a) The transaction cost (brokerage) = price of secondhand 5-year-old vessel * 1%

(b) ROI = ($Revenue_{5 \ years}$ − $Expenses_{5 \ years}$ − Newbuilding price$_{first \ month}$ + Secondhand price − Transaction cost)/ (Newbuilding price$_{first \ month}$ * 5)

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[6] Kavussanos, M.G., Alizadeh, A.H., (2002). Efficient pricing of ships in the dry bulk sector of the shipping industry.

4.4 Result of calculation

YEAR	20 YEAR ROI NORDIC	15 YEAR ROI NORDIC	10 YEAR ROI NORDIC	5 YEAR ROI GREEK	10 YEAR ROI GREEK	LIBOR ROI
1976	10.9%	16.5%	-	-	-	12.6%
1977	11.0%	24.5%	-	-	-	12.6%
1978	8.4%	26.7%	-	-	-	12.6%
1979	6.0%	9.5%	-	-	-	12.6%
1980	3.5%	5.6%	-	-	-	12.6%
1981	2.5%	5.9%	-	20.8%	-	12.6%
1982	3.8%	16.9%	-	10.1%	-	12.6%
1983	5.8%	21.3%	-	2.9%	-	12.6%
1984	8.1%	16.9%	-	0.2%	-	12.6%
1985	11.9%	23.7%	-	-6.7%	-	12.6%
1986	11.0%	27.0%	-	-10.5%	-	12.6%
1987	9.7%	13.1%	-	-5.3%	-	12.6%
1988	10.0%	5.9%	-	4.6%	-	12.6%
1989	7.5%	3.0%	-	15.4%	-	10.1%
1990	6.5%	3.8%	-	25.0%	-	8.3%
1991	5.3%	3.1%	-	24.1%	-	6.1%
1992	4.9%	4.5%	-	18.7%	-	3.9%
1993	4.2%	7.8%	-0.1%	11.7%	11.3%	3.4%
1994	4.4%	9.8%	1.4%	5.1%	12.6%	5.1%
1995	3.5%	7.5%	1.0%	4.8%	19.6%	6.1%
1996	3.7%	8.3%	2.2%	1.3%	16.3%	5.6%
1997	3.6%	6.0%	3.4%	2.5%	13.0%	5.8%
1998	5.3%	9.1%	20.4%	0.0%	6.4%	5.5%
1999	6.9%	11.7%	26.7%	-2.2%	2.5%	5.5%
2000	5.7%	10.6%	23.4%	-3.5%	1.3%	6.6%
2001	6.6%	13.0%	27.5%	-4.7%	-0.7%	3.7%
2002	7.4%	12.4%	22.5%	-5.3%	-0.6%	1.9%
2003	5.9%	8.4%	15.8%	0.5%	0.1%	1.2%
2004	0.0%	-0.4%	2.8%	19.5%	5.9%	1.8%
2005	-3.3%	-3.8%	-1.3%	25.7%	7.5%	3.8%
2006	-4.1%	-4.2%	-1.5%	25.0%	7.6%	5.3%
2007	-9.1%	-11.2%	-10.1%	55.9%	18.6%	5.2%
2008	-18.0%	-18.8%	-18.5%	71.9%	32.3%	3.0%
2009	-24.4%	-24.6%	-24.4%	18.5%	20.6%	1.1%

2010	-33.7%	-34.0%	-34.1%	15.2%	21.1%	0.5%
2011	-51.1%	-51.6%	-51.9%	12.0%	19.6%	0.5%
2012	-96.4%	-96.7%	-95.1%	0.4%	15.8%	0.7%
MEAN	7.3%	12.0%	13.1%	11.0%	11.5%	7.2%
VAR	2.9%	7.8%	11.0%	17.3%	8.8%	4.5%

Table 8 Comparison on ROI between Greek and Nordic operating mode
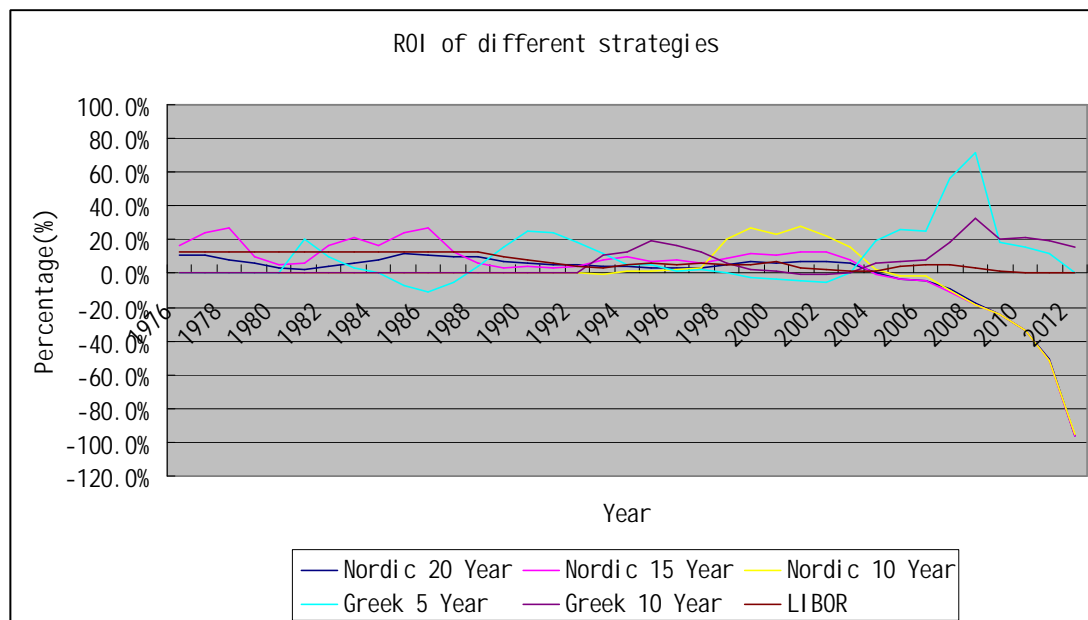
Figure 6 Comparison on ROI between Greek and Nordic operating mode

(A) Analysis on the second-hand market

First of all, let us focus on the second-hand market, which is more complex and suitable for both strategies to connect with each other. From the result, we can see that the profit of different strategies in second-hand market is quite good. Then let us look at the ROI in detail.

