Dissertation for Master's Degree

A Study on the Effects of Market Structure on Market Performance in Busan Container Terminal

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Graduate School of Korea Maritime and Ocean University

KMI·KMOU Cooperative Program

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This dissertation, which is an original work undertaken by Da Ye Lee in partial fulfillment of the requirements for the degree of Master of Economics, is in accordance with the regulations governing the preparation and presentation of the dissertation at the Graduate School in the Korea Maritime and Ocean University, Republic of Korea.

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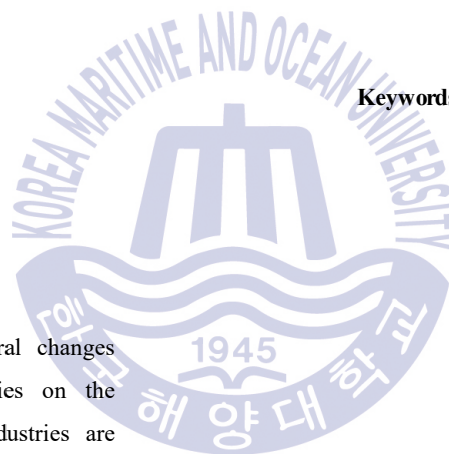
Abstract

The liner industry and the port industry have gone through structural changes during the last decades. Even though there are many existing studies on the shipping industry or on the port industry, studies considering both industries are still insufficient. To fill this gap, this study aims to analyse the relationship between market structure and market performance in case of Busan container port.

In this study, the market is defined as the place where the seller(container terminal operating company) sells services to the buyer(shipping company). Market structure variables as explanatory variables include the buyer concentration as well as the seller concentration. Market performance variables as dependent variables reflect two aspects. To reflect the economic performance, sales per unit and costs per unit data are measured. And to reflect the managerial performance, operating margin ration and price-cost margin data are measured. After measuring the market structure and performance, the effects of market structure variables on four different marker performance variables are analysed. The results support that the market structure affects the market performance.

This study deals with the buyer side market structure and economic performance at the same time. Many studies on the relationship between market structure and performance only considered the seller side market structure and its effects on the managerial performance. However, this study attempts to reflect various aspects. By doing so, this study can help devise policies that are suitable for the port sector.

Keywords : SCP Framework, Market structure, Market performance, Busan container port

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Chapter 1. Introduction

1.1 Background of the Study

The shipping industry and the port industry are closely related to each other. The shipping industry has gone through many challenges. Shipping companies have increased their capacity and expanded service coverage to much broader regions to meet the growing seaborne trade volume. Due to the change of average capacity and service coverage, changes in routing have occurred. At the same time, to avoid capital risk, many shipping companies introduced new managerial strategies such as M&A, conference and alliance. Along with the capacity enlargement and managerial strategies that caused the growth of firm, the shipping industry has become more concentrated. Recently, some global shipping companies directly invest the terminal and put pressure on port to lower the port service price.

The port industry is confronted with huge challenges. Larger ship size means increase demand for bigger berth. In addition, as the fewer number of larger vessel called at fewer ports, the function of a hub port had been strengthened. Ports that want to grab huge volume of cargo and become a global hub port need to make a huge investment to reorganize berth and equipment. The government of developed countries considered the port as a main logistics gateway and offered an assistance to strengthen its competitiveness. Competition between ports or terminals has become an important issue. During the last decades, the port industry seems to become more vulnerable to the shipping industry.

Especially the competition among ports in Far-East region has become fiercer. Since 1990s, container ports in Far-East region have recorded remarkable growth. Busan port also has recorded increasing throughput. Considering that growth rate of transshipment cargoes is much higher than that of import-export cargoes, it is acceptable that Busan port maintains competitiveness as a regional hub port. In contrast with the favorable economic background, terminal operators in Busan port have appealed their managerial difficulties. Fierce competition within both inter and intra port is pointed as a main reason.

1.2 Aims and Objectives

Considering the recent dynamic changes, it is important to understand the effects of changes in the shipping industry and the port industry. Within this context, this study aims to define the relationship between market structure and market performance in container port sector.

Market is a place where seller and buyers interact to exchange the goods, services and everything with payment. Based on this definition, this study define the market as follows. A container terminal operating company(CTOC) as a seller offers cargo handling and related services such as stevedoring at price "tariff" to a buyer which mainly is a shipping company(SC). In short, the market in this study can be demonstrated as Figure 1.
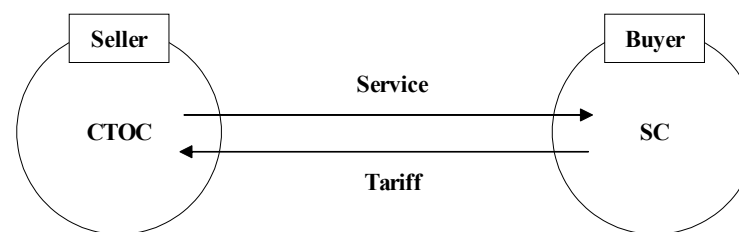
Figure 1 Description of Market

The main purpose of this study is to empirically analyze whether market structure affects market performance. Many studies have tried to verify the

relationship between market structure and market performance. However, only a few studies for now have studied market structure and market performance in port sector and among those barely considered the buyer side of market characteristic. To fill this gap, the market structure in this study includes both seller and buyer sides.

Market structure of buyer was barely considered because it is hard to observe. Generally, in case of most commodities, the buyer includes all public and it is nearly impossible to get the data from them. In contrast, the buyer in port sector can be defined as a certain group, meaning that the port sector is an adoptable subject to observe the buyer side's market structure.

As many classic economic theories pointed out, relative bargaining power of both supplier and demander is a decisive factor of setting the price. That is why many literatures consider the price as a result of mechanism in a market. And given that the criteria of excessive profit or rents are marginal costs, the cost also is an important economic performance. However, many studies did not consider those economic performance and only focus on managerial performances. To fill this gap, in this study, market performance reflects both economic and managerial aspects.

1.3 Structure

The contents of this study are organized as follows.

In the first chapter, the background and purpose of this study is introduced.

In chapter two, theoretical background on SCP framework, the shipping industry, the port industry, and Busan container port are presented. Firstly, the definition and mechanism of market structure, conduct, performance is suggested. And then literature review on each market follows. This study, in particular, focuses on the characteristics of each market and how they have been changed.

Chapter three suggests industrial characteristics with statistic data. Through this chapter, we can answer how real industry have changed and where they are in now?

Chapter four defines the variables and introduces the methodology employed in this study. Then, empirical analysis results are suggested. The effects of market structure on market performance is estimated in the empirical case of Busan container port.

In the last chapter, implications and limitations are suggested with a summary of this study.
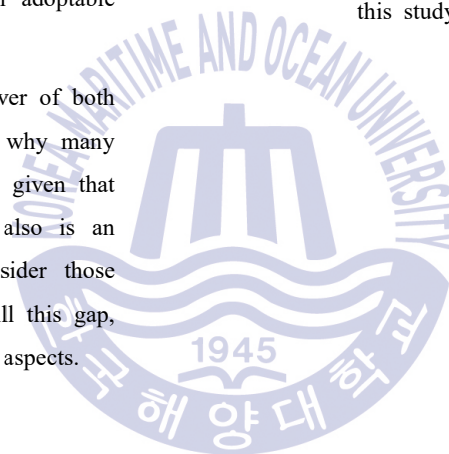
Chapter 2. Theoretical Background

2.1 Structure-Conduct-Performance Framework

Structure-Conduct-Performance(SCP) framework, introduced by Chamberlin and Robinson in 1933, is a basic view of industrial organization to understand the interrelationship among structure, conduct, and performance. SCP framework assumes that market structure affects market performance by affecting the market player's conduct as Table 1 describes.

The structure of market is determined by various factors. Even though there still is a debate, number and size of sellers and buyers, entry barrier, product differentiation are the most commonly accepted factors[1]. Especially, the concentration which include the concept of the number and size of sellers and buyers is the most widely used way to describe the market structure. Generally, market structure can be divided into four categories based on its contestable nature; perfect competition, oligopoly, duopoly, and monopoly.

The market also can be divided into four as of the relative concentration degree of sellers and buyers. If both sellers and buyers are small in size, the market is an atomistic market. The market with small buyers(sellers) while the seller's(buyer's) concentration degree is high is a simple oligopoly(oligopsony). If both sides shows significant concentration degree, the market is bilateral oligopoly[2].

Player's conduct appears in various ways including pricing strategy, product strategy, advertisement, and others. For example, the players' pricing strategy depends on the market structure and inter-dependence and varies from independent profit maximization to joint profit maximization[3]. Conduct is a debatable issue in

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1) J.V. Koch, 1974, *Industrial organization and Price*, Prentice-Hall, p.76.
2) J.S. Bain, 1968, *Industrial Organization,* Wiley, p.151.
3) *IBID*, pp.317-320.

Table 1 SCP Framework

BASIC CONDITIONS	
SUPPLY	DEMAND
Price elasticity Product durability Location	Price elasticity Growth rate Substitutes Cyclical and seasonal character

MARKET STRUCTURE	
Number and size distribution of sellers and buyers Product differentiation Barriers to entry Scale economy	Cost structures Industry maturity Vertical integration Diversification

CONDUCT	
Collision Pricing strategy Product strategy	Research and innovation Advertising Legal tactics

PERFORMANCE	
Price and average cost Profitability Output	Technical advance Allocative efficiency

POLICY

Source : Author's own based on Bain(1968), Koch(1974), Schmalensee(1987)

imperfect competition markets, especially in oligopoly. Collusion is a representative conduct to seek extra profit. In an oligopoly market, conduct usually aims to keep rival firms in check so that they can take advantage or cooperate with each other. The results are price competition or cooperative rent seeking through collusion. That makes oligopoly market seems extremely unstable or calm.

The market performance refers to the results from the market structure and market conduct. The economic performance includes the results from the market power. Generally, it is expressed with the price, cost, profitability, and technical development. In perfect competition market, price is equal to marginal cost, which means resources are highly efficiently distributed. The more weaker firm's market power is the price is near to normal profit.

SCP framework suggests two flows. The one is the process of structure-conduct-performance and the other one is the process of structure-performance. The second way is easier to get data and analyze, so it has been applied on various industries to determine if market structure affect market performance. Among those, the manufacturing industry is the most common subject. The early study by Bain(1951) found that worse market performance was brought out in monopolistic markets due to abnormal rent seeking. Other studies on manufacturing market(Lee, 2006) also showed significant correlation between supplier concentration and supplier's managerial performance. The same results were driven from another industries; banking(Short, 1979), mobile telecommunication (Kyung, 2006), and so on. However, only a few studies focused on port and shipping industry.

Lam. et al.(2007) applied the SCP framework on major global liner routes. In this study, the effects of concentration degree based on slot capacity in Transpacific, Europe-Far East, and Transatlantic trade routes on financial performance were analyzed. The results revealed that increasing the concentration of slot capacity had no significant effect on financial performance. The study

concluded that in each major trade routes, liner shipping industry is turned out to be competitive.

