A Comparative Study of the Determinants of Capital Structure in Korean and Greek Shipping Companies

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Approval Sheet

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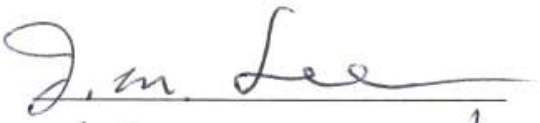

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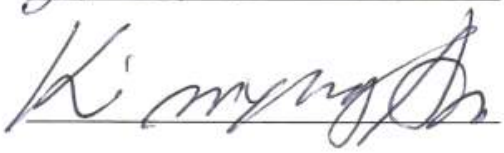

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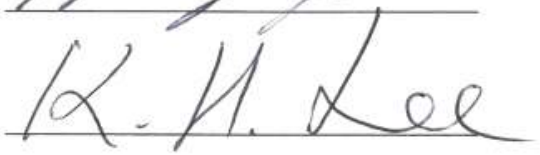

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양 혁 준

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요 약

해운기업은 선박 확보를 위해 막대한 자금을 필요로 하며, 회사의 내부자금만으로 선박 구매 자금을 조달하기에는 한계가 있으므로 외부자금을 이용하게 된다. 여기서 내부자금과 외부자금 등 기업의 자본구조를 어떻게 구성하느냐에 따라 기업의 가치는 달라지게 되는데, 기업가치 극대화를 위한 적절한 자본구조 결정은 기업의 재무활동에서 필수적이며, 기업가치 극대화는 재무관리의 목표라 할 수 있다.

자본구조에 관한 연구는 MM 이론 (Modigliani and Miller, 1958) 이후 활발하게 진행되어 왔으나 해운기업 관련 연구는 미미한 실정이다. 따라서, 이 연구는 해운산업의 자본조달 행태를 파악하기 위해 한국과 그리스 해운기업의 자본구조 결정요인을 분석하고 비교하였다.

자본구조 회귀모형 분석 결과, 두 국가 모두 자본조달순서이론을 따르면서 성장성을 제외하고 모든 변수들의 부호가 기존 선행연구들에 부합하는 것으로 나타났다. 한국과 그리스 해운기업의 유형성과 성장성이 레버리지에 통계적으로 유의미한 정의 영향을 미치며, 수익성은 레버리지에 부의 영향을 미치는 것으로 분석되었다. 하지만 기업규모의 경우 두 국가 모두 통계적 유의성이 없는 것으로 나타났다. 또한, 수익성이 한국 해운기업의 레버리지에 가장 큰 영향을 미쳤고, 그리스 해운기업의 레버리지에는 유형성이 가장 큰 영향을 미치는 것으로 분석되었다.

거시경제 변수를 포함한 자본구조 모형에서는 중고선가가 두 국가의 레버리지에 모두 부의 영향을 미치는 것으로 나타났으며, 이는 자본조달 순서이론을 지지하는 것으로 볼 수 있다. 또한, 세계해상물동량은 한국 모형의 레버리지에 부의 영향을 미치고, 그리스 모형의 레버리지에는 정의 영향을 미치는 것으로 나타났다.

그리스 해운기업의 자본구조 조정속도는 최소자승법 모형의 조정속도가 20.6%, 고정효과 모형의 조정속도는 34.9%로 나타났다. 한편, 한국 해운기업은 레버리지 변수에 단위근이 존재하여 조정속도 분석에서 제외하였다.

이 연구를 통해 파악된 한국과 그리스 해운기업의 주요 세가지 차이점은 다음과 같다. 첫째, 한국의 선대 증감률은 그리스 보다 훨씬 변동이 심하다. 둘째, 한국의 부채비율이 그리스보다 훨씬 높다. 셋째, 한국은 오퍼레이터 모델, 그리스는 선주 모델로서 해운기업의 자본조달 행태는 해운의 독특한 비즈니스 모델로 설명된다.

이 연구는 한국과 그리스 해운기업의 자본구조를 분석하고 비교한 결과를 제시함으로써 재무 의사결정자가 자본조달 행태를 이해하고, 적절한 자본구조를 결정하는데 기여할 것으로 기대된다. 또한 국가별 해운기업의 자본구조를 분석하고 비교한 첫 시도라는 점에서 의의가 있다.

한편 이 연구는 다음과 같은 한계점이 있다. 첫째, 자료 확보의 한계로 향후 연구에서는 그리스 해운기업 표본 수를 늘려 모형의 정확성을 향상시킬 필요가 있을 것이다. 둘째, 향후 연구에서는 두 국가뿐만 아니라 더 많은 해운 국가를 포함하여 각 국가별 분석과 전체 분석을 함께 수행하고 선박 및 화물종류 등의 기업특성 변수를 추가하거나 구분하여 분석할 필요가 있을 것이다.

핵심어: 자본구조이론, 자본조달순서이론, 상충이론, 자본구조 조정속도, 한국 해운기업, 그리스 해운기업, 해운 비즈니스 모델.

A Comparative Study of the Determinants of Capital Structure in Korean and Greek Shipping Companies

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Abstract

Shipping is well known for being one of the most capital intensive businesses. Shipping companies and investors are required to have deep pockets in order to be able to purchase new ships or second-hand ships. Hence, shipping companies need a huge amount of external fund, and financing choices have a decisive effect on a firm's valuation. In short, capital structure decisions are of great importance for maximizing corporate value, which is apparently the primary goal of the financial management.

Even though there have been constant attempts to explain the capital structure of firms since the MM theory (Modigliani and Miller, 1958), the literature with regard to the capital structure in the shipping industry has remained limited. This paper, therefore, aims to analyze the capital structure decision of Korean as well as Greek

shipping companies and compares the results of the two countries' capital structure in order to explain the financial behavior in the shipping industry.

In accordance with pecking order theory in both countries, the results of capital structure regressions show that the signs of the estimated coefficients of all variables are consistent with prior studies except for growth. Tangibility and growth are positively related to leverage, while profitability is negatively related to leverage in both countries. However, size shows a statistically non-significant.

Both Korean and Greek capital structure models, including macroeconomic factors, has shown interesting results. To illustrate, the factor of secondhand ship prices shows a negative relationship with leverage in both models, supporting the pecking order theory. However, it has shown different relationships with leverage when it comes to the perspective of seaborne trade volume. Particularly, the factor indicates a negative relationship with leverage in the Korean model, but a positive one to leverage in the Greek model.

The partial adjustment model is only applied to the Greek model as Korean model was excluded due to the existence of unit root in the leverage. The result shows that the speed of adjustment is 20.6% in the OLS model and 34.9% in the fixed effect model.

Taken together, there are three significant differences between Korean and Greek shipping companies related to this study. Firsty, the growth rate of the Korean fleet has fluctuated more substantially than that of the Greek fleet. Secondly, the leverage ratios (total liability to total assets and total liability to total equity) of Korean companies are much higher than Greek companies. Lastly, the financial behavior of shipping companies in Korea and Greece can be explained by two distinctive unique

shipping business models: An operator model for the former and an owner model for the later.

This paper is meaningful as it fills in the literature gap and provides insights to decision makers on determining the appropriate capital structure for shipping companies.

In spite of that, this research is not without its limitations. Firstly, the Greek sample is small in size due to the lack of Greek shipping companies' financial statements. Bigger sample size could enhance the accuracy of the model. Secondly, the scope of samples needs to be extended by adding a variety of shipping countries.

Keywords: capital structure theory, pecking order theory, trade-off theory, speed of adjustment, Korean shipping companies, Greek shipping companies, shipping business models.

Chapter 1 Introduction

Shipping is well known for being one of the most capital intensive businesses. Shipping companies and investors are required to have deep pockets in order to be able to purchase new ships or second-hand ships. Hence, shipping companies need a huge amount of external fund, and financing choices have a decisive effect on a firm's valuation. In short, capital structure decisions are of great importance for maximizing corporate value which is apparently, the primary goal of the financial management.

Shipping companies nowadays raise funds at the global capital market to purchase ships. Small firms, however, have no option but to secure bank loans, which is the traditional source of external funds. According to estimates by Marine Money (2017), bank loans accounted for 68% of capital sources of the shipping industry in 2016.

In the extent of the Korean shipping industry, shipping companies have been suffering from raising funds due to the high debt ratio, which affects corporate credit rating. The banks, hence, are reluctant to approve loans by shipping company even though it is the right time to expand the fleet. However, the Greek fleet has been keeping the lion's share of the world shipping market for a long time despite the country's financial crisis. According to UNCTAD (2018), the Greek fleet recorded around 330 million deadweight tonnage (DWT), which accounted for around 17% of the total world fleet(l,910 million DWT) in 2018.

Greece is well known as a traditional maritime nation and plays a key role in the world shipping market. Despite the Greek population is only 0.15% of the world population, the Greek fleet transported 20% of the world seaborne trade (Union of Greek Shipowners, 2018). In addition, the contribution of the Greek shipping industry is of vital significance for the Greek economy, accounting for 4% of the Greek Gross

Choosing the proper capital structure for a company has been gaining a lot of attention in relevant academic research. There have been constant attempts to explain the capital structure of firms since the MM theory (Modigliani and Miller, 1958).

Evidently, literature with regard to the capital structure in the shipping industry does exist (Arvanitis et al., 2012; Drobetz et al., 2013; Anna et al., 2015; Paun and Topan, 2016). However, most of the literature dealt with the determinants of capital structure and whether a company follows the target capital structure in the shipping industry.

Concerning the literature gap, this paper aims to analyze the differences of capital structures of Korean and Greek shipping companies by considering the characteristics of the shipping industry.

1.1. Purposes and Contributions

The purposes of this paper are as below:

- Investigating the Korean and Greek shipping industry
- Verifying the differences of capital structure decisions in the two shipping industries.
- Examining the dynamics of capital structure choices through the shipping companies' speed of adjustment

Meanwhile, the results of this paper are expected to provide some insights to the decision maker of the shipping company, especially Korean shipping companies to maximize their corporate value through balancing capital structure between equity and debt by comparing with Greek shipping company. Furthermore, there have been few studies analyzing the capital structure in the shipping industry, and no research had analyzed the capital structure of the shipping industry based on country. In fact, as each country has its own shipping policies such as taxation system, financing system and the like, it is necessary to analyze the capital structure of each country separately. Thus, this research can contribute to the academia of Korean shipping industry.

1.2. Structure of the Paper

This paper is structured as follows: Chapter 2 provides an overview of Korean and Greek shipping industry. Chapter 3 discusses the major results of the existing studies of capital structure. Chapter 4 describes data and methodologies to be utilized for this study. Chapter 5 reports and discusses the results of the capital structure regression and the speed of adjustment. Finally, conclusions are presented in Chapter 6.