The average ROI of Greek operating mode in 5 years during whole period is 11.0%.

The average ROI of Nordic operating mode in 15 years is 12.0%.

The average ROI of Greek operating mode in 10 years during whole period is 11.5%.

The average ROI of Nordic operating mode in 10 years is 13.1%.

According to the calculation of LIBOR Interest Rates, the average of LIBOR is nearly 7.2%. And from the result, we can see that the ROI of both Greek operating mode and Nordic operating mode in terms of 5-year-old Panamax vessel and 10-year-old Panamax vessel exceed the average LIBOR Interest Rates 7.2%. This

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means that investor will get good profit if they put their eyes on the secondhand market.

So next thing is to find the specific period of time when both operating models can make profit more than 7.2%. But in the whole 40 years during the range of data I have calculated, only during these periods of time from September of 1981to October of 1982 and from June of 1993 to December of 1993, both Greek and Nordic operating model can make profit more than 7.2%. However, there is no denying that 7.2% profit is not enough. Normally, the ordinary expected profit of most investors is 10%. So 10% profit is the base line, and no such investor is willing to get back his money more than 10 years, leaving alone the whole life of one vessel.

(B) Analysis on the newbuilding market

But if we take a look at the newbuilding market, the result is not so satisfying. The average ROI of operating a new ship for 20 years is only 7.28%, which means that a ship owner or investor will only make a little money but with a lot of risk while comparing depositing his money in the bank. Let us look at the following three data.

Date	Price of newbuilding	ROI
1978 August	18.5 million	7.7%
1984 March	17.5 million	7.3%
1989 August	26.5 million	7.3%

The above three data is a good example to analyze the tendency of price of newbuilding vessel. The date of 1978 and 1989 are in the same way, on the way to the peak of current market. This means that the newbuilding price of Panamax vessel is increasing and investor will not make profit if they invest in a new vessel more than 26.5 million. But considering investing vessel in 1989 has enjoyed the crazy growing from 2002 to 2008, the 26.5 million for a newbuilding Panamax vessel is a little higher.

The market of 1984 is in a low situation, waiting for booming period since 1985. So the fact tell us that investing a new vessel and operating it in a low market for a relatively long time might not be better than purchasing the vessel in a relatively high price. But all the result is determined by the fluctuation of future freight, which can not be forecasted precisely and timely. So normally, the good timing of investing newbuilding vessel is when the market is bad as well as the price of newbuilding vessel is low.

The average price of newbuilding vessel is 26.29 million according to the calculation, which also means that the newbuilding price is above what it is supposed to be. So investor who invests in newbuilding vessel will not make money in most cases, except investing in a good chance during the trough when the newbuilding price is below the average level.

(C) Analysis on price of newbuilding and second-hand vessel

From the result, we can see that buy a secondhand vessel for operation is better than operating a new ship for 20 years. This is because that mostly the price of secondhand vessel is below its theoretical value, especially on the way from bottom to the peak. Although the average percentage of 5-year-old secondhand price over current newbuilding price is 74.5%, the percentage was below 50% such as the year of 1977 and 1986. So at that time investor purchasing a secondhand vessel in a relatively low price will make a good profit definitely.

Date	Panamax 75-77K DWT Bulkcarrier Newbuilding Prices	Panamax 76K Bulkcarrier 5 Year Old Secondhand Prices	Panamax 75K Bulkcarrier 10 Year Old Secondhand Prices	5 Year Old/ Newbuilding	10 Year Old/ Newbuilding
	$ Million	$ Million	$ Million	Percentage%	Percentage%
1976	13.50	9.00	-	66.7%	-
1977	15.60	6.00	-	38.5%	-

1978	18.00	11.50	-	63.9%	-
1979	22.50	16.50	-	73.3%	-
1980	28.00	22.00	-	78.6%	-
1981	25.50	12.00	-	47.1%	-
1982	18.50	7.00	-	37.8%	-
1983	17.50	8.50	-	48.6%	-
1984	15.50	8.50	-	54.8%	-
1985	13.50	6.00	-	44.4%	-
1986	16.50	7.70	-	46.7%	-
1987	20.00	12.80	-	64.0%	-
1988	25.00	17.20	-	68.8%	-
1989	27.50	23.00	-	83.6%	-
1990	30.00	19.00	-	63.3%	-
1991	34.00	24.00	-	70.6%	-
1992	28.00	18.75	-	67.0%	-
1993	28.50	19.50	14.50	68.4%	50.9%
1994	28.00	21.00	15.75	75.0%	56.3%
1995	28.50	21.50	16.50	75.4%	57.9%
1996	26.50	19.50	14.00	73.6%	52.8%
1997	27.00	22.00	15.75	81.5%	58.3%
1998	20.00	14.00	9.75	70.0%	48.8%
1999	22.00	16.75	12.00	76.1%	54.5%
2000	22.50	16.00	11.75	71.1%	52.2%
2001	20.50	14.00	9.50	68.3%	46.3%
2002	21.50	17.00	11.50	79.1%	53.5%
2003	27.00	28.00	20.00	103.7%	74.1%
2004	36.00	40.00	31.00	111.1%	86.1%
2005	36.00	29.50	24.00	81.9%	66.7%
2006	40.00	45.50	37.00	113.8%	92.5%
2007	55.00	88.50	72.00	160.9%	130.9%
2008	46.50	26.00	20.00	55.9%	43.0%
2009	33.75	36.00	27.50	106.7%	81.5%
2010	34.50	36.00	28.00	104.3%	81.2%
2011	29.00	26.50	20.00	91.4%	69.0%
2012	25.75	18.00	13.00	69.9%	50.5%
Mean	26.42	21.21	21.18	74.5%	65.3%
VAR	8.82	14.60	13.79	23.7%	20.5%
VAR	8.82	14.60	13.79	23.7%	20.5%