Kil(2010) analyzed industrial characteristics of container port. This study deals with the challenges Korean container ports faced in terms of market structure, market conduct, market performance, and government policy. Basically, demand is price-sensitive and instable. As a result, demander easily changes calling port and has superior bargaining power. Supply is non-movable natural monopoly market. And it is hard to quickly reorganize or differentiate service. Especially, Busan port is composed of relatively many but relatively small operators to rival port in Singapore, and China.

Prior studies have two limitations. First one is about the market structure. The countervailing power of sellers and buyers have impacts on the performance[4]. Due to the difficulty of collecting buyers' data, most of studies focused on the sellers' concentration only. Generally, most of industry provide the products and services to the public and it is hard to define the buyer. Within this context, the concentration of buyer was considered in limited sector[5]. However, even if the terminal operators offer the services to the certain group(shipping companies), the attempt to study the buyer concentration is still in short.

The second on is about the market performance. Many studies have tried to verify the effect of market structure on market performance. However, in most case, the market performance includes managerial performance of seller such as price-cost margin, returns of equity, and return on assets. Considering that the market power implies the ability to set the price(Bain, 1968; Koch, 1974), the price seems to be a fundamental performance. A seller who has substantial market power tends to set the price above marginal cost. That gives a rational reason why the cost has to be considered together. However, many prior studies have focused on

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4) *IBID.,* p.152.
5) *IBID.,* p.153.

the managerial performance due the most firms produce multiple services and products[6].

This study aims to fill the gap. Firstly, the market structure was defined considering both seller and buyer sides. Secondly, the market performance was measured including both economic and managerial performances. This is the main differences between this study and the prior studies.

2.2 Shipping Industry

2.2.1 Industrial Conditions and Structure

Stopford(2009) describes shipping demand as "mercurial and quick to change" and price-inelastic due to the lack of competing transport modes. However, shipping supply is "slow and ponderous in its response to changes in demand."[7] Due to 2-3 years of time-lag between establishing a new-build contract and its physical delivery followed by 15-20 years of physical life, it is hard to adjust supply promptly. Then, shipping supply is short-term fixed?

Fusillo(2004) states that the liner shipping industry's supply curve is more flexible than the 'stylised facts' of the industry would suggest. In his study, short-term and long-term elasticity of capacity developments in major US east and west trade lanes were analyzed and the results revealed that capacity is less flexible in Trans-Atlantic route than in the Trans-Pacific route due to shipping conferences.

A new type of pattern appeared after the Ocean Shipping Reform Act of 1998. Shipping alliances in Trans-Pacific route are proved to be more capable at adjusting to demand than shipping conferences in Trans-Atlantic routes(Fusillo, 2006). Then

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6) R.Schmalensee, 1987, Inter-industry studies of structure and performance, *Handbook of industrial organization,* North Holland, p.13.

7) M.Stopford, 2006, *Maritime economics,* 3rd Ed. Routledge, p.150.

is it acceptable to increase the capacity of alliances to adjust to demand and supply and a balance to market price? This is not a simple question. The consequences of increasing the market power of shipping companies needs to be considered as well.

Sys(2009) questioned whether the liner shipping industry is an oligopoly. In the study, the liner shipping industry was defined by calculating market concentration degree(CR4, HHI), Lorenz curve, Gini coefficient, and instability. In terms of 'market concentration', the liner shipping industry is in loose oligopoly(25%<CR4<1005, HHI<1000). In allowance of 'market share variation', shipping market is positioned in the middle of a symmetric and asymmetric market. In terms of 'variation in competition and collusion', it is closer to a tacitly collusive market, where operational agreement becomes more important, from previously being a formal collusive oriented market until the conference system was abolished in 2008. Lastly, from the point of 'variation in interdepence', the industry had transformed from a guessing-game oligopoly into a chain monopoly.

Ha and Seo(2013) calculated the concentration degree of Korean shipping markets in 1992, 2004, and compared it with the 1996, 2000, 2005, 2007 results of world top 4 liner companies concentration from a prior study. CR4 and HHI have decreased meaning that Korean shipping industry became more competitive. In contrast, CR4 and HHI had increased around the world. Although Korean and world shipping industry still remain unconcentrated, the shipping industry has become more competitive with various strategies. It seems that the competition in Korea has become even more competitive.

2.2.2 Strategies, Policies & Consequences

Heaver et al.(2000) explained the various types of agreements such as mergers, alliances, conferences, and involvement of shipping companies in terminal management, and their effects on the shipping and port industry. Shipping companies have involved in terminals or hinterlands to provide door-to-door service.

In the process, market power have shifted towards shipping companies little by little. Ports have to deal with successive changes. With the enlargement of ship size, the number of calling terminals has decreased due to limited physical accessibility or as a strategic decision in management. Some global alliances and shipping companies require dedicated terminals, while others intentionally avoid them. Port authority and terminal operators are in an awkward situation. They want to attract huge customers but do not want to be swayed by them.

Notteboom(2004) points out that dramatic changes in shipping and port industry have taken place. Shipping companies developed capacity to obtain economy of scale which unfortunately led to overcapacity. To survive within such an unfavorable situation, shipping companies are pushed to set the tariff at the level of marginal cost. It remains debatable whether the benefits brought on by economy of scale outweighs the additional expenses incurred by the shipping companies such as lower tariff, addition of wider services, and expenses in marketing and technical research. From the shipper's view, shipping is a part of total supply chain. From this concept, to avoid investment risk and improve service coverage, expansion strategies involving M&A, alliances, and providing multi-modal transport have prevailed. Ports have also tried to transform from a local port into a part of port network. The era of global terminal operator(GTO) started.

However, the effects of increasing competition are not always bad. Fusillo(2006) explains the positive results of increasing competition after Ocean Shipping Reform Act(OSRA) and the EU reform. Due to the two new rules prohibiting shipping conferences, conferences have been replaced by alliances. Vessel sharing arrangements allow shipping companies to improve operational efficiency and provide better services. Even though the shipping industry seems to be more competitive, in some ways, better results followed.

2.3 Port Industry

2.3.1 Industrial Conditions and Structure

Natural monopoly can be found when firms take advantage of the huge effects brought on by economy of scale. Price competitiveness derived from lower average total cost functions as an entrance barrier. Then, only one firm is in the market without granting monopoly of government. That kind of market is called as "natural monopoly". Industries which have natural monopolistic characteristics are better at sustaining one or a small number of firms.

The port industry is a representative example of a natural monopoly. The port industry's natural monopolistic characteristics enable the port to function as a node or intersection of total supply chain. For that reason, network investment at a national level is required to develop a logistic framework as well as huge facility investment at private level. Due to economy of scale and economy of network, a number of operators within the same port tend to bring problems in port industry(Kil, 2011)

However, due to non-mobility and in-elasticity of facilities, the ability to adjust demand and supply imbalances is weak. Therefore, in case of competing with other ports or terminals, excessive price competition will be occurred for pursuing economies of scale and facility efficiency even during temporary imbalances.

2.3.2 Inter-port Competition

Woo et al.(2012) investigated the trends and themes of studies on 'seaport' during the last three decades(1980s-2000s). According to the results, shown in Table 3, the number of studies on 'competition and performance' and 'terminal operation' have increased while the number of studies on 'planning and development' are diminishing. Especially 'ports in supply chains' is uprising as a

new topic. The change in research theme means that the physical development of ports was a major concern in the 1980s, but after the port industry environment changed in 1990, competition and management strategies in the 2000s became a hot topic. Through this trend, we can infer that managerial and operational issues became more important while physical issues became less important. Especially 'Ports in supply Chains' is a newly emerging theme since the 1990s, reflecting the change in perspective of port as part of the whole supply chain.

Table 2 Research Themes on 'Seaport' by times

Theme	1980s	1990s	2000s
Port Policy	9	11	11
Governance and reform	3	20	7
Management and strategy	19	19	20
Competition and performance	15	11	24
Ports in supply chains	-	1	8
Planning and development	32	13	12
Terminal operation	4	9	13
Spatial analysis	18	17	8

Source : Woo et al.(2012)

Notteboom and Yap(2012) analyzed the impacts of container shipping services on inter-port competition. The authors defined container port competition as gains made or losses incurred by changes in the annualized slot capacity(ASC) that calls at container ports. According to the study, inter-port competition in three major regions have been directly affected by container shipping services during 1995-2006.

Yap et al.(2006) focused on the developments in container ports in East Asia from 1995 to 2001. Container port competition in two major routes in East Asia has intensified; Europe-Far East and Transpacific. The most decisive factors in increased competition stems from Chinese ports as "direct calling ports" that derives service re-organization.

Song(2003) argues that due to conceptual change in the port industry towards co-opetition, along with changes in global economy and shipping industry, ports no longer benefit from a natural monopoly. Port operators have extended their operational scope from local to regional or global. Given that environment, co-opetition among ports is a crucial factor. Co-opetition refers the combination of competition and cooperation. In Hong Kong and South China, there are cases where terminal operators form a joint ventures. Individual operators lose market power due to the growing industry rivalry and increasing bargaining power of shipping lines. By forming co-opetitive strategies, operators mutually attempt to recover market power. Figure 2 below shows the mechanism of co-opetition.
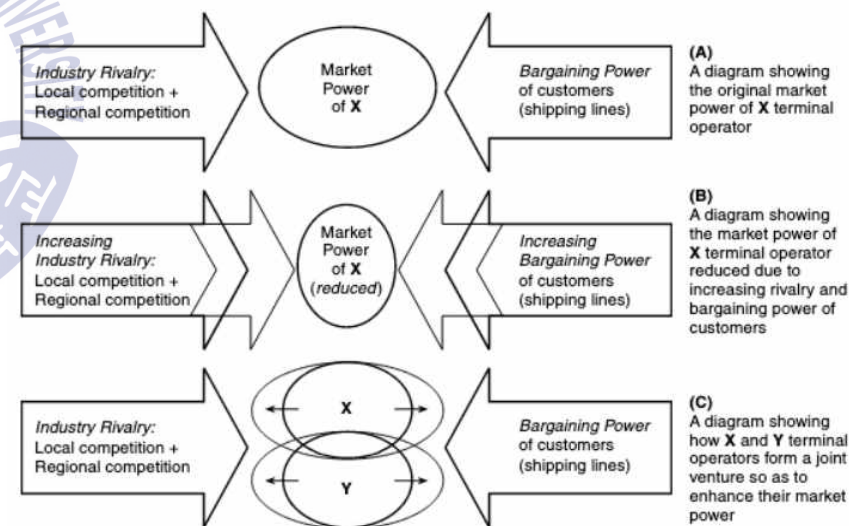
Source : Song(2003)

Figure 2 Mechanism of Co-opetition

2.3.3 Intra-port Competition

Intra-port competition also is an important issue. Inter-port competition refers to '*competition between different ports*' and intra-port competition refers to '*competition among marine terminals within the same port.*'[8] If there only is one terminal operator in a port, to call at that port means to be a customer of that terminal operator. However, if there are several terminal operators, it is inevitable for terminal operators to compete against each other. In some cases, however, intra-port competition has a positive effect.