Chapter 2 Overview of Korean and Greek Shipping Industry

2.1. Korean Shipping Industry

The history of Korean shipping began after the Korean War in 1950. In the 1960s and 1970s, the Korean shipping industry grew rapidly, and it went through the adjustment period from the 1980s to the mid-1990s. Since then, Korean shipping has become the seventh largest shipping country based on the amount of fleet in the world (Kim et al., 2009).

In January 2018, the Korean fleet recorded 77,277,000 DWT and ranked seventh in the world shipping. On top of that, 66.6% of the total Korean vessels are less than 15 years. However, the number of Korean ocean-going shipping companies shows a slight fall over the recent two years.

2.1.1. The current state of the Korean shipping industry

Table 1 shows the Korean and Greek fleet based on deadweight tonnage (DWT). The Korean fleet ranked seventh in the world fleet, while the Greek fleet ranked first showing 330,176,000 DWT.

Table 1 Korean and Greek fleet as of January 2018

World rank	Country	Number of vessels			Dead-weight tonnage (thousands of tons)		
		National flag	Foreign or international flag	Total	National flag	Foreign or international flag	Total
1	Greece	774	3,597	4,371	64,977	265,199	330,176
7	Korea	801	825	1,626	14,019	63,258	77,277
World total		21,775	28,957	50,732	440,513	1,469,499	1,910,012

Source : UNCTAD(2018), *REVIEW OF MARITIME TRANSPORT 2018*
Note : The data as of January 2018.

Table 2 indicates the development of the Korean fleet from 2001 to 2017. The growth rates of the number of vessels and G/T peaked at 21.8% and 25.1% respectively in 2007. Notably, the growth rates of G/T overtake that of the number of vessels since 2007. This trend indicates the start of large vessel orders by Korean shipping companies for economies of scale.

Table 2 The development of the Korean fleet

Year	Number of vessels (growth rate)	1,000 G/T (growth rate)
2001	354	11,153
2002	392 (10.7%)	11,724 (5.1%)
2003	415 (5.9%)	11,460 (-2.3%)
2004	475 (14.5%)	12,586 (9.8%)
2005	537 (13.1%)	13,455 (6.9%)
2006	578 (7.6%)	14,269 (6.0%)
2007	704 (21.8%)	17,850 (25.1%)
2008	786 (11.6%)	21,378 (19.8%)
2009	861 (9.5%)	23,737 (11.0%)
2010	933 (8.4%)	27,839 (17.3%)
2011	972 (4.2%)	32,163 (15.5%)
2012	1,034 (6.4%)	37,293 (16.0%)
2013	1,016 (-1.7%)	39,747 (6.6%)
2014	1,031 (1.5%)	42,558 (7.1%)
2015	1,088 (5.5%)	43,269 (1.7%)
2016	1,028 (-5.5%)	40,091 (-7.3%)
2017	1,024 (0.4%)	41,603 (3.8%)

Source : Korea Shipowners' Association(2018), *2018 Maritime statistics*.

Table 3 illustrates the Korean fleet by age. The vessels less than 5~10 years (31.5%) recorded the highest proportion of the Korean fleet, followed by vessels less than 0~5 years at 20.3% and 10~15 years at 14.8%. Accordingly, the proportion of vessels less than 15 years is 66.6% in the end of 2017.

Table 3 The Korean fleet and fleet age in 2017

Ages of vessels	Number of vessels	G/T	Percentage
Less than 0~5 years	160	8,428,744	20.3%
Less than 5~10 years	262	13,124,092	31.5%
Less than 10~15 years	236	6,172,996	14.8%
Less than 15~20 years	105	4,236,158	10.2%
Less than 20~25 years	167	5,691,330	13.7%
More than 25 years	94	3,949,717	9.5%
Total	1,024	41,603,037	100.0%

Source : Korea Shipowners' Association(2018), *2018 Maritime statistics.*
Note : The data based on the end of 2017.

The number of Korean ocean-going shipping companies increased consistently from 2000 to 2015 except for 2011 and 2014 as shown in Figure 1. However, the numbers show a slight decrease for the recent three years.

Source : Statistics Korea, Korean Statistical Information Service.
Note : The companies operate ocean-going cargo transportation service.

Figure 1 The number of Korean shipping companies

2.1.2. The political aspects of the Korean shipping industry

There are three major systems to enhance the competitiveness of Korean shipping industry such as ship investment company system, tonnage tax system, and international ship register system.

2.1.2.1. Ship investment company system

Ship investment company system is a method of establishing a ship investment company with funds raised from individual and institutional investors. The company then builds or purchases vessels by combining the funds recruited from the ship investment company and funds borrowed from the external financial institutions. Eventually, the company allots the dividend with return generated by leasing the ship to shipping company (Choi, 2010).

Tracing back to the past, shipping funds used in Germany and Norway was devised in the late of 1999 in order to raise funds from capital markets. The draft of ship investment company law was prepared in July 2001, and the law was enacted in August 2002 (Choi, 2010). Since the launch of the first shipping fund in 2004, a total of 159 ship investment corporations have been approved by 2014, resulting in a ship financing of 11.2 trillion Korean Won (Korean Ministry of Oceans and Fisheries, 2015b).

2.1.2.2. Tonnage tax system

In the past, the profits of shipping company were largely influenced by the fluctuations of exchange rate, which caused unreasonable taxes to be imposed because they did not reflect their business results properly. In order to solve this irrationality and strengthen the competitiveness of the Korean Shipping industry, the tonnage tax system was implemented on 1st January 2005. The tonnage tax is a system that calculates corporate tax based on the net tonnage of the ship and the number of sailing days, not the operating profit (Kim, 2007a).

Kim (2009) argues that tonnage tax system had brought benefits to Korean shipping industry from 2005 to 2007 such as tax reduction of 713 billion Korean Won which was then invested for expanding their fleets by 5,451,000 DWT (worthed 3.565 trillion Korean Won).

In addition, Korean Ministry of Oceans and Fisheries (2015c) announced that with the effect of the tonnage tax system, fleets, foreign exchange earnings, total sales and the number of crews were also increased. According to Kim et al. (2013), however, the actual investment effect of the savings from the tax reduction is insignificant.

2.1.2.3. International ship register system

The international ship register system was introduced in 1998 that gives preferential treatment to tax cuts and employing foreign crews when registering as international vessels at Korea or as bareboat charter hire purchase (BBC/HP) under the Korean Ship Act. The purpose of this system is to maintain the Korean fleets and prevent the transfer of the ship's nationality (Kim, 2015). Accordingly, the Korean government established Jeju international ship register system in 2002, as shown in Table 4.

Table 4 The overview of Jeju register

Year	Korean flagged (A)	International ship register (the number of vessels)				Jeju register (the number of vessels)			
		Total(B)	Korean flagged	BBC/HP	Ratio (B/A)	Total(C)	Korean flagged	BBC/HP	Ratio (C/B)
2003	420	403	255	148	95.9	386	238	148	95.7
2004	491	474	349	125	96.5	446	330	116	94.0
2005	546	526	388	138	96.3	509	371	138	96.7
2006	612	591	443	148	96.5	583	435	148	98.6
2007	718	685	529	156	95.4	668	512	156	97.5
2008	828	810	590	220	97.8	799	575	224	97.9
2009	861	835	545	290	96.9	809	519	290	96.8
2010	937	876	564	312	93.4	852	540	312	97.2
2011	979	936	554	382	95.6	915	533	382	93.4
2012	1,034	992	545	447	95.9	961	514	447	96.9
2013	1,077	1,074	587	487	99.7	1,051	564	487	97.9
2014	1,125	1,118	590	528	99.4	1,100	572	528	98.4

Source : Korean Ministry of Oceans and Fisheries (2015a).

2.2. Greek Shipping Industry

The current structure of the Greek shipping industry has been formed for more than two hundred years. It began with middlemen for trade between European and the Ottoman Empire (Grammenos and Choi, 1999). The Greek owned fleet was 1% of the world fleet in 1894, while nowadays, Greece has the largest fleet in the world (Harlaftis, 1996). The Greek fleet recorded 330,176,000 DWT in January 2018 and ranked first in the world fleet with the market share of 17.3%. The number of Greek shipping companies, however, has been decreasing steadily for seven years from 792 companies in 2011 to 588 companies in 2018.

2.2.1. The current state of the Greek shipping industry

The Greek fleet accounts for 17.3% of the world fleet and ranked first of 330,176,000 DWT, as shown in Table 1.

Table 5 indicates the development of the Greek fleet from 2001 to 2018. In comparison with Korea, the variation of the fleet is small. To illustrate, the growth rates of the number of Greek vessels are ranging from -5.11% to 6.54%, while the Korean fleet recorded growth rates from -5.5% to 21.8%.

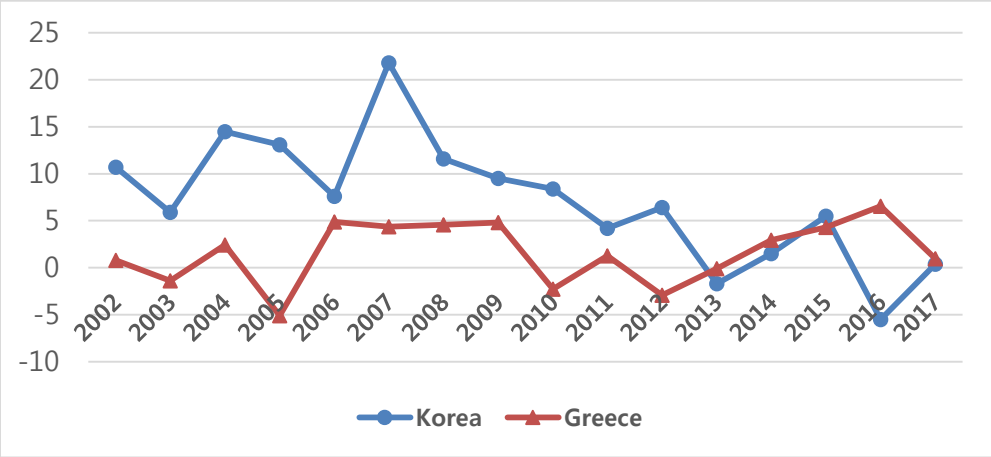
The Greek fleet shows that the growth rates of DWT surpass that of the number of vessels since 2006. This implies that the Greek shipping industry had also tried to secure large ships for economies of scale under the competitive pressure occurring in the world shipping market. However, the average age has been decreasing steadily for the whole period.