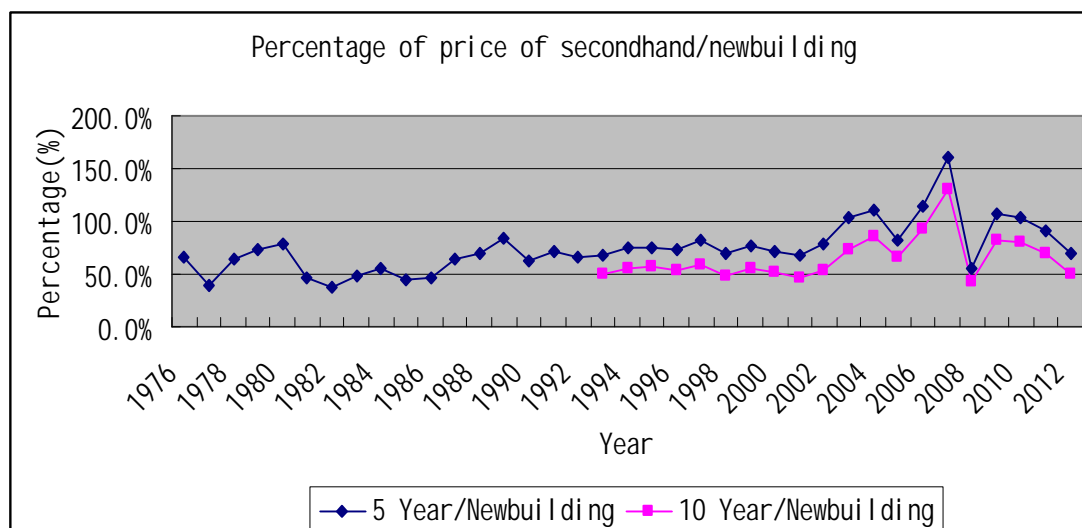**Table 9 Percentage of price of second-hand/price of newbuilding**

Figure 7 Percentage of price of second-hand/price of newbuilding

Reason of this result:

The facts that price of second-hand vessel deviates its theoretical level is because people have a tendency to follow the same route and think everything not to be changed by the light of nature. So when market is growing, most investors do not think market will grow in a sustain way until some specific and especial information appears. So at first the price of second-hand vessel does not increase along with the rise of freight rate, then the secondhand price will be close to its real value, even exceeds what it should be. So that is the reason why when market is decreasing from the peak, the secondhand price is higher than its real value. At that time, most investors also think market will keep the same way instead of collapsing sharply.

This is the most important reason why these two Greek and Nordic operating models exist. It is the fact that secondhand price deviates from its real value that leads to the Greek operating model. And people started to buy vessel when it is cheap and sell it in a relatively high price. So if the secondhand price does not fluctuate in a wide way, the Greek operating model will not be used any more.

4.5 The results of best timing of investing vessel

According to the calculation result, the best timing of investing Panama vessel in terms of different operating strategies is different.

When implementing Greek operating mode, the best timing of investment is buying a newbuilding vessel in November of 2002 and sell the 5-year-old second-hand vessel in December of 2007, which will bring an 86.61% average annual return of investment.

In the Nordic operating mode aspect, if investor wants to buy a secondhand vessel for operation, buying a 5-year-old Panamax vessel on the March of 1978 will bring the most revenue, a 38.4% average annual return of investment.

If we are talking about operating a newbuilding vessel for 20 years until scrap, the best timing is October of 1985, which only produces a 13.1% average annual return of investment.

4.6 Comparing two operating modes and analyzing the outcomes

While comparing Greek and Nordic operating mode in the second-hand market, I need to analyze the ROI and variance of buying secondhand vessel and operating the vessel (Nordic operating mode) and buy new ships and selling that vessel in the secondhand market (Greek operating mode).

| Date | 15 YEAR | | 5 YEAR | 10 YEAR | | 10 YEAR |
| | ROI | 5 Year Old/ Newbuilding | ROI | ROI | 10 Year Old/ Newbuilding | ROI |
	NORDIC	Percentage%	GREEK	NORDIC	Percentage%	GREEK
1976	16.5%	66.7%	-	-	-	-
1977	24.5%	38.5%	-	-	-	-
1978	26.7%	63.9%	-	-	-	-
1979	9.5%	73.3%	-	-	-	-
1980	5.6%	78.6%	-	-	-	-
1981	5.9%	47.1%	20.8%	-	-	-
1982	16.9%	37.8%	10.1%	-	-	-
1983	21.3%	48.6%	2.9%	-	-	-
1984	16.9%	54.8%	0.2%	-	-	-
1985	23.7%	44.4%	-6.7%	-	-	-
1986	27.0%	46.7%	-10.5%	-	-	-
1987	13.1%	64.0%	-5.3%	-	-	-
1988	5.9%	68.8%	4.6%	-	-	-

1989	3.0%	83.6%	15.4%	-	-	-
1990	3.8%	63.3%	25.0%	-	-	-
1991	3.1%	70.6%	24.1%	-	-	-
1992	4.5%	67.0%	18.7%	-	-	-
1993	7.8%	68.4%	11.7%	-0.1%	50.9%	11.3%
1994	9.8%	75.0%	5.1%	1.4%	56.3%	12.6%
1995	7.5%	75.4%	4.8%	1.0%	57.9%	19.6%
1996	8.3%	73.6%	1.3%	2.2%	52.8%	16.3%
1997	6.0%	81.5%	2.5%	3.4%	58.3%	13.0%
1998	9.1%	70.0%	0.0%	20.4%	48.8%	6.4%
1999	11.7%	76.1%	-2.2%	26.7%	54.5%	2.5%
2000	10.6%	71.1%	-3.5%	23.4%	52.2%	1.3%
2001	13.0%	68.3%	-4.7%	27.5%	46.3%	-0.7%
2002	12.4%	79.1%	-5.3%	22.5%	53.5%	-0.6%
2003	8.4%	103.7%	0.5%	15.8%	74.1%	0.1%
2004	-0.4%	111.1%	19.5%	2.8%	86.1%	5.9%
2005	-3.8%	81.9%	25.7%	-1.3%	66.7%	7.5%
2006	-4.2%	113.8%	25.0%	-1.5%	92.5%	7.6%
2007	-11.2%	160.9%	55.9%	-10.1%	130.9%	18.6%
2008	-18.8%	55.9%	71.9%	-18.5%	43.0%	32.3%
2009	-24.6%	106.7%	18.5%	-24.4%	81.5%	20.6%
2010	-34.0%	104.3%	15.2%	-34.1%	81.2%	21.1%
2011	-51.6%	91.4%	12.0%	-51.9%	69.0%	19.6%
2012	-96.7%	69.9%	0.4%	-95.1%	50.5%	15.8%
Mean	12.0%	74.5%	11.0%	13.1%	65.3%	11.5%
VAR	7.8%	23.7%	17.3%	11.0%	20.5%	8.8%