De Langen(2006) demonstrated the advantages of intra-port competition. Firstly, intra-port competition prevents abnormal rents meaning that intra-port competition makes terminal operators within the port hard to set monopolistic price. In other words, the higher price is expected to be set when there is no intra-port competition. Secondly, intra-port competition triggers innovation, specialization and diversity. Terminal operators within the port share their political and economical background, for example, regulation, labor market, and supplier. Consequently, the tendency for terminal operators to develop their own competitiveness is stronger when there is an intra-port competition.

2.4 Researches on Busan Container Port's Structure and Performance

Recently, some studies suggest excessive competition to be the main reason of the current difficulties faced by Busan port container terminal operators.

Kil(2011) analyzed the market structure of Busan Port. Compared to 2003, supplier concentration is declining and becoming a competitive market in 2010. Although the degree of buyer concentration seemed to be competitive without

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8) W.K.Talley, 2009, *Port Economics*, Routledge, p.140.

outstanding changes, a few top alliance groups' market share had increased. Accordingly, shipping companies or alliance groups put pressure to reduce costs. Unstable and unfavorable market structure is the main reason for current difficulties of Busan port terminal operators.

Ryoo, Choi and Kim(2012) pointed out current monopolistic and oligopolistic structure in Busan port. Due to the interdependence among terminal operators' profit, a price strategy of one operator easily spread to the others. In short, they are in non-cooperative price competition.

Jun, Ahn and Yoon(2016) evaluated Busan container terminal as monopolistic competitive market or homogeneous oligopoly. Due to such markets characteristic cooperation among terminal operators is almost impossible. More worse, intensified polarization between Busan North Port and Busan New Port let demander exercise stronger bargaining power. To stabilize the market, there are growing demand for government to intervent.

Then is current price competition really a matter? Hasn't it contributed to the improvement of public utility? Recent research(Choi, Kim and Kim, 2016) answers the question. The result revealed that even though stevedore service price dropped, the economic value including consumer surplus declined. It implies fierce competition makes the industry depressed. Causality test also showed no evident result to support low tariff brings more demand.

Jwa(2009) studied the relationship between market structure and market performance in Busan, Gwangyang, and Incheon port. Market structure was estimated by HHI based on throughput. Market performance was represented as Price Cost Margin(PCM). Three terminals of Busan port and one from each Gwangyang, and Incheon port were selected as objectives. The results suggested the trend that in Busan port turned into a loose oligopoly and along with market structure change PCM also diminished during 2004-2007. However, market

concentration and PCM showed a negative trend in Gwangyang and Incheon port.

Kim and Ryoo(2016) estimated the effects of the market structure computed by HHI on the market performance in terms of profitability (PCM, ROA), and growth (total TEU, rate of the increasement of TEU). Six terminal operators of Busan port and five terminal operators of Shanghai port were selected. Major finding of the study is that the market structure had positively effected on market growth(total TEU) in Busan port and Shanghai port, but had negatively effected on market profitability(PCM, ROA and total TEU) in Shanghai port. The negative relationship is contrary to what industry organization theory assumes. The researchers assumed that conduct factors which are more powerful than market structure had affected the result.

Chapter 3. Industrial Trend in Liner Shipping and Container Port

3.1 The Liner Shipping Industry

As shown in Figure 3, global container trade volume has steadily expanded excluding 2009. As a matter of fact, the world seaborne container trade volume has tripled over the past 18 years. According to World Bank data[9], GDP growth rates recorded between −2% to +4% during that period. Compared to world GDP growth, world container trade volume has grown steeply up to 13.7%. However, world container trade took hard hit during the financial crisis in late 2008 recording −9.1% growth while world GDP decreased by only 1.7%.
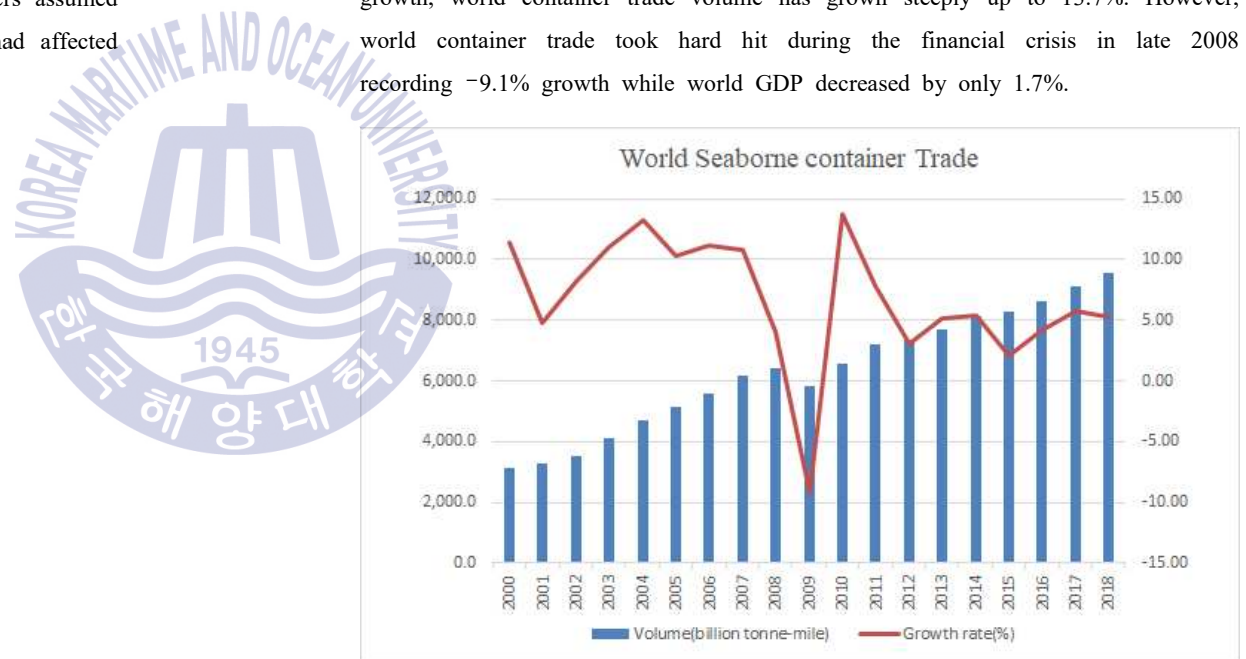
Source : Author's own using Clarkson Research Services Limited Data

Figure 3 World Container Trade Volume

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9) World Bank (http://www.worldbank.org/)

As figure 4 indicates, two main routes(Trans-Pacific and Europe-Asia-Europe) greatly contributed to world container trade growth. Trades on the Europe-Asia-Europe route have tripled, reaching 23 million TEUs while trades on the Trans-Pacific route have increased more than two times, reaching 26 million TEUs. Following the financial crisis in 2008, container trade volume growth on the Europe-Asia-Europe route remains rigid while trade on the Trans-Pacific route shows a steep increasing trend. For the last two decades, Asian has led the way as a trigger of container trade. China especially is a major driver. Other potentially important countries, namely those of ASEAN, are expected to be future triggers[10].

To deal with demand volume growth, liner shipping companies have developed their capacity. According to UNCTAD[11], as shown in figure 5, *bigger ships are deployed by fewer companies.* Index of vessel number seems to remain on a similar level while average vessel size as well as maximum vessel size have increased. In contrast, indices of companies and services showed decreasing trends. These contrasting trend indicate that concentration in the liner shipping industry has strengthened, which put pressure on routing. Large, new emerging vessels mainly deploy on Europe-Asia or Transpacific routes. To fill up capacity, the frequency and diversity of services provided have decreased. They also let exiting ships which operated the route moved on to other routes. In short, bigger ships being deployed by fewer companies have led to rearrangements in the global shipping route.

Source : Author's own using UNCTAD Data

Figure 4 Container Trade Volume on East-West routes
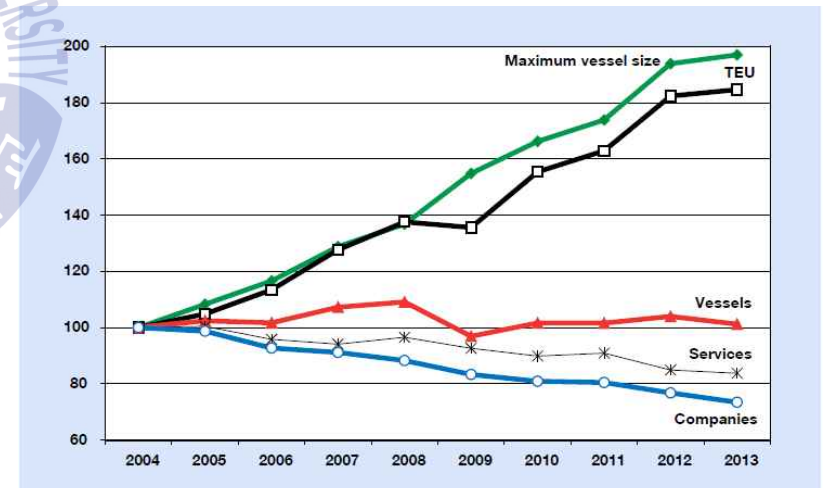
Source : UNCTAD

Figure 5 Trends in container-ship fleet deployment

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10) UNCTAD, 2014, *Review of Maritime Transport,* p.23.

11) UNCTAD, 2013, *Review of Maritime Transport*, p.52.

The N-firm concentration ratio, which is the summed market share of N largest firms, shows increasing concentration degree in the liner shipping industry. As Table 3[12] indicates, fewer companies possess larger market share. CR4 increased 20% during 2000-2017. Considering that CR8, CR10 also increased by 20%, it can be inferred that the growth in market share of the top four companies is overwhelming. As several academic reviews in chapter 2 pointes out, the liner shipping industry turned into oligopoly.

Table 3 Concentration Ratio in Liner Shipping Companies

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CR4	30.5	31.2	32.1	33.2	33.2	32.9	40.8	40.6	41.3	41.5	41.2	41.2	43.8	43.8	43.6	44.4	50.6	51.9
CR8	46.8	47.6	48.4	48.8	49.5	49.6	57.6	56.7	57.2	57.1	56.6	57.6	60.0	59.7	60.0	61.4	67.1	68.3
CR10	52.5	53.5	54.8	55.2	55.8	56.6	65.1	63.5	63.6	63.7	63.4	64.2	65.9	66.4	66.7	67.6	72.9	74.0

Source : Author's own using BPA data

Considering the alliance as a single firm, four largest companies gain an even higher market share. Table 3 indicates market share in 2000, 2003, 2006, 2008, 2016, and 2017 of shipping alliances. Data for 2000, 2003, 2006, and 2008 were collected from prior work(Sys, 2009), and data for 2016 and 2017 were collected from Alphaliner. The three alliances have gained more than 90 percent of the market since being reorganized in April, 2017. In short, three mega alliances accounts for dominant portion of the entire liner shipping industry.