Table 5 The development of the Greek fleet at the end of December 2018

Year	Number of Vessels (growth rate)	DWT (growth rate)	Average Age
2001	4,110	150,978,565	21.41
2002	4,142 (0.78%)	166,931,748 (11%)	20.58
2003	4,085 (-1.38%)	171,448,133 (3%)	20.51
2004	4,184 (2.42%)	184,288,917 (7%)	20.12
2005	3,970 (-5.11%)	176,411,750 (-4%)	19.90
2006	4,164 (4.89%)	194,486,455 (10%)	19.14
2007	4,346 (4.37%)	208,001,159 (7%)	18.70
2008	4,545 (4.58%)	222,368,331 (7%)	18.40
2009	4,763 (4.80%)	237,288,216 (7%)	17.60
2010	4,655 (-2.27%)	242,802,092 (2%)	16.40
2011	4,714 (1.27%)	256,174,041 (6%)	15.92
2012	4,577 (-2.91%)	263,635,420 (3%)	14.70
2013	4,573 (-0.09%)	281,467,983 (7%)	14.06
2014	4,707 (2.93%)	303,579,176 (8%)	13.25
2015	4,909 (4.29%)	328,254,495 (8%)	12.73
2016	5,230 (6.54%)	361,934,047 (10%)	12.19
2017	5,281 (0.98%)	387,256,616 (7%)	11.84
2018	5,508 (4.30%)	412,310,405 (6%)	12.08

Source: Petrofin Research(2019), *Greek fleet statistics.*
Note : 1. Greek based, Greek owned fleet.
2. 2018 data based on January 2018.

Figure 2 depicts the development of fleet growth rates from 2002 to 2017. The growth rate of Korean fleet peaked at slightly above 20% in 2007, while the Greek fleet reached a peak in 2016 with a growth rate of under 6%. It is notable that the average growth rate of the Korean fleet is 7.12%, while Greece is just 1.63% from 2002 to 2017. It means that the Korean fleet change is more fluctuated than the Greek fleet according to the market condition. The growth rates of the Greek fleet keep a certain level ranging from -5% to 5%.



Sources: Korea Shipowners' Association(2018), *2018 Maritime statistics*, and Petrofin Research(2019), *Greek fleet statistics*.

Figure 2 The comparison of growth rates of two countries' fleet

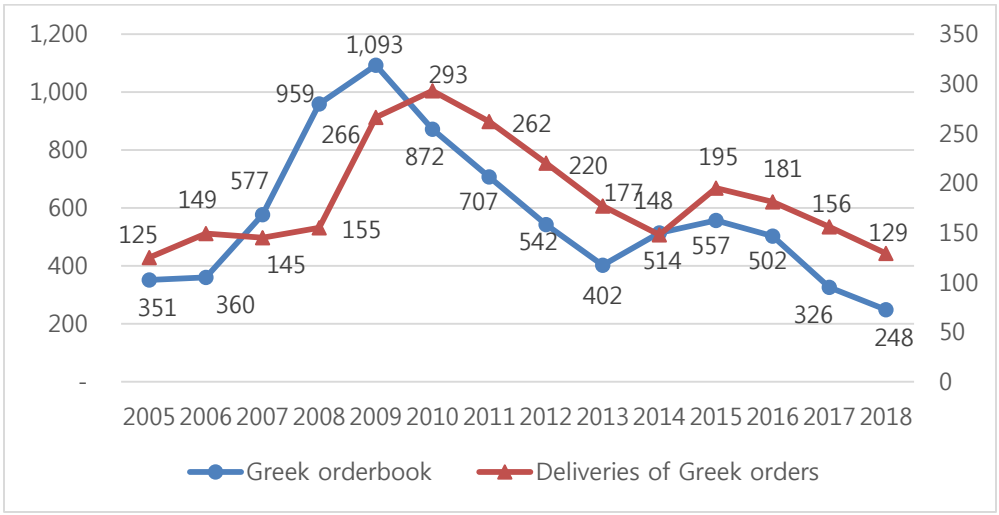
Table 6 indicates the changes of two countries' fleets over a decade in the two respective years; 2007 and 2017. The number of Greek vessels increased by 935 vessels, while the figures for Korea recorded a rise of 320 vessels from 2007 to 2017. In spite of that, the growth rates of the Korean fleet shows a bigger increase than the Greek fleet in the number of vessels and fleet volume.

Table 6 The comparison of the fleet in Korea and Greece between 2007 and 2017

Korea				
Year	Number of vessels	Growth rates	Volume (1000 G/T)	Growth rates
2007	704	-	17,850	-
2017	1,024	45%	41,603	133%
Greece				
Year	Number of vessels	Growth rates	Volume (DWT)	Growth rates
2007	4,346	-	208,001,159	-
2017	5,281	22%	387,256,616	86%

Sources: Korea Shipowners' Association(2018), *2018 Maritime statistics*, and Petrofin Research(2019), *Greek fleet statistics.*

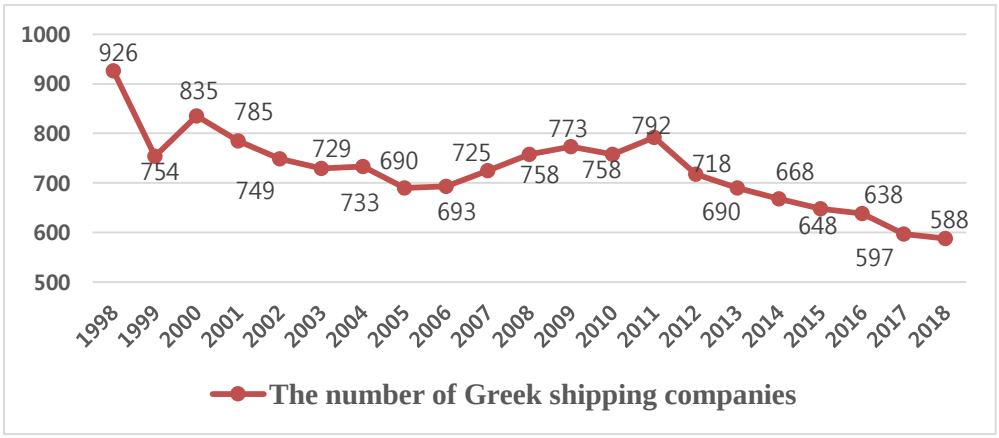
Figure 3 depicts the development of Greek orderbook and deliveries. The figures of Greek orderbook increased sharply to a peak of 1,093 vessels in 1995 before decreasing. The numbers, thereafter, show a slight grow from 2013 to 2015.



Source: Petrofin Research(2019), *Greek shipping companies*.
Note: 2018 data based on January 2018.

Figure 3 Greek orderbook and deliveries

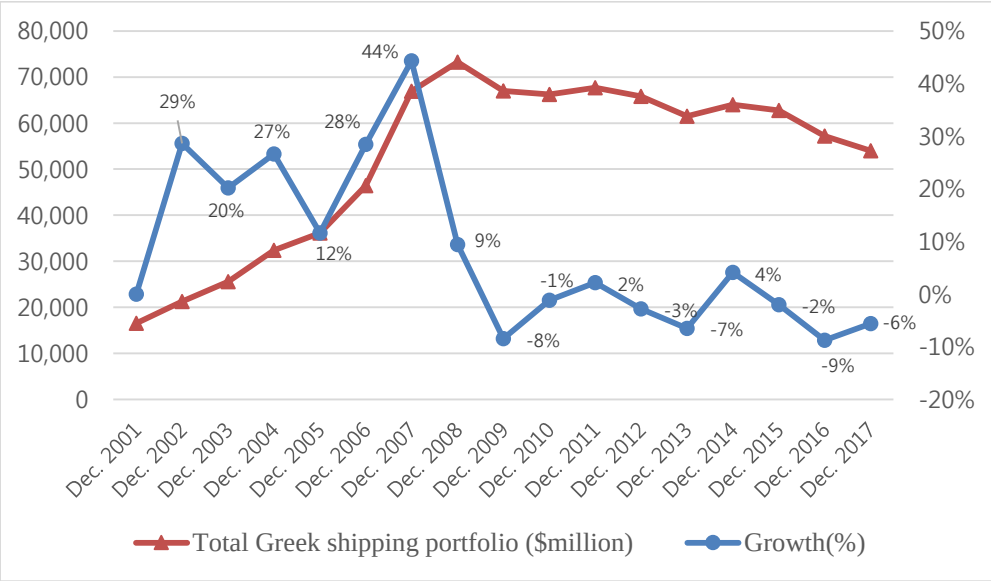
The lowest number of Greek shipping companies was recorded at 588 companies in 2018 as portrayed in Figure 4 below. Ironically, while the number of vessels and DWT increased, the number of Greek shipping companies had decreased from 926 in 1998 to 588 in 2018.



Source: Petrofin Research(2019), *Greek shipping companies.*
Based on data as of end of December 2018.

Figure 4 The number of Greek shipping companies in operation

Figure 5 illustrates the amount of ship finance portfolio over the period of 17 years from 2001 to 2017. Greece invested the largest amount of money of around 73,000 million USD in 2008.



Source: Petrofin Bank Research(2018), *Key Developments and Growth in Greek Ship-Finance*.

Figure 5 The development of Greek ship finance portfolio

Table 7 shows the Greek shipping portfolios by bank rankings. Most of the banks are international banks, and only four Greek banks ranked in the top 30 at the end of 2017.

Table 7 Greek shipping portfolios by bank rankings as of end 2017

Rank	Bank	Volume (million USD)
1	Credit Suisse[1]	6,200.00
2	DVB	4,308.00
3	BNP Paribas	2,800.00
4	Piraeus Bank[2]	2,750.00
5	Citi	2,700.00
6	HSBC[1]	2,500.00
7	National Bank of Greece	2,427.60
8	ABN AMRO	2,350.04
9	Alpha Bank	2,225.00
10	ING	2,069.00
11	HSH Nordbank[1]	1,950.00
12	DNB	1,609.00
13	CHINA EXIM[1, 4]	1,600.00
14	Eurobank	1,524.00
15	Royal Bank of Scotland[3]	1,500.00
16	Nordea	1,393.00
17	KEXIM[1]	1,300.00
18	Unicredit	1,100.00
19	DB – Deutsche Shipping[1]	1,000.00
20	KFW	941.14
21	Nord LB	710.00
22	Calyon[1]	650.00
23	China Everbright Bank[1, 4]	600.00
24	China Development Bank[1, 4]	400.00
25	CIT Maritime Finance[1]	350.00
26	Qatar National Bank[1]	200.00
27	Barwa Bank	200.00
28	NIBC	200.00
29	Aegean Baltic	164.43
30	Amsterdam Trade Bank	148.75
	Other Banks (21)	6,125.00
	Total Greek portfolio	53,994.96

Source: Petrofin Bank Research(2018), *Key Developments and Growth in Greek Ship-Finance*.
Note: The volume is including drawn and committed but undrawn loans
1. Market estimate.
2. Excluding ferries.
3. Withdrawing from shipping.
4. Chinese bank finance excluding ship leasing finance.