Although the average ROI of Greek operating mode in 5 years during whole period is 11.0%, the average ROI of Greek operating mode in good timing (buying at low price) is 25.85%. Compared with the average ROI of Nordic operating mode in 15 years is 12.0%, the profit of Greek operating mode is better. And also the variance of Greek operating mode is a little bigger than the Nordic operating mode, which means that implementing Greek mode has more risk.

So if investor intends to buy a new vessel and hold it for operation, good timing in investing newbuilding Panamax vessel is when market is bad. When market starts to grow, the ROI for the whole 20 years starts to decrease, even become negative when investing newbuilding ships when market is in the peak such as 1981, 1991 and 2007. But it also depends on the length of time when the market is in a low situation.

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In the secondhand market, the most important thing is the price of secondhand ship rather than the timing of the deal. But I also find in the 10-year-old secondhand market, the price fluctuation is not as volatile as 5-year-old secondhand market. The percentage of 10-year-old price over newbuilding is nearly 50%.

Generally, the Greek operating mode is often implemented when the market is in a low situation.[7] And from the calculation, the maximum profit of Greek operating model is higher than the Nordic operating model. But the good profit is based on the situation that vessel can be sold in a relatively good price. And there is a tendency that the secondhand price is lower than what it should be during the recovery time. And when market is going to decrease from the peak, the secondhand price is over its normal level. This is because that people always keep the current situation in mind and think original market will not change. So there exists opportunity for investors implementing Greek operating mode to purchase vessel in low price and sell it in high price. The fact has proved that this strategy has been used in history and has gotten satisfactory profit.

But the chance that both modes players can get good profit is little. Only during time from December of 1981 to July of 1982 when the market is collapsing from the peak of 1980, both operating mode players make money more than 10%. But actually during the collapse period, most investors are not willing to buy vessel, particularly at high price. So that means that there is no chance for both modes players to get good profit at the same time in accordance with the actual way. And compared to Nordic mode, the Greek operating mode is more likely to disappear.

We have concluded that it is the price of vessel that determines the return of each investment due to the cyclical fluctuation in shipping industry. And according to fact, the Greek operating mode will have no chance to exist because both strategies are not able to make money at the same time. So we need to find the suitable price of secondhand vessel through regression model.

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[7] Amir H. Alizadeh *, Nikos K. Nomikos,. Investment timing and trading strategies in the sale and purchase market for ships

5. Instruction of each operating mode

According to the above calculation process, we have gotten conclusion that in actual experience, Greek mode player is enjoying more profit than Nordic mode player. But there exists problem that both mode players are not able to enjoy good profit at the same time. This kind of result is directly caused by the unreasonable price of second-hand vessel. So in this part, we need to find the suitable price of second-hand vessel through regression model and see whether Greek operating mode can be used any more in the future.

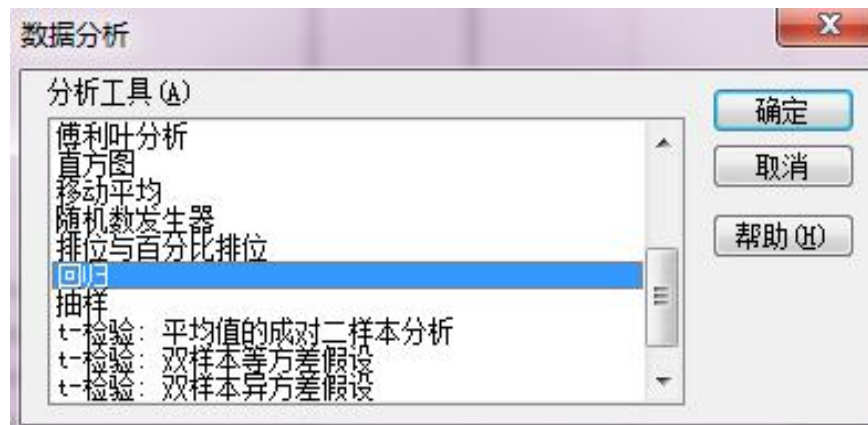## 5.1 The regression model of price of second-hand vessel

In order to get the suitable price of second-hand vessel, we need to get the relationship between second-hand price and other factors. So regression model have to be used. And before analyzing the cause of fluctuation of price of secondhand Panama vessel, we have to decide which factor will influence the fluctuation of secondhand vessel's price.

First of all, there is no denying that the price of second-hand vessel is changed in accordance with the price of newbuilding vessel. So we need to consider the price of newbuilding vessel to make sure that to some extent investor will not get benefit from operating a new vessel until scrap after paying specific money for the vessel. And then the price of second-hand vessel will be changed totally, thus determining whether the deal in second-hand market will be successful or not, further making an effect on the sales volume of second-hand vessel.