Table 4 Alliances' Market Share

Year	Alliance	% share /liner total	Year	Alliance	% share /liner total
2000	GRAND Alliance	13.45%	2008	Maersk Line	16.06%
	CHKY	12.62%		CHKY	11.54%
	Maersrk/Sealand	12.05%		GRAND Alliance	11.08%
	NWA	8.67%		NWA	7.93%
	Total	46.78%		Total	46.61%
2003	GRAND Alliance	13.97%	2016	2M	27.8%
	CHKY	12.35%		CKYH	19.4%
	Maersrk/Sealand	11.95%		G6	17.0%
	NWA	7.84%		O3	11.4%
	Total	46.12%		Total	75.6%
2006	Maersk Line	18.23%	2017	2M+HMM	34.9%
	CHKY	11.68%		OCEAN Alliance	33.7%
	GRAND Alliance	10.83%		THE Alliance	22.8%
	NWA	7.89%			
	Total	48.62%		Total	91.4%

According to new built vessel delivery data from Clarkson Research Services Limited, the average vessel size of newly built container ships have increased from 2,500TEUs in 2000 to 8,000TEUs in 2016. In particular, the number of mega-ships entering market between 2014 and 2016 is noteworthy. Among 549 new vessels built during 2014-2016, 284(51.7%) were larger than 8000TEUs and accounted for 84.5% of total capacity of the world newly built container vessels. In the same period, 55 vessels(10.0%) were larger than 15,000TEUs, which accounts for 24.8% capacity. The entrance of mega-ships have encouraged increase in the concentration degree of the global liner shipping industry.

However, overdevelopment of shipping capacity is proving to be the underlying cause of the current recession that the shipping industry is facing. Global liner shipping companies have bought too many vessels and incurred high expenses. Even with the increase in global container trade volume, supply has catch up with demand(figure 6). To make matters worse, the 2008 financial crisis have made

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12) Top 100 operated fleets as of January 1st, Alphaliner.

world trade decline, and finally opened a new era of low economic growth. Many shipping companies had to lower the tariff to survive. Average containership earnings have dropped to recordable low as shown in figure 7.
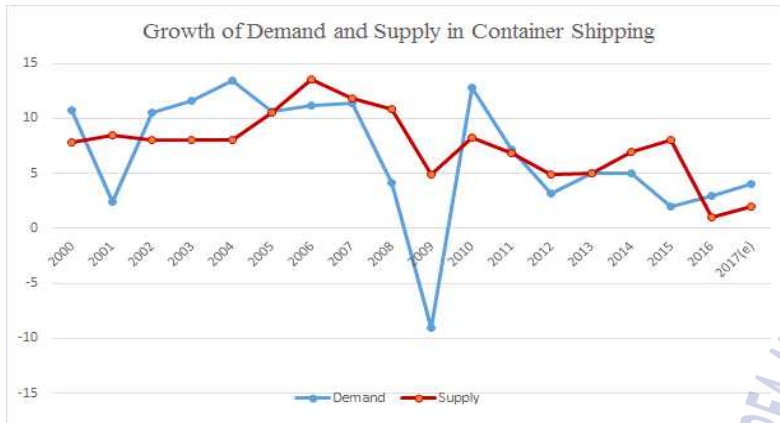
Source : Author's own using UNCTAD data

Figure 6 Growth of Demand and Supply in Container Shipping
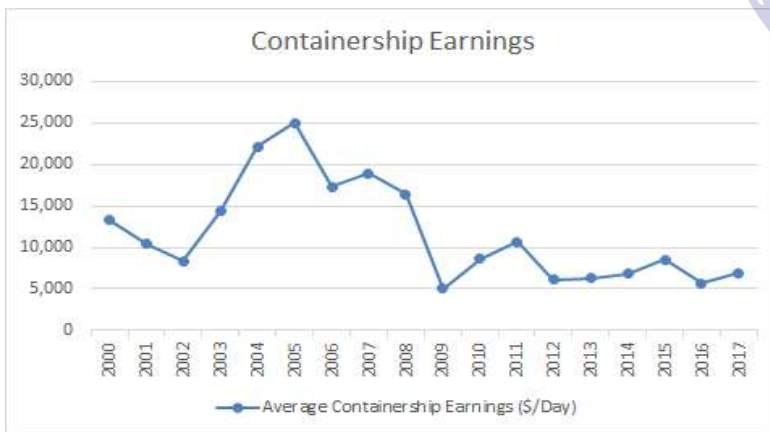
Source : Author's own using Clarkson Research Services Limited data

Figure 7 Average Containership Earnings

3.2 The Container Port Industry

Port plays an important roles as node in transportation chain, creating link between land and sea as well as providing entrance of markets. For that reason, ports have to constantly adapt to changes in the economic, institutional, regulatory and operating environments[13]. In particular, changes in the logistics has had a profound effect on the changes in ports.

The shipping services, that have changed to larger volume in fewer ports, have strengthened the "Hub and Spoke" system. Mega-ships deployed in main routes tend to call at hub ports and smaller-ships deployed in non-major routes handle feeder line allocation at feeder ports. In response to this change, some ports were reborn as mega-ports through the development of terminal facilities while others focused on developing as more feeder network service. In addition, focusing on the whole supply chain, the competition for services and prices to optimize the whole process has intensified.

As figure 8 addresses, the world container port volume reached 701.4 million TEUs in 2016. Figure 9 shows the characteristics of port traffic in different regions. Among regions, East Asia and Pacific accounted for overwhelming share up to 55% in 2016. Market share of East Asia and Pacific shows constant increase while those of North America, and Europe and Central Asia decreased. Although all regions recorded an absolute amount increase, East Asia including China, Hong Kong, Singapore, Korea, Thailand, and Vietnam grew noticeably. The increases in European and North American ports traffic can also be seen as a consequences of the increasing trade volume with Asia.

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13) UNCTAD, 2017, *Review of Maritime Transport,* p.61.

Figure 8 World Container Port Traffic (`000 TEUs)
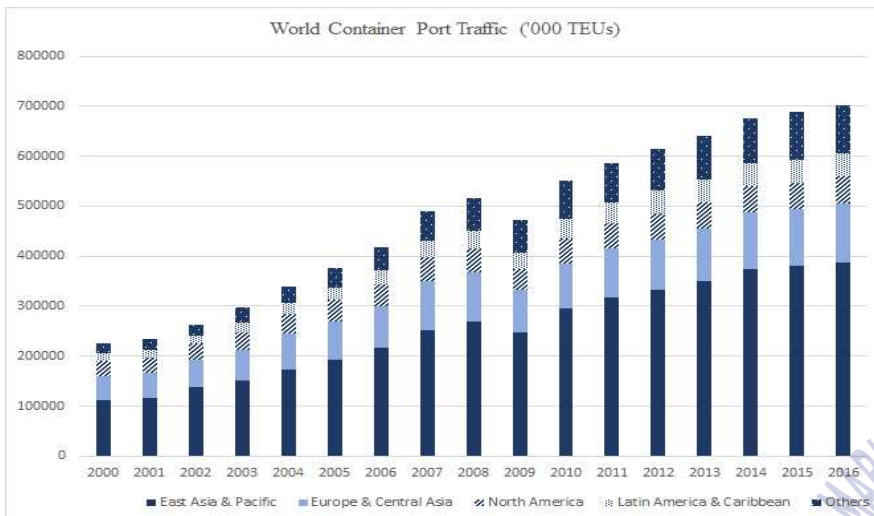
Source : Author's own using World Bank data

Figure 8 World Container Port Traffic

World Container Port Traffic by Region (%)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Others	8.1	9.4	8.5	9.8	9.4	10.4	10.7	11.8	12.7	14.0	13.8	13.6	13.6	13.5	13.5	13.8	13.6
Latin America & Caribbean	7.1	6.9	5.7	6.6	6.6	6.6	6.7	6.7	6.9	6.9	7.0	7.0	7.2	7.1	6.8	6.7	6.6
North America	13.9	12.8	12.5	12.2	11.5	11.3	10.9	10.1	9.1	8.8	9.2	8.7	8.5	8.3	7.6	7.8	7.7
Europe & Central Asia	21.5	21.6	21.1	20.3	21.0	20.1	19.5	19.9	19.1	17.8	16.4	16.7	16.5	16.3	16.9	16.5	17.0
East Asia & Pacific	49.5	49.3	52.2	51.1	51.5	51.5	52.3	51.5	52.2	52.5	53.6	54.0	54.2	54.8	55.1	55.2	55.1

Source : Author's own using World Bank data

Figure 9 World Container Port Traffic by Region

Although global container port traffic has grown, inter-port competition has become more fierce owing to several ports' rapid growth and new entrants that are later revealed as super rookies. Table 5 lists world's top 20 container ports by volume. The top 20 ports handled about 316.6 million TEUs, accounting for 45% of world total volumes. It is notable that the European and U.S. ports which ranked in top 10 in the early 2000s have dropped and Asian ports filled up the positions. In 2016, nine of the ten largest ports are Asian ports, and among those, seven ports are in China. This trend reflects that the growth of Asian ports based on the massive volume of traffic from the hinterland markets. The growth of Chinese ports is especially surprising.

Increasing ship size brings the challenges to ports. Larger ships commonly call at fewer ports with lower frequencies and that causes unbalance in port operation time. Over-utilization and under-utilization repeated. There are also problems with congestion. Much more time is spent to enter the berths or gates, to load or discharge, and to transship. The larger volume per vessel, the longer time in port. Liners as a provider of regular and timely service have to keep compliance with the regular port call. Shipping companies required higher productivity from the operators or moved to more efficient terminals to reduce the time and improve their services. Port productivity index, as shown in table 10, indicates productivity of global major ports has improved as a results of efforts to introduce automation equipment and to expand port facilities.

Table 5 World's Top 20 Container Ports' Volumes ('000 TEU)

('000 TEUs)

Rank 2016	Port	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	Shanghai	21710	26150	27980	25005	29069	31700	35529	33617	53290	36540	37135	40233
2	Singapore	24792	27936	29918	25866	28431	29937	31649	32579	33869	30922	30930	33667
3	Shenzhen	18469	21099	21414	18250	22510	22570	22940	23279	24040	24200	23980	25250
4	Ningbo	7068	9360	11226	10503	13144	14686	15670	17351	19450	20630	21565	24640
5	Hong Kong	22539	23998	24248	21040	23699	24384	23117	22352	22200	20100	19580	20755
6	Busan	12039	13261	13425	11955	14194	16184	17064	17686	18683	19467	19378	20473
7	Guangzhou	6600	9200	11001	11190	12550	14400	14744	15309	16610	17590	18859	20100
8	Qingdao	7702	9462	10320	10260	12012	13020	14503	15520	16580	17430	18050	18300
9	Dubai	8923	10653	11827	11124	11600	13000	13270	13641	15200	15590	14772	15370
10	Tianjin	5950	7103	8500	8700	10080	11500	12300	13000	14060	14110	14523	15040
11	Port Kelang	6326	7119	7970	7310	8872	9604	10001	10350	10946	11887	13167	11980
12	Rotterdam	9655	10791	10800	9743	11146	11877	11866	11621	12298	12235	12385	13730
13	Kaohsiung	9775	10257	9677	8581	9181	9636	9781	9938	10593	10264	10460	10270
14	Antwerp	10019	8176	7670	7310	8468	8664	8635	8578	8978	9654	10037	10450
15	Xiamen	4018	4627	5034	4680	5820	6461	7202	8008	8572	9180	9614	10400
16	Dalian	3212	4642	4503	4552	5242	6400	8064	10015	10130	9450	9584	9700
17	Hamburg	8862	9900	9700	7008	7900	9014	8864	9257	9720	8821	8900	8860
18	Los Angeles	8470	8355	7850	6749	7832	7941	8078	7868	8340	8160	8857	
19	Tanjung Pelepas	4770	5500	5600	6016	6530	7500	7700	7628	8500	9130	8029	8380
20	Long Beach	7290	7312	6488	5068	6263	6061	6046	6648	6818	7190	6775	