2.2.2. The political aspects of the Greek shipping industry

One of the major competitive factors of Greek shipping is flag-state policies (Grammenos and Choi, 1999; Pallis, 2007). Grammenos and Choi(1999) point out that the Greek government has made an effort to attract Greek shipping companies and keep existing companies via tax reduction.

The current tonnage tax system was introduced by Greece in 1975 as Law 27/1975 and apply only to Greek-flagged ships regardless of the business place of shipping companies (Marlow and Mitroussi, 2008).

In addition, the flags of convenience was also another contributing hand to the competitive structure of Greek shipping. It supported post-war Greek shipping to develop first among other European countries by encouraging flagged-in rather than flagged-out (Thanopoulou, 1998). Konsta(2017, p.65) list the seven contributions of the Greek-flagged for Greece as followed:

(1) It transfers 90% of the export trade of Greece.

(2) It brings shipping maritime exchange raised from wages of seafarers, the amounts for repairs and alterations, contributions to the NAT, and taxes to the State.

(3) It creates jobs both on board and ashore in shipping companies and other companies such as repairs and shipbuilding companies.

(4) It activates the development of other companies.

(5) It enhances the sovereignty of Greece in international shipping, each ship acting as an ambassador of the state.

(6) It strengths the negotiating power of Greece in international organisations and fora

(7) It is dynamic and autonomous, in the sense that it does not absorb resources from the domestic economy. This means that shipping does not require full currency outflow from Greece. The only output is the replacement of older vessels and operating costs for companies moving abroad.

Manning rules, however, are connected to the flag, which has obligations about seafarer's nationality. Marlow and Mitroussi (2008) argue that the Greek flag was the most important concerns with respect to the number of officers and crews. Accordingly, Greek flag manning requirements was reflected in 2007 as table 8.

Table 8 Requirements for a minimum number of Greek nationals for Greek flag

1997-2006 (Before)		2007 (After)	
Types of vessels	Number of Greek nationals	Types of vessels	Number of Greek nationals
Dry bulk and tankers of 3,000–20,000 GT	Min. 5 officers (incl. necessarily master) and 3 ratings	Dry bulk and tankers of 3,000–30,000 GT	Min. 4 officers and ratings (incl. necessarily master)
Dry bulk and tankers of 20,001–45,000 GT	Min. 6 officers (incl. necessarily master) and 3 ratings	Dry bulk and tankers of 30,001–80,000 GT	Min. 5 officers and ratings (incl. necessarily master)
Dry bulk and tankers of 45,001–100,000 GT	Min. 6 officers (incl. necessarily master) and 4 ratings	Dry bulk and tankers over 80,001 GT	Min. 6 officers and ratings (incl. necessarily master)
Dry bulk and tankers over 100,001 GT	Min. 7 officers (incl. necessarily master) and 4 ratings	-	-

Source : Marlow and Mitroussi (2008), p.198.

Table 9 shows the results of Greek government policies since the 1970s. Taxation is favorable for all policy areas over a long time, while the subsidization is an inconclusive policy. Market regulation, however, shows that it is necessary to escape government interference. In terms of manning, the strict rule is related to negative outcomes except for deep sea area, the most successful sector in Greek shipping (Corres, 2007).

Table 9 Greek government policies in the shipping industry

Policy Area	Manning	Taxation	Market regulation	Subsidization	Outcome
Deep sea	Less strict	Soft	-	None	High growth
Short-sea	Strict	Soft	None	None	Decline
Domestic ferries	Strict	Soft	State imposed	Yes	Static
Cruises	Strict	Soft	Cabotage protection	None	Collapse
Domestic cargo	Strict	Soft	Exclusive market	None	Decline

Source : Corres(2007), p.237.

2.2.3. The characteristics of the Greek shipping industry[1]

Greek shipping plays a significant role in the world shipping market through their unique characteristics. Pallis (2007) argue that Greek shipping companies have led the industry via fleet renewal practices, organizational structures, and management practices and strategies.

Theotokas (2007) provides Greek-owned shipping companies' resources and structural characteristics as Table 10.

Table 10 Greek-owned shipping companies' resources and structural characteristics

Companies' resources	Structural characteristics
· Human resources	· Family Business
· Entrepreneurship	· Entrepreneurial philosophy–culture
· Knowledge base	· Fragmentation
	· Networking

Source : Theotokas(2007), p.65.

For human resources, a lot of Greek seafarers have skilled hand, knowledge, willingness to solve problems. The officer turned to office staff ashore, which is also conducive to back-office work.

Entrepreneurship plays a key role in the development of the Greek shipping industry. Greek shipowners had proven this spirit via innovative practices such as the introduction of new ship types: the mini bulk carrier, supertanker, and double-hull

[1] This paragraph is based on Theotokas (2007).

VLCC. On top of that, they also indicated the ability to coordinate resources they have for judgmental decisions on creating business venture.

In regard to the knowledge base, most of the Greek shipowners have tacit knowledge about ship operations. They acquired the knowledge through the vast work experiences as ship officers and employees. The experiences served as a driving force to manage their business.

Family Business is a well known key factor of the Greek shipping industry for the world shipping market. Family firms have efficient and effective decision-making in the highly volatile and competitive shipping market. In particular, Greek Shipping companies controlled by family cut a fine figure in asset-play and the chartering strategies.

One of the key element for business success is the long-run decisions about the structure and culture of firms, which is determined by entrepreneurial philosophy. The culture of firms gives the ability and agility to react promptly to the changing business environment. As a representative example, Greek shipowners often make a prudent decision in controlling their fleets by purchasing, building, or selling ships according to market condition.

Fragmentation is also one of the Greek shipping's attributes. There are two classes of shipowners: Traditional owners and non-traditional owners. The former has families who were at least second generation shipowners, but the latter does not. Accordingly, fragmentation is inferred as the grouping of two classes of shipowners. In the context of traditional owners, the company splits when the founder of the company passes the management rights to the next generation. In regard to the non-traditional owners, the staff who worked at a family business founds his own company. This fragmentation benefited from expanding the Greek fleet.

In the shipping business, networking is of vital significance factors. In the 1940s, Greek shipping firms used networking with the British for their tramp shipping. By preserving their tramp structure and such cooperative relationships, they managed to decrease transaction costs and increase competitiveness. Undoubtedly, Greek shipping has the cohesive and effective network which depends on the trust between network members. Theotokas (2007, p. 82) argues the historical reasons about trust as below:

1. The tradition of the maritime islands of Greece and the development of relationships based on kinship and common origin (Harlaftis, 1996).
2. The industry environment and ethics; the bulk shipping industry where the Greeks were active has the trust as a core value reflected in the traditional motto of the Baltic Stock exchange ''my word is my bond'' (Harlaftis & Theotokas, 2004). The creation of networks was facilitated by such an environment of high-trust relationships.

Theotokas (2007, pp.83-84) states the six advantages of networking offered to Greek-owned shipping companies as follow:

1. External economies.
2. Reduction of transaction costs.
3. Information sharing and cost reduction.
4. Enhancement of the knowledge basis of the industry.
5. Organization of coordinated responses to changes in the external environment.
6. Strengthening of the national competitive advantage in shipping.

2.3. A Comparison of Financial Ratios of Korean and Greek Shipping Companies

A financial ratio is of particular importance to evaluate the overall financial condition of a company. The comparison of financial ratios in this research is analyzed in three ways: Growth, profitability, and stability by using financial statements data collected from 60 Korean and 32 Greek shipping companies for a period of 10 years from 2000 to 2017. Each of the financial ratio obtained is then averaged over the whole period. In addition, outliers in the data are eliminated.

2.3.1. Financial ratios of growth

Table 11 indicates the financial ratios of growth including the growth rate of total assets and sales. Both values of Greek ratios are much higher than Korean. The average growth rates of total assets are 16.11% in Korean shipping companies and 25.61% in Greek, while that of sales are 10.52% and 23% respectively.

Table 11 Financial ratios of growth

Country	Growth	
	The growth rate of total assets	The growth rate of sales
Korea	16.11%	10.52%
Greece	25.61%	23.00%

Note : The ratios are averaged based on data collected financial statements of companies from 2000 to 2017

2.3.2. Financial ratios of profitability

Net income to total assets (ROA) and operating income to sales are the two aspects included in the analysis of ratios of profitability as shown in Table 12. The operating income to sales of Greece was more than double that of Korea. It means that Greece has higher operational efficiency. However, Korea indicates more profitability than Greece in net income to total assets.

Table 12 Financial ratios of profitability

Country	Profitability	
	Net income to total assets (ROA)	Operating income to sales
Korea	0.27%	3.98%
Greece	-1.62%	8.48%

Note : The ratios are averaged based on data collected financial statements of companies from 2000 to 2017

2.3.3. Financial ratios of stability

In terms of financial stability ratios, Greece relies more on the equity market than Korea by around 9% as portrayed in Table 13. Korea has more total liabilities than Greece, and it shows that the market of Korea ship finance accounts on debts more than the equity market, whether they want it or not.

Table 13 Financial ratios of stability

Country	Stability	
	Total equity to total assets	Total liabilities to total equity
Korea	34.66%	270.91%
Greece	43.02%	173.48%

Note : The ratios are averaged based on data collected financial statements of companies from 2000 to 2017

In conclusion, the Greek shipping industry showed better results than the Korean shipping industry in terms of financial ratios. Greece has more growth, profitability, and stability than Korea.

In addition, Korean shipping companies excessively depend on debt capital market, which is inevitable as it implies the reluctance of Korean banks to fund the shipping industry. Korean shipping companies, therefore, need to seek for various financial instruments, especially in the equity market to raise funds including from international institutions.

Chapter 3 Literature Review

3.1. Capital Structure Theory

The discussion about the capital structure theory began with the study of Modigliani and Miller (1958). They argue that capital structure is irrelevant to the firm value under the perfect capital market. In short, the levered firm and the unlevered firm are the same in terms of firm value. In fact, economists had been believing for long that firm value could be increased by using appropriate debt capital before the publication of the paper. After that, Modigliani and Miller (1963) revise the irrelevance theory that the use of debt affects firm value due to tax shields effect.

Since the MM theory (1958), there have constantly been attempts to explain the capital structure of firms until recently. Baxter (1967) asserts that bankruptcy cost must be considered in using debt capital because the use of excessive leverage is likely to increase the bankruptcy cost. In terms of the trade-off theory, the optimal capital structure could be varied according to each firm depends on the trade-off between the tax advantage in using debt and the increasing bankruptcy cost expected. Accordingly, when a firm uses debt more than a certain level, the bankruptcy cost will be increasing thereafter. As a result, the value of the firm is decreased (Kraus and Litzenberger, 1973; Scott, 1976). Meanwhile, Kraus and Litzenberger (1973) note that the firm value is irrelevant to the capital structure under the complete and perfect

capital markets. However, they argue that corporate tax and bankruptcy costs show the market imperfections.