Secondly, we can also make sure that the price of second-hand vessel is also connected with the current freight rates, current deliveries of new ships and interest rate such as LIBOR.
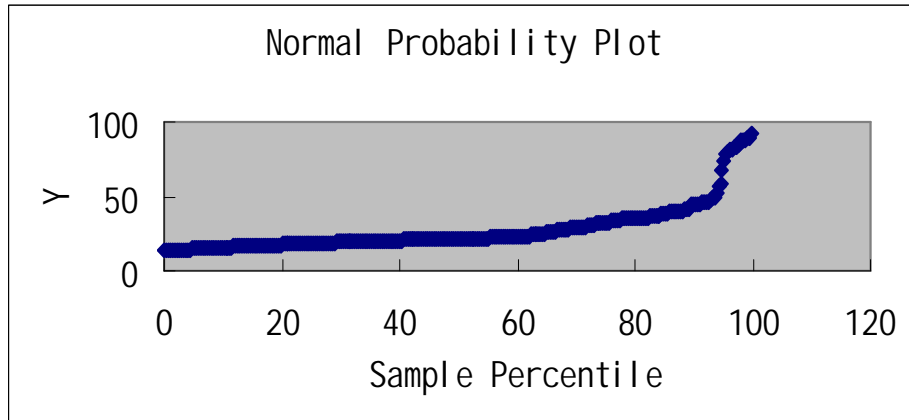
And in this article, I choose the Panamax 75-77K DWT Bulkcarrier Newbuilding Prices, 1 Year Time-charter Rate 75,000 dwt Bulkcarrier, Panamax Bulkcarrier Deliveries and LIBOR Interest Rates as factors to make regression model on the Panamax 76K Bulkcarrier 5 Year Old Secondhand Prices.

Next is the process of regression model in detail:

Figure 8 Regression model

Normal Probability Plot

According to R Square, we can see that the effect of regression model is quite well. And the specific formula is:

$P_{5\text{-year-old}}=0.95383*P_{newbuilding}+0.00074*TCRate+0.22549*Deliveries$

$-0.36221*LIBOR -11.41044$

5.2 Calculating reasonable price of second-hand vessel

So then we are able to calculate the reasonable price of 5-year-old second-hand Panamax vessel according to the regression result and adjusted data of the reasonable price of newbuilding Panamax vessel, average of TC Rates, average deliveries and average LIBOR.

5.2.1 Different factors

(1) Reasonable price of newbuilding Panamax vessel

Year	Price of newbuilding	ROI
1977	15.5	10.2%
1987	17	10.0%
2017	22.5	10.0%

With guarantee of the annual 10% ROI and according to the price in 1977 and 1987 both during the recovery period of time, the newbuilding price of 2017 =

(17-15.5)*((2017-1987)/10) +17 = 22.5

First of all, we should make sure that investor need to guarantee at least 10.0% of ROI while comparing with average 7.2% LIBOR. And the first two data are in the same stage, from the bottom to the peak. And both have nearly 10% ROI. So I think in 2017 when the market is booming, the reasonable price of new Panamax vessel is 22.5 million according to increasing 1.5 million during each 10 years.

(2) Average TC Rates = 11423 $/day

(3) Average deliveries = 5.91

(4) Average ILBOR = 7.2%

5.2.2 Price of second-hand vessel

According to the formula of the regression model, I have calculated the reasonable price of second-hand vessel during different period of time.

(1) The reasonable average price of 5-year-old Panamax vessel during whole time = 00.95383*22.5+0.00074*11423+ 0.22549*5.91 -0.36221*7.2 -11.41044=17.22

(2) The reasonable price of 5-year-old Panamax vessel during 1976-1985 = 0.95383*15.5+0.00074*11423+ 0.22549*5.91 -0.36221*12.60 -11.41044= 8.6

(3) The reasonable price of 5-year-old Panamax vessel during 1986-1995 = 0.95383*17+0.00074*11423+ 0.22549*5.91 -0.36221*8.07 -11.41044 = 11.7

(4) The reasonable price of 5-year-old Panamax vessel during 1996-2005 = 0.95383*18.5+0.00074*11423+ 0.22549*5.91 -0.36221*4.16 -11.41044 = 14.5

(5) The reasonable price of 5-year-old Panamax vessel during 2006-2015 = 0.95383*21+0.00074*11423+ 0.22549*5.91 -0.36221*2.41 -11.41044 = 17.5

From the result of calculation, the most reasonable price of second-hand Panamax vessel for both different two mode players range from 17.22 to 17.5 million, which can bring both players at least 10% ROI.

But in actual world the average price of second-hand vessel is 21.74 million dollar, which is bigger than the calculation result. So nowadays implementing Greek operating model is more likely to make money because the second-hand price is a little higher than its theoretical level.

5.3 Result of calculation of adjusted reasonable price of second-hand vessel

History of price determined by market in actual experience has told us there is no opportunity for both players to make money more than 10% at the same time when the market is growing from bottom to peak. During September of 1981 to October of 1982, the ROI of both strategies are more than 10%, but the LIBOR at that time was even higher and at that time the market was collapsing.

And in actual world, mostly Greek mode players often get benefit from the booming period from the loss of Nordic mode players. But I think this regulation will change due to unreasonable profit result.

But if we take the reasonable price of second-hand vessel I have calculated into history, we will get different results. There is some time when both strategy players have relatively good profit at the same time during recovery period of time..

YEAR	ROI 15 YEAR	ROI 5 YEAR	ADJUSTED SECONDHAND PRICE	ROI 15 YEAR	ROI 5 YEAR	Panamax 76K Bulkcarrier 5 Year Old Secondhand Prices
	NORDIC	GREEK	$ Million	NORDIC	GREEK	$ Million
1976	17.2%	-	8.60	16.5%	-	9.00
1977	18.8%	-	8.60	24.5%	-	6.00
1978	19.9%	-	8.60	26.7%	-	11.50
1979	20.3%	-	8.60	9.5%	-	16.50
1980	20.0%	-	8.60	5.6%	-	22.00
1981	19.0%	11.2%	8.60	5.9%	20.8%	12.00
1982	18.6%	14.1%	8.60	16.9%	10.1%	7.00
1983	18.7%	7.2%	8.60	21.3%	2.9%	8.50
1984	18.2%	-1.2%	8.60	16.9%	0.2%	8.50
1985	18.0%	-17.7%	8.60	23.7%	-6.7%	6.00
1986	11.5%	-21.8%	11.70	27.0%	-10.5%	7.70
1987	11.0%	-11.8%	11.70	13.1%	-5.3%	12.80
1988	10.1%	1.2%	11.70	5.9%	4.6%	17.20
1989	10.6%	9.5%	11.70	3.0%	15.4%	23.00
1990	11.5%	20.4%	11.70	3.8%	25.0%	19.00
1991	11.2%	15.8%	11.70	3.1%	24.1%	24.00
1992	12.5%	13.9%	11.70	4.5%	18.7%	18.75
1993	19.8%	6.1%	11.70	7.8%	11.7%	19.50