Source : Author's own using UNCTAD data
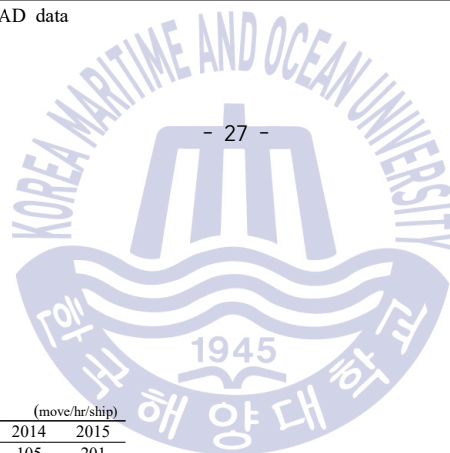
Table 6 Major Ports' Productivity

(move/hr/ship)

Port	Country	2012	2013	2014	2015
Yokohama	Japan	85	108	105	201
Jebel ali	United Arab Emirates	81	119	138	156
Qingdao	China	96	126	125	150
Tianjin	China	86	130	125	150
Khor al Fakkan	United Arab Emirates	74	119	108	137
Yantian	China	78	106	117	133
Ningbo	China	88	120	107	124
Busan	Republic of Korea	80	105	102	118
Bremerhaven	Germany	N/A	N/A	N/A	116
Nansha	China	73	104	119	N/A
Xiamen	China	76	106	90	114

Source : Author's own using JOC Port Productivity data

Global rearrangement was a burden to port industry as well. To become one of the diminished calling ports of larger shipping companies or vessels, many ports introduced incentives. Liner shipping alliances added a burden as well. By expanding coverage through strategic alliances, global liner shipping companies afford to introduce direct services. Ports which mainly handle transshipment cargos were affected directly. These ports needed to improve productivity and reduce prices to sustain their market share. It served as a major cause for the increase in inter-port competition as described in chapter 2.

3.3 Container Terminals in Busan Port

Busan port was once the world's third largest port, but is now ranked sixth. Due to the rapid growth of Chinese ports represented by port of Shanghai, Shenzhen, and Ningbo, many trunk liner shipping services have begun directly calling at Chinese ports. Busan container port, which started with the opening of Jaseongdae terminal in 1978, has grown to a surprising scale. Since BPT launched in November 2016, as a result of the merger between KBCT and BIT, eight operators at nine terminals are currently on operation in Busan Port(table 9).

Even if the dramatic growth, terminal operators seem to be in trouble. According to table 7, the decline in rates is very serious. The port has seen its tariff halved over the past decade as competition in the port has intensified, while the company's negotiating power has increased. Due to the low-tariff competition, some terminal operators had to bear losses rather than make profit. Comparing major ports' tariff in 2012 from table 8, it is easy to notice that Busan Port charged very low rates. The problem is even more serious considering the introduction of incentives to maintain market share.

Table 7 Busan Port Stevedoring Tariff Trend

(2000=1.00)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tariff	1.00	0.94	0.88	0.81	0.75	0.69	0.63	0.56	0.55	0.55	0.51	0.49	0.49

Source : KMI(2012)

Table 8 Major Ports' Stevedoring Tariff in 2012

(Won / TEU)

	North	New	Gaohsiung	Singapore	Shanghai	Hong Kong	Rotterdam	Tokyo	Takoma	LA
Tariff	45,135	57,962	73,743	73,850	115,054	140,730	150,325	194,407	368,713	380,058

Source : KMI(2012)

Table 9 Busan Container Terminal Operation Status (2017.7.)

			Terminal Operator	Pier Length (m)	Water Depth (m)	Annual handling capacity	Simultaneous berthing capacity	Unloading device
North	Jaseongdae	1978.9	HKT	1,447	15	1700	50,000 / 4 10,000 / 1	C/C 14 T/C 33
	Sinseondae	1991.6	CJ KBCT BPT	1,500	15-16	2000	50,000 / 5	C/C 15 T/C 42
	Gamman	1998.4	BIT	1,400	15	1560	50,000 / 4	C/C 13 T/C 30
	Singamman	2002.4	DPCT	826	15	780	50,000 / 2 5,000 / 1	C/C 7 T/C 19
	Uam	1996.9	-	500	11	300	20,000 / 1 5,000 / 2	C/C 5 T/C 13
New	Phase 1-1	2010.3	PNIT	1,200	16	2420	50,000 / 3	C/C 11 T/C 30
	Phase 1-2	2006.1	PNC	2,000	16-17	3677	50,000 / 6	C/C 19 T/C 61
	Phase 2-1	2009.2	HJNC	1,100	18	2310	50,000 / 2 20,000 / 2	C/C 12 T/C 42
	Phase 2-2	2010.2	HPNT	1,150	16-17	1938	50,000 / 2 20,000 / 2	C/C 12 T/C 38
	Phase 2-3	2012.1	BNCT	1,400	17	2440	50,000 / 4	C/C 11 T/C 38

* HKT(Jaseongdae Container Terminal), CJ KBCT(CJ Korea Express Busan Container Terminal Co., Ltd.), BIT(Busan International Terminal Co., Ltd.), BPT(Busan Port Terminal), DPCT(ingamman Container Termina), *UTC(Uam Container Terminal),* PNIT(Pusan Newport International Terminal), PNC(Pusan New Port Company), HJNC(Hanjin New Port Company Terminal), HPNT(Hyundai Pusan New-port Terminal), BNCT(Busan Newport Container Terminal Co. Ltd)

Source : Author's own using BPA data

A number of factors can be underlying causes of the current situation. Firstly, it would have been difficult to maintain cooperative strategies among terminal operators as inter-port and intra-port competition intensified. Secondly, the problem of supply and demand imbalance would have maximized instability. And thirdly, due to the characteristic of the demand, the buyer's negotiation power might be relatively strong. Taking a look at each factor helps to assume that wether the current problem in Busan port is caused by market structural factors or not.

3.3.1 Inter-port Competition Among Asian Ports

In many cases, Asian ports can be substituted for each other. For that reason, they compete against each other. However, Busan port has lost the competitive position among East Asian ports. As table 10 suggests, the results of shift-effect among twelve Northeast Asian ports revealed that the traffic of Busan port had moved to Chinese ports during 1986-2006(Kim and Kwak, 2008). In particular, 6 million TEUs were moved to rival ports between 2002 and 2006, meaning Busan port's competitive position had weakened.

Another research that considered twenty one ports in East Asian region found that Busan port had lost the competitive position during 2003-2012(Lee and Kwon, 2014). The shift-effect of 2012-2016 on twelve ports in Northeast Asia, which ranked within top twenty ports in 2016, showed Busan port recovered some of its traffic but not so much. It is noteworthy that Hong Kong port, the conventional global port, and Shanghai port, Shenzhen port, which showed high growth in early 2000s, seemed to lost their competitive positions.

Table 10 Shift-effect among Northeast Asian Ports ('000 TEU)

PORT	1986-1990	1990-1994	1994-1998	1998-2002	2002-2006
Shanghai	88,752	498,127	1,446,526	2,931,904	5,378,584
Qingdao	62,223	242,353	597,830	1,161,726	1,231,925
Tianjin	40,755	203,697	158,228	524,709	1,378,721
Dalian	79,827	123,117	38,051	471,732	648,290
Ningbo	-	-	353,000	1,206,260	3,531,959
Busan	**220,334**	**-41,590**	**1,342,057**	**-1,557,658**	**-5,892,232**
Gwangyang	-	-	68,000	1,000,067	-384,185
Tokyo	-34,912	-349,520	-418,511	-1,303,698	-1,479,772
Yokohama	-277,863	33,659	-1,228,879	-1,508,701	-1,285,005
Goya	200,581	-19,612	-296,463	-773,048	-903,912
Kobe	-170,979	-681,279	-2,277,544	-1,527,132	-1,582,998
Osaka	-208,718	-8,953	217,703	-626,162	-641,375

Source : Kim and Kwak(2008)

Table 11 Shift-effect among East Asian Ports ('000 TEU)

2003-2006		2006-2009		2009-2012	
PORT	SHIFT	PORT	SHIFT	PORT	SHIFT
Kaohsiung	6,497.46	Guangzhou	3,384.29	Dalian	2,361.07
Shanghai	3,082.87	Ningbo	3,052.41	Ningbo	1,620.68
Ningbo	2,526.39	Shanghai	935.05	Guangzhou	1,001.38
Guangzhou	2,078.37	Dalian	-224.83	**Busan**	**933.43**
Dalian	1,281.12	**Busan**	**-1,499.69**	Shanghai	-774.43
Busan	**-4,946.57**	Kaohsiung	-2,998.13	Kaohsiung	-1,222.14
Hong Kong	-9,964.60	Hong Kong	-6,088.31	Hong Kong	-4,702.47

Source : Lee and Kwon(2014)

The above results suggest that Busan has lost its competitive position since the late 1990s. This is assumed to be due to the weakened function of Busan port as

a hub port, as direct service increased along with the growth of the Chinese economy. A large amount of traffic, which once transported through Busan port, no longer pass through Busan port. Since 1990s, Busan port and Chinese ports seemed to have a complementary relationship. However, after 2000s, as the demand for direct services not passing through Busan port increases, it seems that the relationship has turned into a substitute relationship.

The similar change is also observed among Chinese ports recently. As a result of the analysis of the shift-effects after 2012 on Northeast Asian ports, which ranked within the world top 20 ports in 2016, Busan port has restored some of its traffic(table 12). However, Hong Kong port and Shanghai port had lost the largest amount of traffic during 2012-2016. The growth of another Chinese ports, such as Ningbo-Zhoushan port, Guangzhou port and Qingdao port has intensified inter-port competition in Northeast Asia.

Table 12 Shift-effect among Busan Port and Chinese Ports ('000 TEU)

PORT	2012	2013	2014	2015	2016	2012-2016
Shanghai	35,529	33,617	53,290	36,537	37,135	-2,522
Shenzhen	22,940	23,279	24,040	24,204	23,980	-1,625
Ningbo	15,670	17,351	19,450	20,593	21,565	4,074
Hong Kong	23,117	22,352	22,200	20,114	19,580	-6,223
Busan	**17,064**	**17,686**	**18,683**	**19,296**	**19,378**	**331**
Guangzhou	14,744	15,309	16,610	17,457	18,859	2,402
Qingdao	14,503	15,520	16,580	17,465	18,050	1,862
Kaohsiung	9,781	9,938	10,593	10,264	10,460	-457
Xiamen	7,202	8,008	8,572	9,179	9,614	1,575
Dalian	8,064	10,015	10,130	9,449	9,584	583

Source : Author's own using UNCTAD data

3.3.2 Increasing Intra-port competition

Busan port container terminal operators are competing unfavorably in the oligopoly market of homogeneous products. Under these circumstances, when the economy is stagnant or a new market entrant appears, price wars appear to be repeated and continually lowering prices to maintain market share.