On the other hand, Jensen and Meckling (1976), as well as Myers (1977), provide agency problems related to debt. They argue that the optimal capital structure is determined by the debt ratio, which minimizes the agency cost, unlike minimizing capital cost between the tax advantage of debt and bankruptcy cost expected.

DeAngelo and Masulis (1980) find that optimal leverage depends on nondebt tax shields, such as R&D expenditures and depreciation. When increasing the usage of debt, chief financial officers (CFOs) evaluate the tax benefits effect and bankruptcy cost expected and determine the amount of optimal debt and equity capital, which is the target debt ratio (Graham and Harvey, 2001).

Besides, Graham and Harvey (2001) survey 392 CFOs of U.S. companies about the practice of corporate finance such as cost of capital, capital budgeting, and capital structure. They find that large firms tend to use the NPV and CAPM, while small firms use the payback criterion for their project evaluation method. In regard to a survey about the target debt ratio, 81% of the respondents answered they have a target debt ratio.

Pecking order theory claims that a firm however, raises capital in the following order : Internal funds, debt and equity due to the existence of asymmetric information among different market participants in the real market, unlike the assumption of MM theory that "all information is transmitted to all investors at the same time and accurately" (Myers, 1984; Myers and Majuluf, 1984). Furthermore, some studies also deal with the pecking order theory by considering debt capacity (Lemmon and Zender, 2010; de Jong et al., 2011)

Baker and Wurgler (2002) however, test the market timing theory which says low levered firms used to issue equity when the firm's valuation was high, while high levered firms issued equity when the firm's valuation was low. They highlight that equity market timing is important in terms of real financial policy.

In recent literature, capital structure choices of corporations have remained as debatable topic especially on which is the better theory between trade-off and pecking order to describe the financial behavior (Shyam-Sunder and Myers, 1999; Fama and French, 2002; Frank and Goyal, 2003; de Jong et al., 2011).

Shyam-Sunder and Myers (1999) study about the trade-off and pecking order theory using data of 157 firms. The result shows that despite the two capital structure theories are significant in the test, pecking order theory outperforms trade-off theory. When they analyze the theories jointly, the performance of pecking order models is more significant than the other.

Fama and French (2002) research the predictions of trade-off and pecking order theory with respect to dividend payout ratio. The result shows that there is no predominant model of both models. Leverage is reversely related to the profitability, which supports the pecking order theory, while the volatility and the leverage are inverse relationships consistent with the trade-off theory.

Meanwhile, Frank and Goyal (2003) examine pecking order theory using the regression of Shyam-Sunder and Myers (1999). They show that the correlation coefficients of net equity is 0.80 with the financing deficit, which is much higher than net long-term debt and deficit (0.48), which is contrary to the pecking order theory. In addition, they find that large firms follow the pecking order, but not small firms. They conclude that the pecking order theory is denied with respect to describing the financial behavior.

On top of that, de Jong et al. (2011) investigate the empirical relevance of the trade-off and the pecking order theory in two cases. They conclude that when the debt ratio exceeds target leverage, firms issue more debt in line with the pecking order theory. In contrast, repurchase decisions were driven more by the trade-off theory than the pecking order theory.

As illustration, there are some papers in order to find factors affecting capital decisions (Titman and Wessels, 1988; Harris and Raviv, 1991; Rajan and Zingales, 1995; Frank and Goyal, 2009).

Titman and Wessels (1988) document that firm size, uniqueness, and profitability are negatively related to short-term leverage. Contrary, others such as non-debt tax shields, volatility, and collateral value are not statistically significant.

Speaking of the determinants of leverage ratios, Harris and Raviv (1991) organize the determinants through nine prior studies as follows: Fixed assets, non-debt tax shields, growth opportunities, firm size, advertising expenditure, research and development expenditures, bankruptcy probability, profitability, and uniqueness of the product.

The standard influencing factors of the capital structure are proposed by Rajan and Zingales (1995). They investigate the determinants of capital structure choice in G-7 countries (the United States, Japan, Germany, France, Italy, The United Kingdom, and Canada) using four factors which are tangibility, market-to-book ratio, size, and profitability.

In addition, Frank and Goyal (2009) examine the important factors affecting capital structure. They find six key factors for capital structure as follows: Industry median leverage, tangibility, market-to-book assets ratio, profitability, a log of assets, and expected inflation.

3.2. Speed of Adjustment Analysis

Under the trade-off theory, if a firm has the optimal debt ratio without adjustment costs of leverage, the optimal debt ratio is then consistent with the actual debt ratio(Flannery and Rangan, 2006).

While some papers still confirming the existence of the optimal debt ratio for firms and whether the firms follow the optimal debt ratio, recent literature estimates firms' speed of adjustment for target capital ratio.

Jalilvand and Harris(1984) find the significant coefficients of target adjustment models and the existence of long run financial targets. Additionally, they document that the larger the firms, the faster the companies move toward the target long term debt than small firms.

Hovakimian et al. (2001) find that firms have target debt ratios in line with trade-off theory, and the target debt ratio is changed by profitability and stock price over time.

Fama and French (2002) research about the capital structure model by taking into account leverage and dividend, and show the relatively slow adjustment speed of target leverage from 7% to 18% in their results.

In the meantime, Flannery and Rangan (2006) propose a partial adjustment model which is set by firm characteristics by using data of 12,919 US firms from 1966 to 2001. The results indicate that an average adjustment speed of firms is more than 30% per year.

Lemmon et al. (2008) analyze the speed of adjustment using pooled OLS, firm fixed effect, and GMM. The results document that the speed of adjustment is 17%

(Pooled OLS, year fixed effect), 39% (Firm fixed effect, year fixed effect), and 25% (GMM, year fixed effect) respectively.

Huang and Ritter (2009) estimate the speed of adjustment using the long differencing estimator, and they find that the speed of adjustment is 17% in the book leverage model and 23.2% in the market leverage model.

Antoniou et al. (2008) document the speed of adjustment of the G5 countries. The results show that France is the fattest country with speed of adjustment of 39%, followed by the U.S., U.K., Germany, and Japan. Specifically, the rates are 32%, 32%, 24% and 11% respectively.

Ö ztekin and Flannery (2012) examine the partial adjustment model using firms in 37 countries from 1991 to 2006. The adjustment speeds are ranging from 6.50% to 40.61%, while the average for book leverage is 21.11%. Additionally, they find that institutional features, in particular, legal and financial traditions have an effect on adjustment speeds. It means that the better institutions were found to have lower transaction costs.

Some papers attempt to analyze the speed of adjustment with economic conditions. They find that when the macroeconomic environment conditions are good, the adjustment speed is faster (Drobetz and Wanzenried, 2006; Hackbarth et al., 2006; Cook and Tang, 2010).

However, some papers show that the speed of adjustment varies depending on the firm characteristics(Drobetz and Wanzenried, 2006; Faulkender et al., 2012; Elsas and Florysiak, 2011).

3.3. Capital Structure in the Shipping Industry

There are some literature with respect to the capital structure in Shipping Industry (Arvanitis et al., 2012; Drobetz et al., 2013; Anna et al., 2015; Paun and Topan, 2016; Lee, 2016; Kim and Lee, 2019).

Arvanitis et al. (2012) examine the capital structure of European shipping companies and the existence of target capital structure ratio using 32 listed companies from 2005 to 2010. They find that capital structure supports the pecking order theory with a positive relationship between tangible asset and leverage, and a negative relationship between size and profitability against leverage.

Drobetz et al. (2013) study capital structure decisions by analyzing 115 globally-listed shipping companies. The result shows that tangibility is positively correlated to leverage, while profitability is negatively correlated to leverage. Additionally, they find that the speed of capital structure adjustment to target capital ratio in the shipping industry is higher than other industries from G7 countries due to substantial financial distress costs expected. In addition, they estimate the speed of adjustment using five estimators(OLS 22%, fixed effect 42%, difference GMM 59%, system GMM 46.7%, DPF 30.7%).

On the other hand, Anna et al. (2015) investigate the determinants of capital structure in the shipping industry using 117 globally listed shipping companies by dividing four economic cycles: Expansion(2003Q4), peak(2007Q4), trough (2008Q4) and sideways movement(2010Q4). They show that profitability is inversely related to leverage during the period of expansion, trough, and sideways movement. However, profitability is positively related to leverage in the peak period.

Paun and Topan (2016) find that the capital structures of globally listed shipping companies follow the trade-off theory in which firm size and tangibility is positively

correlated to leverage, while profitability and growth are negatively correlated to leverage.

Lee (2016) examines the factors affecting the capital structure of Korean shipping companies. The results show that all factors (firm size, tangible assets, profitability, and non-debt tax shields) are negatively related to leverage except for growth.

Kim and Lee (2019) analyze the determinants of capital structure in Korean shipping companies. They show that lagged total debt to total equity and lagged ROA are positively and significantly correlated to the leverage. In addition, they examine the effect of the difference between a normal company and an insolvent company and firm age on the capital structure.

3.4. Capital Structure in Korean Companies

Korean companies have suffered from various financial crises including the foreign exchange crisis in 1997, the global financial crisis in 2008 and the like. As a result, the capital structure of Korean firms has changed by the crises, economic conditions, regulations, and so on. Korean economists thus started to study about the capital structure from the 1990s. However, up to the middle of the 1990s, only the static capital structure model was considered by Korean researchers under the tradition capital structure theory.

Sonu (1990) analyzes the key factors affecting the capital structure and find that all variables including default risk, growth, and ROA are statistically significant except for asset size for leverage ratio.

Kim (1994) studies the capital structure of Korean listed firms with asset form and profitability from 1988 to 1992. The results show that intangible fixed assets (R&D

and advertisement) is negatively related to the leverage, while tangible fixed assets are positively related. The profitability, however, shows a positive relationship with leverage, which is not in line with the pecking order theory.

However, there was a louder voice to consider the characters of Korean firms (Jeon, 2003). In fact, Shin (1990, 1993) and Gong (1998) has considered a firm's capital structure with its firms' environment in Korea.

On top of that, there are some other papers which investigate the capital structure models and analyze the pecking order theory as well as trade-off theory for the cases of Korea.

Jeon (2003) finds that both of the pecking order theory and the trade-off theory are statistically significant. Trade-off theory, however, has more explanatory power. Accordingly, both theories should be considered together for the capital structure choice.