1994	21.1%	-2.0%	11.70	9.8%	5.1%	21.00
1995	20.1%	-6.2%	11.70	7.5%	4.8%	21.50
1996	13.9%	-6.7%	14.50	8.3%	1.3%	19.50
1997	12.2%	-5.5%	14.50	6.0%	2.5%	22.00
1998	11.2%	-5.2%	14.50	9.1%	0.0%	14.00
1999	12.0%	-6.4%	14.50	11.7%	-2.2%	16.75
2000	11.5%	-12.3%	14.50	10.6%	-3.5%	16.00
2001	10.9%	-9.7%	14.50	13.0%	-4.7%	14.00
2002	10.8%	-11.6%	14.50	12.4%	-5.3%	17.00
2003	10.4%	-6.9%	14.50	8.4%	0.5%	28.00
2004	8.4%	2.0%	14.50	-0.4%	19.5%	40.00
2005	6.1%	4.4%	14.50	-3.8%	25.7%	29.50
2006	3.1%	11.4%	17.50	-4.2%	25.0%	45.50
2007	1.2%	19.0%	17.50	-11.2%	55.9%	88.50
2008	-4.6%	35.1%	17.50	-18.8%	71.9%	26.00
2009	-6.4%	22.5%	17.50	-24.6%	18.5%	36.00
2010	-6.9%	10.8%	17.50	-34.0%	15.2%	36.00
2011	-7.0%	8.4%	17.50	-51.6%	12.0%	26.50
2012	-6.4%	-7.0%	17.50	-96.7%	0.4%	18.00
MEAN	15.9%	2.5%	12.72	12.0%	11.0%	21.21
VAR	3.9%	12.7%	3.17	7.8%	17.3%	14.60

Table 10 Comparison of ROI between reasonable and actual price of second-hand vessel
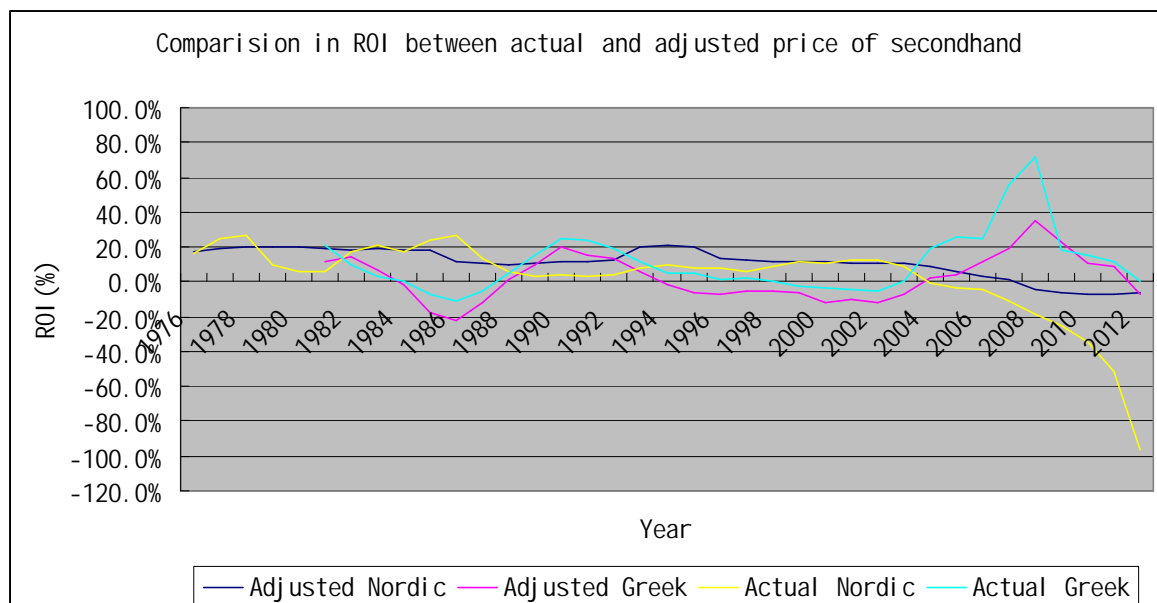

Figure 9 Comparison of ROI between reasonable and actual price of second-hand vessel

From the comparisons between adjusted and actual price of second-hand Panamax vessel, we can see that if the second-hand price is reasonable, both Greek and Nordic operating model players can get more than 10% profit.

During from March of 1981 to May of 1983 and from August of 1989 to February of 1993, the ROI of each operating mode players exceed 10%. And in these periods of time, the recovery period is included. But in fact, if the price of second-hand vessel is reasonable instead of big fluctuation, there will be no such period of time in relative terms. The freight rate is fluctuating but the price is not. And the whole structure of shipping cycle will be transformed accordingly.

In actual deal, most Greek mode players are focusing on the high price of ship, so they will wait until the price is as good as expected. Generally, the price is satisfactory when the freight is close to the peak such as the year of 1981, 1989-1992 and 2006-2009. But during these years, the Nordic mode players did not get good profit, even lost money. So this also means that the price of these years exceed its real value.

After the crazy fluctuation between 2002 and 2009, most investors must have known the basic theory of cyclical shipping industry, so the price second-hand vessel will not be so high like before any more.

Also we can see that the price of second-hand Panamax vessel in 2012 is close to my adjusted reasonable price. But there is no doubt that the price of newbuilding vessel is so low now because shipyards do not have enough orders to build. So in the coming future, the price of newbuilding vessel will increase definitely, thus increasing the price of second-hand vessel. Once the price of second-hand deviates from my adjusted price a lot, the Nordic mode players will not get enough return and then they will decide not to buy so expensive second-hand vessel. In due course the Greek mode players who want to sell the vessel are not able to find any buyer in such high price. So there may not be chance for Greek operating mode to be implemented any more. But this has to be based on the condition that Nordic mode players are sensible. After the profound lesson by now, more investors have known the importance of cheap price of vessel. So I still do not think Greek operating mode could be used easily during the next recovery period especially with non-strong demand factor.