Along with the opening of Busan New port, intra-port competition has strengthened. Compared to other Asian ports, more number of terminals that are smaller in size are competing in Busan port. In particular, most of the operators recorded operational losses as the competition between the North port and the New port became fierce. The physical conditions are favorable to Busan New Port. Container terminals in Busan New Port generally equip more berths with more unloading devices and are deeper in depth. Simultaneous berthing capacity is also much larger than Busan North Port. Comprehensively, Busan New Port is more adoptable to handle mega-ships. In addition, highly automated facilities and systems encourage efficient traffic and document flows.

The market competition index presented by Ha, Choi, and Kim(2013) shows the degree of competition. The competition index is calculated by dividing the total trade volume by the number of operators multiplied by the length of the quay wall. It is an index reflecting the number and size of operators. An increase in competition as of 2002 indicates a easing of competition, and a decrease indicates an escalation of competition. The index has fallen sharply in 2009, and since then it remained below 100 until 2016. The index also showed the competition during 2009-2013 was particularly fierce.

Table 13 Competition Index

Year	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
C.I.	100	110	122	125	95	131	112	76	81	83	70	73	94	98	98	116

Source : Author's own by the method of Ha. et. al(2013) using BPA data

3.3.3 Balance of Demand and Supply

The table 14 shows the balance of supply and demand measured by dividing the total container throughput into the total capacity of container terminal operators. A 100 refers to the equilibrium state in which the ability and the performance are exactly the same. A value above 100 means a relative shortage of supply, and conversely, a value below 100 means a relative excess of supply. The status of supply and demand in Busan port is generally above 100, indicating that supply is relatively in short. This implies that there is a doubt whether the current managerial difficulties of operators are caused by oversupply.

Table 14 Demand and Supply Balance

Year	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Total	135	106	107	101	99	101	138	101	94	113	105	110	116	116	101	107
North	135	106	107	106	188	133	161	136	116	124	112	99	103	103	97	112
New					26	24	66	55	73	103	100	119	125	125	103	105

Source : Author's own using BPA data

Busan port container throughput recorded steady growth, exceeding 20 million TEUs in 2017. By dividing the ports, trends in the opposite direction reveal. While shipments from the North port have declined, those from the New port have increased dramatically(Figure 10). Some of the Busan North Port's traffic seems to have been taken away to Busan New port. Overall, Busan port seems to be in a favorable growth trend, but there is a fierce competition in detail. This raises the need to look more closely at the competition among operators.
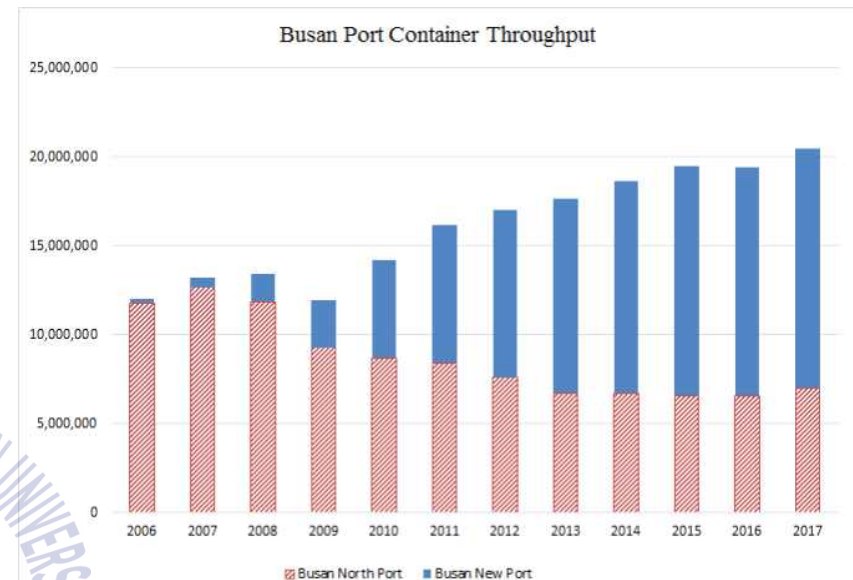
Source : Author's drawing using BPA data

Figure 10 Busan Port Container Throughput

Until 2011, the growth of import and export volume and transshipment volume seemed coupled. However, after 2011, transshipment volume maintains a high growth rate while the growth of import and export volume recorded modest growth. The recent growth can be attributed to the increase in the number of trans-shipment. As transshipment cargoes exceed 50%, Busan Port has also been established as a global hub port. However, Busan port became more vulnerable to market share volatility due to increasing transshipment.

Busan Port Container Throughput
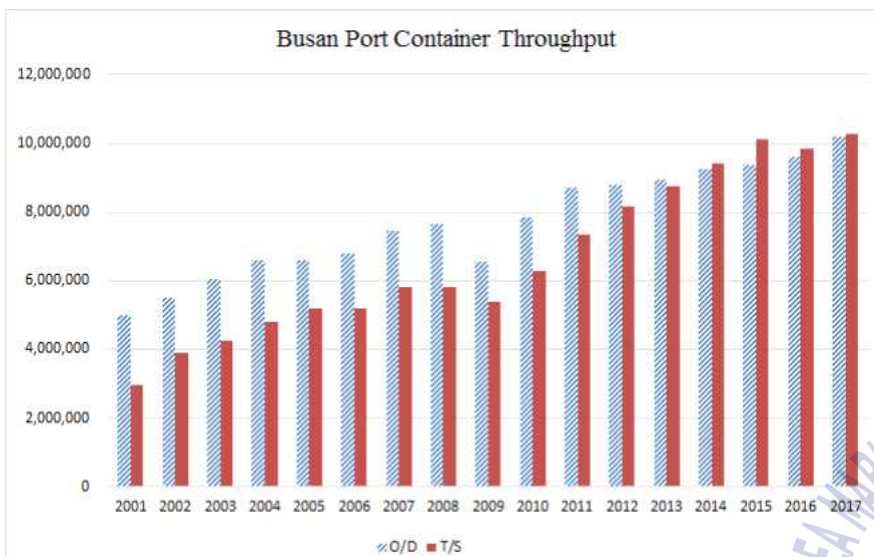
Source : Author's own using BPA data

Figure 11 Busan Port Container Throughput by Cargo Types

3.3.4 Characteristics of the buyer group

If the buyers possess strong market power, they can affects the price and they are the market dominant players. As of Monopoly Regulations and Fair Trade Law, the market dominant player refers to the firm that sells(or buys) more than 50% of total market volume or the three firms that sells(or buys) more than 75% of total market volume. According to table 15, There seems to be no market dominant buyer. The buyer concentration has steadily risen, but still remain at unconcentrated level. However, looking into concentration ratio of 3 largest firms(CR3), there is an important characteristic. The CR3 of foreign shipping companies showed a steep increase while that of national shipping companies maintained a similar level. During the analyse period, it can be inferred that some foreign shipping companies have become major customers of Busan Port. If the strategic alliance group is

regarded as a single company, the share of the top three shipping companies(2M+HMM, OCEAN, THE) reached 58.1% in 2017. It is expected to increase gradually due to the growth of mega shipping companies.

Table 15 Concentration Ratio of Shipping Companies(%)

Year	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
CR3	23.8	23.2	22.4	21.3	21.8	21.8	21.3	23.8	22.9	23.7	26.5	27.7	27.9	27.4	26.5	28.8
CR3 (N)	18.9	23.0	22.4	21.0	21.7	19.5	20.5	22.2	21.9	21.2	23.0	24.7	23.6	21.8	19.8	21.8
CR3 (F)	17.9	15.1	12.8	13.7	14.2	17.8	17.1	19.3	17.7	20.0	21.4	21.9	23.2	24.0	24.4	25.9

Source : Author's own using BPA data

There is a huge gap in volume between the shipping companies. As of 2017, 91 shipping companies called at Busan port, and 20 of which accounted for about 90% of the traffic. Only 11 companies out of 91 handled more than 500,000 TEU. 40 companies of 91 companies handled less than 10,000 TEU per year. Busan port container terminal users are composed of small number of large shipping companies and many small and medium shipping companies. This unbalanced structure enhances the attractiveness of a few large shipping companies.

Considering those characteristics, there is a possibility that the market concentration on the buyer's side may have affected the market performance.

Chapter 4. Empirical Analysis

4.1 Research Design

This study aims to determine the relationship between the market structure and the market performance in Busan container port. For this purpose, the market structure and the market performance in container port are measured. In this study, market structure is divided into seller side and buyer side and market performance variables includes both economic and managerial aspects.

After examining the market structure and the market performance, empirical analysis will be used to define the relationship between the market structure and market performance follows. Firstly, the trend of the market structure and the market performance will be compared. Then, regression analysis will follow to support or reject the comparison results. Figure 12 demonstrates the research process of this study.
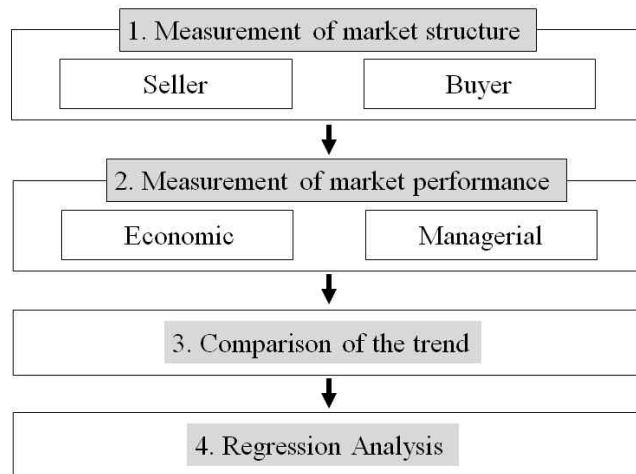
Figure 12 Research Process

4.1.1 Market Structure

One of the most common methods of defining market structure is by measuring the number and size distribution of sellers and buyers. While most studies are focused on market structure only for sellers, this study considers both aspects of the market. Market is defined as a place where container terminal operating companies(CTOC) sell services to shipping companies(SC). In other words, CTOC and SC represent the seller and buyer. Then, market structure is defined as the number and size distribution of CTOC and SC.

Market structure in this respect is a major factor in determining market power. Market power is the ability of firm to determine, maintain, or change the price, quantity, quality, or other conditions of goods and services[14]. Enhancement of seller's market power called "monopolistic power" potentially leads to consequences such as price rise, quality deterioration, and diminishing innovation. On the contrary, enhancement of buyer's market power, so called "monopsony power", may potentially leads to the inverse consequences. The relative market power depending on the market structure is expected to affect the price, profit and other marker performances.

4.1.2 Market Performance

Market performance variables were selected by taking into account the presence and availability of statistical data as well as representativeness. In this study, four variables are selected to reflect the market performance in terms of price, cost and profit rate. The four variables are sales per unit, cost per unit, operating margin ratio and price-cost margin.