Yoon (2005) estimates the static capital structure model, and he concludes that there is no predominant model between the pecking order and trade-off theory. In addition, he documents that exogenous factors are more considered than endogenous factors for Korean firms because Korean firms are more susceptible to the external environment.

Kim et al. (2015) analyze the determinant factors of capital structure and whether the firms follow trade-off theory or pecking order theory. The results show that Korean firms does not follow a specific theory, but supports different theories according to the diefference debt capacity and the gap between the target debt ratio and actual debt ratio

Since the late 2000s, studies on the adjustment speed of the capital structure have been conducted in Korea.

Kim (2007b) provides the eight independent variables which are significantly related to leverage, and he argues that trade-off theory, pecking order theory as well as market timing theory can explain a firm's capital structure. In addition, he further explores the partial adjustment model, and the result indicates that the speed of adjustment is 0.47 in the two-way component and fixed effect model.

Shin and Moon (2008) investigate the adjustment speed of the capital structure of Korean small and medium firms listed in KOSDAQ. They find that the adjustment speed of Korean small and medium firms is 54.6%.

Lee et al. (2013) estimate the adjustment speed of Korean firms using the models of Fama-French (2002) and Blundell and Bond (1998), the former is ranging from 13% to 28% while the latter is from 21% to 42%.

Kim and Lee (2015) examine the changes in listed firms' capital structure over a period of 33 years from 1952 to 2014. The period includes various financial crises including the Korean foreign exchange crisis in 1997 and the global financial crisis in 2008. They find that such financial crises bring pressure to decrease the leverage for Korean firms and trade-off theory outperforms pecking order theory to describe the Korean financial market. Lastly, the adjustment speed of the capital structure is 39% of book leverage and 44% of market leverage over the whole period.

3.5. Factors

Rajan and Zingales (1995) suggest four factors which affect leverage such as tangibility, the market-to-book ratio, firm size, and profitability. The results show that

the factors can be used to explain trade-off and pecking order theory. Drobetz et al. (2013) define the four standard factors of capital structure theory as follows:

Tangibility: Firm's tangibility of assets play a role as collateral, and firms with a higher ratio of fixed to total assets(tangibility of assets) reduce the risk of costs of financial distress. From a trade-off theory, asset tangibility is positively related to leverage due to the higher level of asset tangibility and lower loss of value in the case of bankruptcy.

Market-to-book ratio: The market-to-book ratio means a firm's growth opportunities. With regard to the trade-off theory, market-to-book ratio and leverage are in inverse relationships because the growing company considers high costs of financial distress and debt-related agency costs in using leverage. However, high growth firms have high leverage under the pecking order theory as it claims that expanding companies usually opt for raising funds from debt when they need new investment because they are lack of retained earnings.

Size: In general, larger firms have a higher debt ratio. From the trade-off perspective, size is positively related to leverage because large firms tend to have a lower probability of default. When it comes to a pecking order theory, large firms have low information asymmetry, so the costs of equity are lower.

Profitability: With higher income and lower costs of financial distress, profitability, and leverage are in positive relationships under the trade-off theory. Alternatively, from the pecking order perspective, the more profitable firms have more retained earnings. This notion advocates an inverse relationship between profitability and leverage.

Table 14 shows the results of capital structure factors' sign. Most literature has similar signs supporting the trade-off theory. Tangibility and size are positively correlated with leverage, while profitability and growth have a negative relationship with leverage.

Table 14 Results of literature

Author	Factors			
	Tangibility	Growth	Size	Profitability
Rajan and Zingales (1995)	+	-	+	-
Frank and Goyal (2009)	+	-	+	-
Lemmon et al. (2008)	+	-	+	-
Arvanitis et al. (2012)	+	-	-	-
Drobetz and et al. (2013)	+	-	+	-
Anna (2015)	+		+	-
Lee (2016)	-	+	-	-
Kim (1994)	+			-
Jeon (2003)	-	-	+	-
Shin and Moon (2008)	+	-	+	-
Kim and Lee (2015)	+	+	+	-
Trade-off theory	+	-	+	+
Pecking order theory	-	+	-	-

Note :
+ is a positive sign.
- is a negative sign.

Chapter 4 Data and Methodology

4.1. Data

The sample consists of 60 Korean shipping companies and 32 Greek shipping companies. The financial statements are obtained from each company's website and Bloomberg terminal in the case of Greece. Meanwhile, the data of Korean shipping companies are gained from the Financial Supervisory Service(DART). The data used in this study is on an annual basis, from 2000 to 2017. However, the data is unbalanced panel data, because the establishment date is not the same for each company. The sample includes 733 and 304 firm-year observations of Korea and Greece, respectively. On a side note, some financial data of Greek shipping companies are converted into US dollars.

Table 15 defines the dependent variable and all explanatory variables of this study. Leverage is defined as total liabilities to total assets, following Frank and Goyal (2009). Meanwhile, the standard capital structure variables are as follows: Tangibility is the ratio of property, plant, and equipment to total assets (Frank and Goyal, 2009; Drobetz et al., 2013); Growth is the first difference natural logarithm of total (Frank and Goyal, 2009; Arvanitis et al., 2012; Anna et al., 2015); Size is the natural logarithm of sales (Rajan and Zingales, 2009; Arvanitis et al., 2012); while

profitability is operating income before depreciation to total assets(Frank and Goyal, 2009; Drobetz et al., 2013).

Table 15 Definitions of variables

Variables	Definition
Dependent variable	
Leverage	Total liabilities to total assets
Explanatory variables	
Tangibility	The ratio of property, plants, and equipment to total assets
Growth	First difference natural logarithm of total assets
Size	Natural logarithm of sales
Profitability	Operating income before depreciation to total assets

Most time series data are non-stationary following a random walk. It can be spurious and misleading in the model. The data, therefore, need to be investigated whether there is a unit root in the variables. Hence, the stationarity of the data can be determined with the presence of the unit root.

Equation (1) is an autoregressive model, while $|\rho| < 1$ is a stationary time series, and $\rho = 1$ is a non-stationary time-series.

$$y_t = \rho y_{t-1} + v_t \quad (1)$$

Meanwhile, panel unit root tests have more power than the unit root test, which considers only single time series data. On the other hand, the panel unit root test investigate the existence of the unit root based on multiple time series at once (Levin et al., 2002).

In order to evaluate the presence of unit root in the data of this study, the panel ADF test is applied.

Table 16 and Table 17 shows the results of ADF-Fisher test proposed by Maddala and Wu (1999). The tests indicate that most variables do not have unit root except for leverage in the Korean model. The variable of leverage is hence, converted as natural log first difference to reject the null hypothesis that unit root exists. In spite of having no unit root in the leverage data of the Greek model, the leverage is converted as the first difference as well to facilitate comparison with the Korean model for analysis.

Table 16 ADF-Fisher Test – Korean shipping companies

Variables	ADF-Fisher (Chi-square)	
	Levels	Natural log differences
Leverage	138.005*	258.713***
Tangibility	160.832***	-
Growth	197.383***	-
Size	160.826***	-
Profitability	188.811***	-

* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Table 17 ADF-Fisher Test – Greek shipping companies

Variables	ADF-Fisher (Chi-square)	
	Levels	Natural log differences
Leverage	78.9432***	122.073***
Tangibility	71.9354***	-
Growth	67.6344**	-
Size	64.4367**	-
Profitability	63.9146***	-

* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Table 18 and 19 indicate the descriptive statistics of variables in this study. Noticeably, the profitability (operating income before depreciation to total assets) of the two nations are very similar at around 4%.

Table 18 Descriptive statistics - Korean shipping companies

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
ΔlnLeverage	733	0.009971	0.235404	-0.007479	-1.012750	1.588253
Tangibility	733	0.633918	0.223847	0.673158	0.001448	0.992514
Growth	733	0.092297	0.334219	0.044505	-1.285198	1.807524
Size	733	25.33412	1.742221	25.12962	21.77311	30.19491
Profitability	733	0.043116	0.117907	0.049787	-1.102187	0.688888

Table 19 Descriptive statistics - Greek shipping companies

Variables	Obs.	Mean	Std. Dev.	Median	Min	Max
ΔlnLeverage	304	0.031936	0.435346	0.001119	-2.570015	2.868007
Tangibility	304	0.786761	0.174676	0.839560	0	0.978842
Growth	304	0.097316	0.592579	0.048475	-3.081300	4.159839
Size	304	11.56007	1.899656	11.77983	4.980703	15.79775
Profitability	304	0.041400	0.366626	0.078103	-5.075060	1.102510

Table 20 and 21 provide the correlations coefficients of all variables. Tangibility and growth are positively correlated with leverage in both Korean and Greek shipping companies. In contrast, size and profitability are negatively correlated with leverage.

Most variables show the same sign in both countries except for the correlations between growth and tangibility. Growth indicates negative correlations with tangibility in Korean shipping companies, while the growth of Greek shipping companies is positively related to tangibility. Meanwhile, profitability and growth show relatively high correlations of 0.375 in the Korean model and 0.334 in Greek model. In addition, the result of multicollinearity test provides that variance inflation factors (VIF) are under 2 for all variables in both regressions.

Table 20 Correlation - Korean shipping companies

	ΔlnLeverage	Tangibility	Growth	Size	Profitability
ΔlnLeverage	1				
Tangibility	0.13694	1			
Growth	0.024957	-0.00162	1		
Size	-0.07869	-0.2634	0.089521	1	
Profitability	-0.41282	-0.12823	0.375454	0.150713	1

Table 21 Correlation - Greek shipping companies

	ΔlnLeverage	Tangibility	Growth	Size	Profitability
ΔlnLeverage	1				
Tangibility	0.125320	1			
Growth	0.039832	0.135780	1		
Size	-0.062877	-0.145841	0.102066	1	
Profitability	-0.200744	0.102254	0.333930	0.205717	1

4.2. Methodology

4.2.1. Capital structure regression

The panel data analysis is used as a linear regression equation (2). In regard to the panel model, which can be changed by individual effect and time effect unobserved.

$$y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \ \ (\varepsilon_{it} = \mu_i + \lambda_t + \nu_{it}) \qquad (2)$$

Where μ_i is individual effect unobserved; λ_t is time effect unobserved; ν_{it} is remainder stochastic disturbance term. In order to estimate the capital structure model, equation (3) is designed.

$$\Delta \ln Leverage_{it} = \alpha + \beta_1 Tangibility_{it} + \beta_2 Growth_{it} + \beta_3 Size_{it} + \beta_4 Profitability_{it} + \varepsilon_{it} \quad (3)$$

Where $\Delta \ln Leverage_{it}$ is the first difference natural logarithm total liabilities to total assets for firm i at time t (Frank and Goyal, 2009; Arvanitis et al., 2012); $Tangibility_{it}$ is the ratio of property, plants, and equipment to total assets (Frank and Goyal, 2009; Drobetz et al., 2013); $Growth_{it}$ is the first difference natural logarithm of total assets (Frank and Goyal, 2009; Arvanitis et al., 2012; Anna, 2015); $Size_{it}$ is the natural logarithm of sales (Rajan and Zingales, 1995; Arvanities et al., 2012); $Profitability_{it}$ is the operating income before depreciation to total assets (Frank and Goyal, 2009; Drobetz et al., 2013).