6. Conclusion

In conclusion, the price of vessel both in newbuilding and second-hand reflect and respond to every changes of market, which can be regarded as a good index to identify investment and divestment timing in shipping markets. It is also the price of vessel that determines the return of investment good or not by using Greek or Nordic operating mode.

Furthermore, the Greek and Nordic operating mode have been implemented along with the shipping cycle during the whole history of shipping industry. Now shipowners and investors have started to know that shipping is cyclical industry with a lot of fluctuation and potential risks. So most of them have moved their eyes on the price of vessel of newbuilding and secondhand. So that is why in recent years, many new vessels have been ordered and more and more ships will be delivered. Investors also have started to care about on the buying and selling vessel instead of operating vessel. Whether selling own vessel or not in the future, buying vessel in low price with low break-even point is a better choice for them regardless of losing money in next period of years.

6.1 Result of two operating modes regarding to the timing of investing vessel

Investors in the shipping industry rely not only on the profits generated through shipping operations but also on capital gains from buying and selling vessels. Someone believe that the latter mode is relatively more important than the former one, since correct timing of sale and purchase can be highly rewarding, whereas operating vessels may not be as profitable at times. So two different ways Greek and Nordic operating modes appear corresponding to two activities in shipping.

In fact, it is true that Greek operating mode has a better profit than Nordic operating mode. But it also ignore that Nordic operating mode can enjoy good profit at good timing of investment. So nowadays investing on new or secondhand vessel by using Nordic model depends on the timing of investment. Investing with a low break-even point is connected directly with the profit of investment.

And in terms of two market newbuilding and second-hand in the Nordic operating mode, generally the profit of investing in second-hand vessel is better than investing in newbuilding vessel. It is because that the price of second-hand vessel is always lower than is real value during the recovery period, when most Nordic mode players start to invest.

Otherwise the Greek operating mode, which also can be called "buy and sell" strategy, is another world. Investors have to buy vessel in low price and wait for the high price to sell. So many small companies are more focusing on this strategy to gain good return. Compared to Nordic operating model, Greek operating model is more related to the price of vessel.

While compared with operating a second-hand vessel for 15 years, the Greek operating mode of buying a second-hand vessel with operation for 5 years has the similar average profit. But if we are talking about the normal timing of each mode, the Greek operating mode is better, which means than its profit is quite attractive.

6.2 Suggestion on timing of investment by implementing two modes

Nowadays, everyone is waiting for the booming of shipping market. But so many new orders will definitely slow the speed of recovery period. The fact that shipping is a cyclical industry has gotten into our deep minds. So we know that next peak will arrive one day. But we have no idea about the length of time on peak, which will make a profound influence on the whole investment.

And according to the experience of the crazy fluctuation in these nearly 10 years, now more and more investors are paying attention on the timing of buying vessel. Most of them are choosing to buy vessel when the price of vessel is low. Maybe some of them do not care about the operation of the vessel and they are just thinking when to sell the vessel to get good profit.

(1) In terms of newbuilding market, although most cases have showed that low break-even point is the most important key in the area, especially the average profit is not good only nearly 7%, it also has been proved that buying vessel in low price with

a period of time of losing money may not be better than investing when the market is recovery. And there is no doubt that in short-term period of time, the situation of over-supply will not be changed. So a big number of orders of newbuilding vessel in recent years is not the most sensitive idea.

(2) In terms of second-hand market, the price of second-hand vessel will increase in line with the price of newbuilding vessel. When the market is booming in the future, the shipyards will increase the price of newbuilding vessel, which will lead to the rising price of second-hand vessel.

But my calculation result has stated that in second-hand market, both Greek model players and Nordic model players have no chance to get good profit at the same time on the recovery stage. It is the matter of price of second-hand vessel, whether too high or too low. If the price of second-hand is higher than the adjusted reasonable price in my calculation, which is nearly 17.5 million, most investors will not attend the second-hand market by using Nordic mode. So in the future, I think most Greek mode players will not find buyer to sell their vessels, so all the players in shipping market will have to be Nordic mode players if the price of second-hand vessel is determined by the market in such good competition.

(3) In the future, if all investors become Nordic mode players, the shipping cycle will change accordingly and it will not be so volatile like before. Neither do the price of newbuilding and second-hand vessel. So this result will lead to the number of shipyards and S&P broker in second-hand market will decrease definitely. Once market is recovery and investors are not willing to invest in both newbuilding and second-hand market due to high price of vessel, the length of time when the market is in the peak will be longer. In that time, that will be a fierce game theory between investors and shipyards.

Once the price of second-hand vessel as well as percentage of secondhand price over newbuilding price are fixed with only a little fluctuation just as my adjusted reasonable price, the result shows that there exist chances for both Greek and Nordic

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mode players to get relatively good profit at the same time. But this entire wish is determined by the price of second-hand vessel, which is affected by the price of newbuilding vessel and profit of investing in newbuilding market. So in the future, the Nordic and Greek operating modes are based on the price of second-hand vessel as well as the percentage of second-hand price over newbuilding price..

6.3 The shortcoming of this thesis

Of course, there exist a lot of shortcomings in this article in terms of rough calculation and inexperienced suppose and inference.

(1) Calculation process is too easy, which may lead to the low accurate result. And a lot of factors are not considered such as capital cost in the calculation process.

(2) Lack of actual experiences and effective cases in specific companies in Greek and Nordic operating modes. No experience of actual corporate will decrease the efficiency of the calculation a lot.

(3) Not analyzing the profit in terms of different types of bulk markets such Capesize and Handysize, which may have different results whether in big or small markets.