The sales per unit(TEU) is suggested as a proxy of price. Price is a fundamental result derived from the interaction between supply and demand. In the port

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14) Ministry of Government Legislation, Monopoly Regulations and Fair Trade Law, 1.1

industry, price refers to "tariff." Real tariff is hard to obtain because it is negotiable and confidential. However, an estimation can be inferred from 3 data sets; rariff published and released by the Ministry of Ocean and Fishery, reported tariff from each terminal operator, and calculated tariff(sales per unit) by author. Released tariff and reported tariff do not reflect actual tariff because actual tariff are subject to change through negotiation and terminal operators refrain from uncovering it. This study assumes calculated tariff, sales per TEU, possibly reflect actual trend in contrast with prior two data. Given that calculations are done by using actual data and most of sales are from stevedoring services, it is acceptable to use "sales per unit" as a proxy variable of price.

In terms of industrial organization, in addition to being able to set a high price, another important variable of market power is whether to reduce costs or not. Container terminals are relatively high in fixed costs. There is a difference in cost between filling the same volume with several smaller vessels and a single mega vessel. Therefore, it is necessary to examine the impact of changes in the relative market power on the cost.

Operating Margin ratio, also known as operating profit margin, measures the profitability that is associated with all operational activities and excludes non-operational activities such as financing, accounting and tax. The Financial Supervisory Service (FSS) considers operating profit rate, net profit rate, return on equity and return on assets and so on as an index of profitability. Considering the instability of equity and asset at the time of new entrance, operating profit ratio was selected as the most appropriate indicator.

Price-cost margin was also selected as a profitability variable. Many studies on the relationship between market performance and market structure uses price-cost margin to define the profitability. As Bain(1968) mentioned, price-cost margin is a reasonable variable to explain profitability because it is affected by both price and cost.

4.2 Methodology and Data

4.2.1 Market Structure Data

In order to measure the market structure, the concentration degree was calculated which is the most widely used method to define the market. There are two popular ways to measure the degree of concentration; concentration ratio of largest k-firms(CRk), Herfindahl-Hirschman Index(HHI). In this study, the HHI is employed to examine the market structure. Compared to the CRk, the HHI has the advantage of taking into account all participants in the market and weighting them according to their influence. The HHI is the sum of the squares of the market share of each market participant, meaning that the market concentration is greater when the result is a larger value.

Even if the same number of firms exist in different markets, the bigger the difference of market share among companies, the bigger HHI becomes. *The HHI ranges from 10,000 in monopoly to a number approaching zero in an atomistic market*. The normalized HHI also used as much as the HHI. Table 16 describes how to calculate the HHI in two ways. Several differences could be observed between two ways of calculating HHI. Market 1 is a monopoly with HHI equals to 1. There are four market participants in Market 2 and 3 respectively while one firm in market 3 dominates more than a half of the market share. Comparing the two markets, the HHI of market 3 is higher than that of market 2 as a result of the larger difference in market share among market participants.
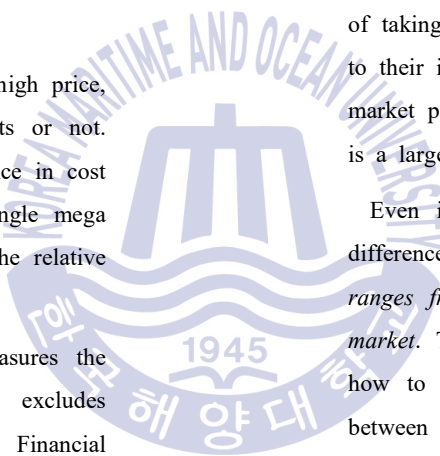
Table 16 Example of Herfindahl-Hirschman Index

Market	Market Share (%)				HHI
	a	b	c	d	
1	100	-	-	-	$10,000 = 100^2$
2	25	25	25	25	$2,500 = 25^2 + 25^2 + 25^2 + 25^2$
3	25	10	10	55	$3,800 = 25^2 + 10^2 + 10^2 + 55^2$

Market	Market Share				Normalized HHI
	a	b	c	d	
1	1	-	-	-	$1 = 1^2$
2	0.25	0.25	0.25	0.25	$0.25 = 0.25^2 + 0.25^2 + 0.25^2 + 0.25^2$
3	0.25	0.10	0.10	0.55	$0.38 = 0.25^2 + 0.10^2 + 0.10^2 + 0.55^2$

The U.S. Horizontal Merger Guideline classified market into three types based on HHI; Highly concentrated markets, Moderately concentrated markets, and Unconcentrated markets. The criteria for dividing the market has changed after an amendment in 2010. Korea's Monopoly Regulations and Fair Trade Law applies similar standards to determine the market concentration, but it does not clearly name the types. Both provisions chare the assumption that high or increasing concentration may potentially raise market power, indicating a need for further investigation and caution. A comparison of the HHI criteria is shown in Table 17.

Table 17 Market Classification based on HHI

Market	U.S. (Before 2010)	U.S. (After 2010)	Korea
Highly Concentrated	HHI > 0.1800	HHI > 0.2500	HHI > 0.2500
Moderately Concentrated	0.1000 < HHI < 0.1800	0.1500 < HHI < 0.2500	0.1200 < HHI < 0.2500
Unconcentrated	HHI < 0.1000	HHI < 0.1500	HHI < 0.1200

Source : The United States Department of Justice, 1982, 『1982 Horizontal Merger Guidelines』,
The United States Department of Justice, 2010, 『2010 Horizontal Merger Guidelines』,
Ministry of Government Legislation, 『Monopoly Regulations and Fair Trade Law』

HHI calculation is generally based on the sales data. However, this study measured two market structure variables based on the volume data as many prior studies have done before(Jwa, 2009; Lam et al., 2007). In short, the market structure variables can be defined as two following equations.

$$CTOC-HHI = \sum_{i}^{n} MS_i \qquad (1)$$

$$SC-HHI = \sum_{j}^{n} MS_j \qquad (2)$$

All data in calculation of HHI is provided by Busan Port Authority(BPA), and Korea Maritime Institute(KMI). Table 18 shows market structure from 2006 to 2017. Seller HHI has steadily decreased until 2013 and started increasing again during period of 2014-2017. Before the U.S. Horizontal Merger Guideline was revised in 2010, the seller concentration that was close to being a "highly concentrated" in 2006 have become more competitive, bringing it into the "moderately concentrated" parameter. As of the U.S. Horizontal Merger Guideline after revision in 2010, the degree of seller concentration has changed its classification from a "moderately concentrated" to a "unconcentrated" form 2008 onwards. Under Korea Monopoly Regulations and Fair Trade Law standards, the seller concentration is "moderately concentrated", except for in 2012 and 2013. In recent years, the HHI has generally ranged from 1100 to 1300, which appears to be at the boundary between "moderately concentrated" and "unconcentrated".

Table 18 Busan Container Port Market Structure

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CTOC	.1745	.1663	.1453	.1381	.1238	.1234	.1180	.1126	.1218	.1259	.1290	.1399
SC	.373	.390	.392	.435	.415	.430	.473	.503	.520	.532	.518	.561

Source : Author's own using BPA data

The seller HHI is increasingly declining due to the increasing number of operators. This trend puts a great deal of pressure on the seller and likely to lead to excessive competition. Therefore, it implies the need for measures to prevent distortion of the market order due to excessive competition.

In contrast, the degree of buyer concentration has steadily increased. Even though buyer HHI is still classified as "unconcentrated", the increasing trend is noteworthy. This is a result of the rapid expansion of the size of the top companies, and the degree of imbalance has intensified.

4.2.2 Market Performance Data

As a limitation of data collection, nine terminals currently in operation were selected. Among nine CTOC, four are located in Busan North Port and the other five are located in Busan New Port. All financial data in this study were collected from the Financial Supervisory Service(FSS).

The marker performance variables measured are shown in table 19-22. The two variables(S/U, C/U) were indexed with an average value equal to 1.00. The trend of sales per unit is shown in Table 20. The price index is above 1.00 from 2006 to 2010 and falls below 1.00 from 2011 onwards. In recent years, the index shows little change. With the exception from 2008-2010, costs per unit tends to fall during the overall period. Operating margin ratio(OMR) has changed dramatically. In first five years, it has fallen to a negative level, while increasing again in the last recent five year to exceed the previous level of 2006. The price-cost margin seems to remain high level from 2006 to 2008 and from 2014 to 2017.

Table 19 Busan Port Sales per Unit Trend

(Average=1.00)

Year	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
S/U	1.11	1.09	1.10	1.09	1.00	0.95	0.91	0.90	0.95	0.95	0.98	0.96

Source : Author's own using FSS data

Table 20 Busan Port Costs per Unit Trend

(Average=1.00)

Year	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
C/U	1.03	1.01	1.19	1.18	1.12	0.96	1.01	0.96	0.82	0.90	0.85	0.87

Source : Author's own using FSS data

Table 21 Busan Port Operating Margin Ratio Trend

Year	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
OMR	0.16	0.15	0.09	-0.01	-0.02	0.06	0.00	0.04	0.12	0.14	0.18	0.18

Source : Author's own using FSS data

Table 22 Busan Port Price-Cost Margin Trend

Year	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
PCM	0.17	0.16	0.12	0.09	0.05	0.12	0.05	0.09	0.17	0.19	0.26	0.22

Source : Author's own using FSS data

4.2.3 Regression Analysis

Regression analysis is one of the most widely used method to examine the relationship between an independent and dependent variable. Through regression analysis, the influence of the independent variable on the dependent variable can be measured. If two or more independent variables are considered, multiple regression analysis are used. In this study, multiple regression analysis is employed to define the relationship between two independent variables and dependent variable.

Multiple regression analysis should consider the problem of multicollinearity. Distortion in data may result when two highly related variables are simultaneously taken into consideration. To check the multicollinearity, tolerance and the variance inflation factor(VIF) must be investigated. Generally, a model with a tolerance of over 0.1 and VIF level under 10 is accepted.

Generally, the result of multiple regression can be described as a linear equation as follows.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_i + e \qquad (3)$$

where Y = Dependent variable

   β_0 = Regression constant

   β_i = Regression coefficient of x_i

   x_i = Explanatory variable

   e = Residual

Each equation explains the effect of explanatory variables on one dependent variable. Then, in this study, four equations will be derived to describe four dependent variables.

4.3 Results of Trend Analysis

Figure 13 to 16 show trends in the market structure and market performance of ports. Sales per unit is very similar to the concentration of the seller concentration and shows a tendency to be opposite to that of the buyer concentration. It can be assumed that the sales per unit are highly correlated with the degree of the sellers concentration.