In addition, to confirm whether a fixed effect or random effect is suitable for panel model, the Hausman test is performed. For Hausman test, if the null hypothesis is adopted under the null hypothesis that the random effect is correct, the random effect is more appropriate, and if the null hypothesis is rejected, the fixed effect is more appropriate for the model. The result of the Hausman test shows that the Korean model rejected the null hypothesis (p-value is 0.001), and it is interpreted that the fixed effect would be more appropriate. On the other hand, Greek model is adopted the null hypothesis (p-value is 0.482) and it is estimated that random effect is more proper.

4.2.2. Speed of adjustment

Firms move towards the optimal capital structure which changes over time. To keep pace with a target debt ratio, firms have to pay the adjustment costs, which makes it impossible for firms to adjust their capital structure immediately. Consequently, if there is a gap between actual debt ratio and target debt ratio, firms adjust the capital structure on a yearly basis (Flannery and Rangan, 2006).

Since the estimating optimal debt ratio is difficult for each firm, equation (3) is used to estimate target leverage depending on the firm characteristics.

$$Lev^*_{it} = \beta X_{it} \quad (4)$$

Where Lev^*_{it} is target leverage, X_{it} is a vector of firm characteristics, and β is a coefficient vector. The standard partial adjustment model is as shown in the following equation (5).

$$Lev_{it} - Lev_{it-1} = \lambda(Lev^*_{it} - Lev_{it-1}) + \varepsilon_{it} \quad (5)$$

Where $Lev_{it} - Lev_{it-1}$ is changes in leverage; λ is the adjustment speed of the capital structure from actual leverage to optimal leverage. λ is $0 < \lambda < 1$, and the closer to 1 implies the faster the adjustment speed. In order to attain the level of the target debt ratio, the firm will adjust the leverage level as adjustment speed λ, and actual debt ratio converges to the target debt ratio.

Equation (6) is a dynamic panel model by rearranging and substituting (4) into (5).

$$Lev_{it} = (1 - \lambda)Lev_{it-1} + \lambda\beta X_{it} + \varepsilon_{it} \quad (6)$$

Chapter 5 Empirical Results

5.1. Capital Structure Regressions

Table 22 provides the results of regressions for Korean shipping companies. The coefficients signs of all variables are consistent with prior studies(Rajan and Zingales, 1995; Frank and Goyal, 2009; Arvanitis et al., 2012; Drobetz et al., 2013; Anna et al., 2015) except for growth.

The estimated coefficient of growth is positively and significantly related to leverage. The pecking order theory implies that firms with higher growth opportunities have more debt. This result is contrary to most previous studies. While most prior studies used the market to book ratio as the growth factor, this study uses annual changes of the total asset as a growth factor. Growing firms usually invest more to extend their business. However, when the investment exceeds retained earnings, the debt increases. On the other hand, as most of the assets of shipping companies are ships, leverage has the biggest portion in the capital structure.

Tangibility and leverage are in a positive and significant relationship, which means that since the fixed assets are collateral for loans, it causes increasing leverage. This conjecture supports the trade-off theory. Profitability is negatively related to leverage in contrast with other variables. These findings are in line with pecking order theory, which the firms with higher profitability choose internal funds than external funds.

Size shows statistically non-significant results. In addition, profitability shows the highest coefficient, which means that profitability is the most important factors to determine the Korean firm's leverage.

Firm fixed effects and year fixed effects are not increasing the model's explanatory power, unlike prior studies (Lemmon et al., 2008; Drobetz et al., 2013).

Table 22 Leverage regressions - Korean shipping companies

Dependent variable : ΔlnLeverage				
	[1]	[2]	[3]	[4]
Tangibility	0.269***	0.060	0.252***	0.078**
	(4.34)	(1.629)	(3.882)	(2.170)
Growth	0.151***	0.140***	0.146***	0.145***
	(5.794)	(5.173)	(5.108)	(5.785)
Size	0.016	-0.002	-9.720	-0.001
	(1.072)	(-0.508)	(-0.006)	(-0.151)
Profitability	-0.935***	-0.908***	-0.87***	-0.958***
	(-11.872)	(-12.431)	(-10.560)	(-13.34)
Firm fixed effects	Yes	No	Yes	No
Year fixed effects	No	Yes	Yes	No
Observations	733	733	733	733
Adj. R^2	0.210	0.220	0.218	0.209
Durbin-Watson stat	2.149	2.047	2.186	2.011

Note : This model applied the fixed effect by the Hausman Test.
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

The results of capital structure regression in Greek shipping are shown in Table 23. Column 1 shows the random effect model. The only statistically non-significant variable is size, which indicates a negative sign with leverage. The estimated coefficients of tangibility, growth, and profitability are in accordance with the regressions of Korean shipping companies. Additionally, the biggest impact variable to the Greek firm's leverage is tangibility.

Column 2 presents OLS regression. However, the result is almost the same with column 1. This implies that the random effect in the model is weak. Meanwhile, the adjusted R-square is lower than that in Korea because the number of observations is relatively small.

Table 23 Leverage regressions - Greek shipping companies

Dependent variable : ΔlnLeverage		
	[1] Random effect	[2] OLS
Tangibility	0.340**	0.340**
	(2.341)	(2.38)
Growth	0.077*	0.077*
	(1.731)	(1.76)
Size	-0.001	-0.001
	(-0.042)	(-0.042)
Profitability	-0.296***	-0.296***
	(-4.058)	(-4.125)
Observations	304	304
Adj. R^2	0.059	0.059
Durbin-Watson stat	2.195	2.195

Note : This model applied the random effect by the Hausman Test.
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Table 24 shows the comparison of variables sign with prior studies. Most of the literature has a positive sign for tangibility and size; while the negative sign for growth and profitability.

Table 24 The comparison with previous literature

Author	Factors			
	Tangibility	Growth	Size	Profitability
Rajan and Zingales (1995)	+	-	+	-
Frank and Goyal (2009)	+	-	+	-
Arvanitis et al. (2012)	+	-	-	-
Drobetz and et al. (2013)	+	-	+	-
Anna (2015)	+		+	-
Lee (2016)	-	+	-	-
Jeon (2003)	-	-	+	-
Shin and Moon(2008)	+	-	+	-
Kim and Lee (2015)	+	+	+	-
Trade-off theory	+	-	+	+
Pecking order theory	-	+	-	-
Korea	+***	+***		-***
Greece	+**	+*		-***

Note :
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.
+ is a positive sign.
- is a negative sign.

5.2. Capital Structure Regressions with Macroeconomic Factors

The shipping industry is largely affected by the global economic condition, which has an effect on world trade volume. Shipping company manages their fleet strategy depending on the fluctuation of trade volume. Thus, shipping firms' capital structure is substantially changed relying on selling and purchasing ships. Therefore, it is necessary to analyze the impact of macroeconomics on the capital structure of shipping companies. Drobetz et al. (2013) study the impact of macroeconomic factors on capital structure in shipping industry using two variables: Freight rates[2] and secondhand ship price. The result shows that freight rates and secondhand ship price are positively and negatively related to the leverage, respectively.

To study the impact of macroeconomic variables on the shipping firm's capital structure, secondhand ship price and world seaborne trade volume are added to the model. For further information, the data is obtained from Clarkson's Shipping Intelligence Network and UNCTADstat, respectively. The data of secondhand ship prices are a secondhand price index from Clarkson, while the world seaborne trade is the sum of total world goods loaded and unloaded as metric tons in millions. The factor of world seaborne trade is a typical demand factor in the shipping industry (Stopford, 2009). In this study, the two factors are converted as the first difference natural logarithm, and VIF obtained are under 2 for all variables in both regressions.

In addition, the world fleet volume as a supply factor is excluded in the model due to the existence of unit root regardless of conversion to the first difference. Meanwhile, the variable of freight rates is also eliminated in the model due to the statistically non-significant result.

[2] Drobetz et al.(2013) use the variable of freight rates as clarksea index.

Table 25 Leverage regressions with macroeconomic factors - Korean shipping companies

Dependent variable : ΔlnLeverage				
	[1] Table 24, Column 1	[2] Table 24, Column 4	[3]	[4]
Tangibility	0.269***	0.078**	0.266***	0.072**
	(4.34)	(2.170)	(4.317)	(2.012)
Growth	0.151***	0.145***	0.150***	0.142***
	(5.794)	(5.785)	(5.772)	(5.690)
Size	0.016	-0.001	0.003	-0.002
	(1.072)	(-0.151)	(0.211)	(-0.314)
Profitability	-0.935***	-0.958***	-0.894***	-0.931***
	(-11.872)	(-13.34)	(-11.288)	(-12.981)
Secondhand ship prices	-	-	-0.063*	-0.074**
			(-1.871)	(-2.277)
Seaborne trade volume	-	-	-0.524*	-0.440
			(-1.922)	(-1.621)
Firm fixed effects	Yes	No	Yes	No
Observations	733	733	733	733
Adj. R^2	0.210	0.209	0.221	0.221
Durbin-Watson stat	2.149	2.011	2.167	2.023

Note : This model applied the fixed effect by the Hausman Test.
Secondhand ship prices are a secondhand price index from Clarkson, and the world seaborne trade is the sum of total world goods loaded and unloaded as metric tons. The variables of secondhand ship price and seaborne trade volume are converted as the first difference natural logarithm. The data are obtained by Clarkson's Shipping Intelligence Network and UNCTADstat.
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Table 26 Leverage regressions with macroeconomic factors - Greek shipping companies

Dependent variable : ΔlnLeverage				
	[1] Table 25, Column 1	[2] Table 25, Column 2	[3] Random effect	[4] OLS
Tangibility	0.340**	0.340**	0.292**	0.292**
	(2.341)	(2.38)	(2.041)	(2.078)
Growth	0.077*	0.077*	0.102**	0.102**
	(1.731)	(1.76)	(2.296)	(2.337)
Size	-0.001	-0.001	-0.005	-0.005
	(-0.042)	(-0.042)	(-0.340)	(-0.346)
Profitability	-0.296***	-0.296***	-0.299***	-0.299***
	(-4.058)	(-4.125)	(-4.173)	(-4.249)
Secondhand ship prices	-	-	-0.387***	-0.387***
			(-3.695)	(-3.762)
Seaborne trade volume	-	-	1.479*	1.479*
			(1.728)	(1.760)
Observations	304	304	304	304
Adj. R^2	0.059	0.059	0.096	0.096
Durbin-Watson stat	2.195	2.195	2.213	2.213

Note : This model applied the random effect by the Hausman Test.
The variables of secondhand ship price and seaborne trade volume are converted as the first difference natural logarithm. The data are obtained by Clarkson's Shipping Intelligence Network and UNCTADstat.
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Table 25 and 26 show the results of leverage regression with macroeconomic factors. Secondhand ship prices are significantly and negatively related to the leverage in the two models, which is in line with Drobetz et al. (2013). Under the pecking order theory, the increase of collateral value leads to the reduction of the information asymmetry, which drives the decrease of issuing equity cost. Therefore, increasing the price of secondhand vessel brings about the diminution of leverage.