6.4 Further discussion

The following discussion is aimed at the same comparison of Greek and Nordic operating modes in different shipping sectors for different vessels (Capsize and Handysize) due to different volatility and price fluctuations. Maybe larger ships could be more suitable for the purpose of asset play in the shipping markets.[8]

Next analysis can also focus on the comparison on return between market of stable tendency and market of a lot of fluctuation. This analysis can solve the problem this article has not solved. Once the price of vessel is not so volatile and market tends to be stable, this kind of situation is better or not while compared with the current market of fluctuations from the same point of investors' profit.

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[8] Adland, R.O., (2000). Technical trading rule performance in the second-hand asset markets in bulk shipping.

7. References:

1. Shao, Ruiqin. (2006) International shipping vessel investing decision-making method [M], *Shanghai SanLian Publishing House*

2. Xu. Jianhua, Qu Linchi (1997) International shipping economics new theory [M], *China Communications Press*

3. Martin Stopford，Maritime Economics(second edition)[M]．Me Graw Hill，2004．

4. Wang Yan．(2002.03) International shipping economics and market[M]．*Dalian Maritime University Press*

5. Liu Hen．(2003) Research on the mechanism of current China's economy cycle fluctuation [M]．*Southwestern University of Finance and Economics Press*

6. Wang Ran．(2008.06) Analysis on the international dry bulk economics [D]．*Beijing Jiaotong University Press*

7.Li Zhenghon，Yuan Shaohon．(2004.08) Analysis on correlation of Baltic freight index [J]．*Shipping Management*，Vol.260, No.8.

8. Shi Xin．(1999) Research and thought of Baltic freight index [J]．*Statistical Research*

9. Yu Jun, Xie Congjun．Smooth-out of shipping cycle fluctuation [J]．*Citic Securities*

10. Guan Hao, (2011) Research on dry bulk market and cycle fluctuation. *Fudan University Press*

11. Amir H. Alizadeh *, Nikos K. Nomikos, (September 2005). Investment timing and trading strategies in the sale and purchase market for ships, *Faculty of Finance*

12. MA Shuo.2009, 31(*11*) Shipping market cycle theory and change of current dry bulk shipping market. *SHIPPING MANAGEMENT*

13. JIANG Di-na 2010(5) Research on cycle issue of BDI in terms of BP Model *Technoeconomics & Management Research*

14. Gan Aiping, Qu Linchi, Zhen Hon, Zhang Liangwei 2011(7) Countermeasure of shipping development in accordance with economic growth and shipping cycle, *Shipping Management*

15. Li Rui 2011(12) Application of moving average in forecasting BDI, *World*

Shipping

16. Wang Lei, Li Xuying 2011(6) Research on cycle of Baltic dry bulk index in terms of BP analysis, *Application of Statistics and Management*

17. Veensti. Franses A CO 1997(6) Integration approach to forecasting freight rates in the dry bulk shipping sector

18. www.clarksons.net

19. Kwiatkowski, D.P., Phillips, C.B., Schmidt, P., Shin, Y., (1992). Testing the null hypothesis of stationery against the alternative of a unit root. *Journal of Econometrics.*

20. ROBERTA SCARSI，(DECEMBER 2007) The bulk shipping business：market cycles and shipowners'biases，MARIT．POL．MGMT．VOL．34，NO．6，577—590

21. Liu Zijian (2011) Research on dry bulk market cycle fluctuation in terms of wavelet theory, *Dalian Maritime University Press*

23. Kavussanos, M.G., Alizadeh, A.H., (2002). Efficient pricing of ships in the dry bulk sector of the shipping industry, *Maritime Policy and Management.* 29 (*3*), 303–330.

24. Dong Xiaoyong, Chen Jiayuan．2007，7(03) Research on evaluation model of decision on investing vessel【J】．*Shipping Management 17-21*

25. Xu Jianhua 1983(03)．Uncertainty and risk analysis of investing vessel decision 【J】．*Journal of Shanghai Maritime University*

26. He Guowei．(1983) Investment revenue of vessel and its economic life 【J】．*Journal of Wuhan university of science and technology* 19(01)：69-76

27. Kavussanos, M.G., Alizadeh, A., (2002). The expectations hypothesis of the term structure and risk premier in dry bulk shipping freight markets: An EGARCH-M approach. *Journal of Transport Economics and Policy* 36 (*2*), 267–304.

28. Liu Bin．(2005) Research on risk of investing vessel【D】．*Journal of Shanghai Maritime University*

29. Zhang Rongzhon．2007(5) Trends of international ship recycling market【J】．S*hip Economics & Trade, 23-25*

30. Liu Jianming (2009). Division of international dry bulk market cycle and choice of time charter timing,

31. Zhang Dehai, Zhang Jie 2007，7(02)．Research on multi-goal evaluation model of investing vessel【J】．*China Water Transport 212-213*

32. Li Yaoding．(2007) Decision research on investing vessel in uncertain conditions 【D】．*Journal of Shanghai Maritime University*

33. Li Qiang．(2003) Research on dry bulk market analysis and managerial decision, *Dalian Maritime University Press*

34. Beenstock, M. and Vergottis, A., (1989), An econometric model of the world market for dry cargo freight and shipping. *Applied Economics*, 21, 339-356.

35. Beenstock, M., (1985), A theory of ship prices. *Maritime Policy & Management*, 12, 215-225.

36. Tvedt, J., (1997). Valuation of VLCCs under income uncertainty. *Maritime Policy and Management* 24 (*2*), 159–174.

37. H. E. Haralambides, S. D. Tsolakis and C. Cridland, Econometric modeling of newbuilding and secondhand ship prices, *Research in Transportation Economics*, Volume *12*, 65–105

38. Volk, B. (1994). The shipbuilding cycle – A phenomenon explained. Bremen: Institute of Shipping, *Economics and Logistics.*

39. Adland, R.O., (2000). Technical trading rule performance in the second-hand asset markets in bulk shipping. *Foundation for Research in Economics and Business Administration.*

40. Dixit, A.K., Pindyck, R.S., (1994). Investment under uncertainty, *Princeton University Press*

41. Hale, C., Vanags, A., (1992). The market for second-hand ships: some results on efficiency using cointegration. *Maritime Policy and Management* 19 (*1*), 31–39.