It is notable that the factor of seaborne trade volume shows the opposite results in both models. In the Korean model, the seaborne trade volume is negatively related to the leverage. In contrast, the seaborne trade volume shows a positive relationship with leverage in the Greek model. The result infers that Korean shipping companies usually repay their loan during economic boom via high profitability to reduce the debt, while Greek shipping companies invest more during the period to expand their business including fleets.

The results can also be applied to explain the shipping business models of the two countries. The Korean shipping business is an *operator model*. Korean shipping companies operate their business by chartering the ship, as a charterer. Thus, they are very sensitive to the market condition related to profitability. Greek shipping business, however, is an *owner model*. Greek shipping companies run their business by chartering the ships, as a shipowner. In general, they contract the chartering on long-term basis. Therefore, the relatively short-term change of the market condition does not directly affect their profitability.

In terms of the *operator model* in the Korean shipping companies, the increase of the secondhand ship prices mean the rise of freight rates, and it brings the company to the decrease of their leverage. Hence, the growth of seaborne trade volume also leads to the increase of the profit.

In regard to the *owner model* in the Greek shipping companies, the increase of freight rates does not immediately affect the company. This is because the decline of the leverage caused by the increase of secondhand ship prices is depending on the sale of vessels, not the growth of profit. Consequently, the increase of demand in sync with seaborne trade volume does not justify the rise of profitability in the *owner model*. As they contract the chartering on a long-term basis, the growth of the seaborne trade volume does not influence their profitability.

Meanwhile, the explanatory power of the two models is increased by adding macroeconomic factors.

5.2. Speed of Adjustment

The partial adjustment model is also estimated only for the Greek model. Because the leverage of Korea shipping companies has a unit root, the partial adjustment model of Korea cannot be estimated. To evaluate the speed of adjustment, this study uses the capital structure variables based on the result in Table 23.

The estimated partial adjustment models are indicated in Table 27. The speed of adjustment is 0.206 for the OLS model in column 1, which means that the gap between an actual leverage ratio and a target leverage ratio is reduced by 20.6% every year. In the fixed effect model of column 2, the speed of adjustment is 34.9%. It is faster than the OLS model in line with Drobetz et al. (2013).

Table 27 Partial adjustment regressions - Greek shipping companies

Dependent variable : Leverage		
	[1] OLS	[2] FE
Leverage $_{t-1}$	0.794***	0.651***
	(7.453)	(4.242)
Tangibility	0.382**	0.667***
	(2.172)	(2.692)
Growth	0.032	0.010
	(0.619)	(0.189)
Size	-0.003	0.019
	(-0.176)	(0.365)
Profitability	-1.423***	-1.508***
	(-17.859)	(-15.953)
Observations	272	272
Adj. R^2	0.668	0.656
Durbin-Watson stat	2.111	2.237

Note :
* Statistical significance at 10% level.
** Statistical significance at 5% level.
*** Statistical significance at 1% level.

Chapter 6 Conclusion

The Greek shipping industry has the lion's share, particularly regarding the fleet size in the world shipping market for a long time by keeping abreast of the market timing. Korean shipping companies, however, are suffering from financial deficit to expand fleets. Particularly, they have trouble in raising fund, be it from the debt market or the equity market. Hence, this paper aims to contribute in giving more insights to shipping industry players by investigating the differences between Korean and Greek shipping industry in terms of capital structure choices.

Before analyzing capital structure, the current states of the shipping industry for both two countries are first examined. Greek fleet ranked first with 330,176,000 DWT, while Korean fleet ranked seventh with 77,277,000 DWT in 2018 (UNCTAD, 2018). The number of vessels is 1,024 for Korea in 2017 (Korea Shipowners' Association, 2018) and 5,508 for Greece in 2018 (Petrofin Research, 2019). The average growth rate of the Korean fleet is 7.12%, while Greece is just 1.63% from 2002 to 2017. It shows that the Korean fleet is more fluctuated than Greek fleet. In addition, the number of Korean ocean-going shipping companies is 140 in 2017 (Statistics Korea), while Greece has 588 shipping companies in 2018 (Petrofin Research, 2019b).

Speaking of the political aspects of the shipping industry, Korea has three significant shipping systems: Ship investment company system, tonnage tax system,

and international ship register system. Greece also executes similar systems such as the tonnage tax system. However, on top of that, they also implement flags of convenience to enhance the competitiveness of their shipping industry. Meanwhile, Greek shipping companies are said to have excellent companies' resources (human resources, entrepreneurship and knowledge base) and structural characteristics (family business, entrepreneurial philosophy-culture, fragmentation, and networking) too (Theotokas, 2007).

In this research, financial ratios are examined using collected financial statements. Indeed, Greek shipping companies have better results than Korean shipping companies in terms of growth, profitability, and stability. Noticeably, operating income to sales of Greece was more than double that of Korea despite that net income to total assets of Korea is higher than Greece. In addition, total liabilities to total equity of Korea (270.91%) is higher by 97.43%p than Greece (173.48%). It implies that Korean shipping companies excessively depend on debt capital market, which is inevitable considering the reluctance of Korean banks to fund the shipping industry. Korean shipping companies, therefore, need to seek various financial instruments, especially in the equity market to raise up funds including international institutions.

The results of capital structure regressions provide that the signs of the coefficients estimated of all variables are consistent with prior studies (Rajan and Zingales, 1995; Frank and Goyal, 2009; Arvanitis et al., 2012; Drobetz et al., 2013; Anna et al., 2015) except for growth. Both shipping countries show the same signs that tangibility and growth are positively related to leverage, while profitability shows a significant negative relationship with leverage. The growth is contrary to most previous studies supporting pecking order theory. This is mainly attributed to the use of the market to book ratio as growth factors in most prior studies, while annual changes of the total asset are used in this study. Growing firms used to invest more to extend their business.

Nevertheless, when the investment exceeds retained earnings, the debt escalates. On the other hand, because most of the assets of shipping companies are ships, leverage has the biggest portion in the capital structure. Tangibility and leverage show a positive and significant relationship, which means that since the fixed assets are collateral for loans, it causes increasing leverage. This conjecture supports the trade-off theory. Profitability is negatively related to leverage in contrast with other variables. These findings are in line with pecking order theory, which claims that the firms with higher profitability choose internal funds than external funds. Meanwhile, size shows statistically non-significant results in both countries. Additionally, profitability is the biggest influencing variable to leverage of Korean shipping companies, while the leverage of Greek shipping companies is mostly affected by tangibility. To summarize, Korean and Greek shipping companies follow the pecking order theory.

The models including macroeconomic factors show interesting results. Secondhand ship prices are negatively related to the leverage in both models, supporting the pecking order theory. However, when it comes to the seaborne trade volume, the factor indicates a negative relationship with leverage in the Korean model, but a positive relationship with leverage in the Greek model.

The partial adjustment model is also estimated only for the Greek model. Because the leverage of Korea shipping companies has a unit root, the partial adjustment model of Korea cannot be estimated. The result shows that the speed of adjustment is 0.206 in the OLS model, which means that the gap between the actual leverage ratio and target leverage ratio is reduced by 20.6% annually. In the fixed effect model, the speed of adjustment is 34.9%. It is faster than the OLS model in line with Drobetz et al. (2013).

The comparative results can be applied to explain the shipping business models of the two countries. The Korean shipping business is an *operator model*. Korean shipping companies operate their business by chartering the ship as a charterer. Thus, they are very sensitive to the market condition related to profitability. Greek shipping business, however, is an *owner model*. Greek shipping companies manage their business by chartering the ships as a shipowner. In general, they contract the chartering on a long-term basis. Therefore, the relatively short-term change of the market condition does not directly affect their profitability. It can be proved in table 22 and 23 that the most influential variable on leverage is profitability in the Korean model; and tangibility in the Greek model. In terms of the *operator model* in the Korean shipping companies, the increase of the secondhand ship prices mean the rise of freight rates, and it brings the company to the decrease of their leverage. The growth of seaborne trade volume also leads to the increase of the profit. However, in regard to the *owner model* of the Greek shipping companies, the increase of freight rates does not cause an immediate and direct impact on the company. Thus, the decline of the leverage caused by the increase of secondhand ship prices depends on the sale of vessels, not the growth of profit. Meanwhile, from the perspective of seaborne trade volume, the increase of demand is not equivalent to a rise of profitability for owner model. Owing to a long-term chartering contract, the growth of the seaborne trade volume does not largely influence their profitability.

Taken together, there are three significant differences between Korean and Greek shipping companies being found in this study. Firstly, the growth rate of the Korean fleet has substantially fluctuated than that of the Greek fleet. Korean shipping companies should consider stabling their fleet strategy, especially about overinvestment in the period of economic expansion and underinvestment in the period of economic recession. Secondly, the leverage ratios (total liability to total

assets and total liability to total equity) of Korean companies are much higher than Greek companies. Korean shipping companies need to raise funds from the equity market and seek to diversify their financial instruments. Lastly, the financial behavior of the shipping company can be explained by two unique shipping business models : Operator model for Korea and owner model for Greece.

This study has contributions to the shipping industry and academia. First off, it will provide insights to the decision maker of the shipping company, especially Korean shipping companies to maximize their corporation value through balancing capital structure between equity and debt in comparison to Greek shipping company. Secondly, so far, there have been few studies analyzing the capital structure of the shipping industry. Basically, there is no precedent comparative research has been done to analyze the capital structure of each country. Hence, this study will be a meaningful one to call for attention to this literature gap.

In spite of that, this research is not without its limitations. The limitations of this study are as follows. Firstly, the lack of Greek shipping companies' financial statements. If more data could be acquired, it could enhance the accuracy of the model. Second, the scope of samples needs to be extended by adding a variety of shipping countries. With so, the models could be further explored and perfected by taking into account more firm characteristics such as types of cargo as well as other concerns for example the culture of different nations.

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