Figure 13 Trend of Sales per Unit

The seller concentration and costs per unit do not show distinct trends. On the other hand, the buyer concentration tends seems to be opposite to unit costs. Since 2010, unit costs has fallen sharply. This is possibly due to improvement in efficiency of operating.
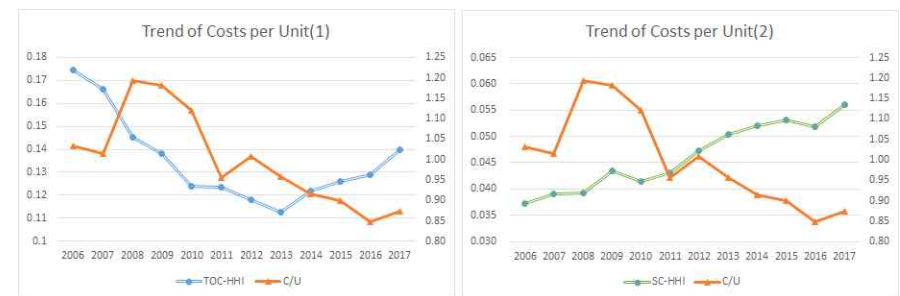

Figure 14 Trend of Costs per Unit

Operating margin ratio and price-cost margin have a similar trend. Both variables show very similar trends to the seller concentration. There is a similar tendency to the buyer concentration after 2008, but it is not as significant as the seller concentration.

Figure 15 Trend of Operating Margin Ratio

Figure 16 Trend of Price Cost Margin

4.4 Results of Regression Analysis

Multiple regression analysis were performed to find the effects of market structure on market performance. Even though the sample size is small, it is still needed to determine the approximate relationship between the two factors. Annual performance data was set as a dependent variable while concentration degree of sellers and buyers was set as independent variables.

Firstly, the relationship between market structure and sales per unit was analyzed. The F-test result, summarized in table 23, indicates that the model is significant at the level of 1%. The value of R-squared is 0.790, meaning the independent variables explain 79.0% of dependent variable. The regression analysis result reveals a positively(+) significant relationship between the seller concentration and sales per unit at the significant level of 0.1%. Even if there is no significant relationship between the buyer concentration and sales per unit, the negative sign which is accordance with the prediction came out. In short, price tend to rise as the concentration of the sellers increases, while fall as the concentration of the buyer concentration increases. But only the seller concentration appears to have had a significant effect on price. It is assumed that the structural changes of the degree of seller concentration have been more rapid compared to the structural changes of the buyer concentration.

Table 23 Analysis Results for Sales per Unit

Analysis of F-test					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	.056	2	.028	21.676	.000
Residual	.012	9	.001		
Total	.067	11			
Regression Statistics					
	R	R-square	Adjusted R-square	Std. Error of the Estimate	
model	.910	.828	.790	0.358827	

Multiple Regression Analysis						
	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics
	B	Std. error	Beta			Tolerance VIF
(constant)	.859	.172		4.982	.001	
CTOC-HHI	2.607	.705	.637	3.696	.005	.643 1.555
SC-HHI	-4.563	2.110	-.373	-2.163	.059	.643 1.555

* Predictors : (Constant), CTOC-HHI, SC-HHI
  Dependent Variable : S/U

$$Y_{SU} = 0.859 + 2.607x_{CTOC} - 4.563x_{SC}$$

Secondly, the relationship between market structure and costs per unit was analyzed as table 24 shows. The model is significant at the level of 5%. The market structure variables explain 53.6% of costs per unit. The regression analysis result reveals a significantly negative(-) relationship between the buyer concentration and price at the significant level of 1%. In contrast, seller concentration turned to be not significantly affect the unit costs. From the perspective of the operators, the sales costs is a fixed cost(KMI, 2013). It is advantageous for terminal operators to handle a larger vessel than to handle multiple small vessels for the same amount of traffic or time. This is because it can reduce the time and congestion required to enter and leave the ship. Therefore, the higher the concentration of shipping companies, the greater the possibility that the average shipments of vessels will increase and the costs per unit can be reduced.

Table 24 Analysis Results for Cost per Unit

Analysis of F-test					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	.091	2	.045	7.362	.013
Residual	.056	9	.006		
Total	.146	11			

Regression Statistics				
	R	R-square	Adjusted R-square	Std. Error of the Estimate
model	.788	.621	.536	.0785494

Multiple Regression Analysis						
	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics
	B	Std. error	Beta			Tolerance VIF
(constant)	1.994	.377		5.282	.001	
CTOC-HHI	-1.674	1.544	-.278	-1.084	.306	.643 1.555
SC-HHI	-16.626	4.619	-.922	-3.600	.006	.643 1.555

* Predictors : (Constant), CTOC-HHI, SC-HHI
  Dependent Variable : C/U

$$Y_{CU} = 1.994 - 1.674x_{CTOC} - 16.626x_{SC}$$

Thirdly, the relationship between market structure and operating margin ratio was analyzed. The results are shown in table 25. The model is significant at the level of 1%. The market structure variables explain 66.8% of operating margin ratio. The

regression analysis result indicates that both market structures have significantly positive(+) relationship with operating margin ratio at the significant level of 1%. There are two dominant arguments as to why a higher level of market concentration, have a higher profit margin. One is that higher price can be set based on high market dominance, and the other is that cost reducing efficiencies can be improved through economies of scale, experience effects and so on. To improve operating margin ratio, sales should increase or costs should be reduced. Based on the previous two results, it can be inferred that rent seeking is possible due to the high seller concentration while cost reduction is possible due to the high buyer concentration. Only then would it finally improve operating margin ratio.

Table 25 Analysis Results for Operating Margin Ratio

Analysis of F-test					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	.044	2	.022	12.053	.003
Residual	.017	9	.002		
Total	.061	11			

Regression Statistics				
	R	R-square	Adjusted R-square	Std. Error of the Estimate
model	.853	.728	.668	.0428496

Multiple Regression Analysis							
	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(constant)	-.909	.206		-4.413	.002		
CTOC-HHI	3.915	.842	1.007	4.647	.001	.643	1.555
SC-HHI	10.197	2.520	.877	4.047	.003	.643	1.555

* Predictors : (Constant), CTOC-HHI, SC-HHI
Dependent Variable : OMR

$$Y_{OMR} = -0.909 + 3.915x_{CTOC} + 1.0197x_{SC}$$

Lastly, the relationship between market structure and price-cost margin is suggested in table 26. The model is significant at the level of 1%. The market structure variables explain 62.5% of price-cost margin. The regression analysis result shows significantly positive(+) relationship between both market structures and price-cost margin at the significant level of 1%. To improve price-cost margin, sales should be increase or cost should be reduced. For the same reason as the relationship between market structure and operating profit ratio, price margin also appears to be a positive relationship between the two markets.

Table 26 Analysis Results for Price-Cost Margin

Analysis of F-test					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	.032	2	.016	10.165	.005
Residual	.014	9	.002		
Total	.046	11			

Regression Statistics				
	R	R-square	Adjusted R-square	Std. Error of the Estimate
model	.833	.693	.625	.0395525

Multiple Regression Analysis							
	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. error	Beta			Tolerance	VIF
(constant)	-.711	.190		-3.742	.005		
CTOC-HHI	2.969	.778	.879	3.818	.004	.643	1.555
SC-HHI	9.778	2.326	.968	4.204	.002	.643	1.555

* Predictors : (Constant), CTOC-HHI, SC-HHI
Dependent Variable : PCM

$Y_{PCM} = -0.711 + 2.969x_{CTOC} + 9.778x_{SC}$

Chapter 5. Conclusions

5.1 Summary

This study measures the market structure and the market performance to verify the relationship between them. As of market structure, the HHI of both sellers and buyers are calculated. The results indicate that the degree of seller concentration had been decreased meaning that they lost monopolistic power while the degree of buyer concentration had increased but still remain competitive. The CTOC-HHI which recorded about 0.1800 at 2006 fallen below 0.1200 during 2011-2013. The SC-HHI had increased about 0.0200 point from 2006 to 2017. However, it still remains under 0.1200 meaning that the buyers are unconcentrated. As of market performance, sales per unit, costs per unit, operating margin ration and price-cost margin are calculated.

By comparing the trend of the market structure and the market performance, we can infer the relation between them. The sales per unit and the market structure seems to have a strong relationship. However, in detail, it shows the opposite relationship with the buyer concentration and seller concentration. The seller concentration shows a very similar trend with the trend of sales per unit and the regression results also support that there is a significantly positive(+) relationship between them. In contrast, the buyer concentration shows an opposite trend with the trend of sales per unit. Even if the regression results revealed that there is no statistically significant relationship between them at the significant level of 5%, we expect to have a significant relationship when inputting more samples.

As of costs per unit, the results reveals the negative(-) relationship with the buyer concentration. This result implies that it is possible to reduce the cost when a mega-shipping company call at a terminal. It is assumed that the reduced the arrival and departure time and process per gross traffic saves the cost.

As of operating margin ratio, and price-cost margin, the both market structure variables turned out to be positively(+) affect the market performance variables. To improve operating margin ration or price-cost margin, a firm need to set the higher price or save the cost. Given that the prior result on the two market performance variables, it is verified that a higher seller concentration tends to bring a higher price and a higher buyer concentration tends to bring a lower cost. That is why such results came out.

In short the seller side market structure turned out to be significantly affected the market performance including sales per unit, operating margin ratio, and price-cost margin. And the buyer side market structure turned out to be significantly affected costs per unit, operating margin ratio, and price-cost margin Taken together, the results in this paper indicate that the market structure affects the market performance in port sector.

5.2 Implications

The academic contribution of this study is to be an empirical evidence of the debating thesis; does market structure affect market performance? The effect of market structure on market performance is generally accepted, but still in debate. For now, some empirical and theoretical studies have suggested reasonable evidence. However, this study is the first attempt to demonstrate the effect of the buyer concentration in port sector. This study also suggests the controversial idea that market power balance affects market performance.

The practical contribution is to give a guideline for port authority and terminal operators to develop market structure into more successful one. For example, if the sellers are in competition while the buyer become more concentrated, meaning bargaining power of buyers become much stronger, sellers should consider strategies

that can lower bargaining power of buyers. Another practical contribution is it can be used as a reference for political decision making by government. As pointed out in this study, the buyers are as important as sellers. With this in mind, policy makers can be wiser without weighing toward one side.

Another practical contribution is to be helpful for policy makers to understand the character of port industry. The port industry possesses the different character from other industries. This study found the different relationship from the prediction. Theoretically, the high seller concentration restrains the cost efficiency, so they show positive relationship. However, the result suggests the opposite sign even if it is not significant. It is due to the port industry has the different basic conditions. In the port industry, the economy of scale is appears clearly and it is more reasonable to fewer operators exist. Also, the high buyer concentration is known to lead to an innovation and lower costs. However, in the port industry, it is more adoptable that the buyer concentration helps improve cost efficiency rather than lead innovation. To lead innovation in port industry, a much bigger investment and much more time are needed. And, it is more acceptable that the high buyer concentration helps to take advantage of economy of scale.

In short, to analyze the market structure and its effects on the market performance helps to understand the port industry's characteristics. To understand the own characteristics of the market is the first step of making the effective and efficient strategies and policies.

5.3 Further Research

This study has a limitation on data. Sales per unit data was used as a proxy variable of price. Even if a proxy data reflects trends, it is hard to distinguish the detailed trend of each type of cargo such as full or empty, trans-shipment, 20 feet

or 40 feet, and special cargo. The period of data set also insufficient to statistical analysis. A more comprehensive study with long-period, actual data could be an extension of this study.

Representativeness as well as statistical limitations should be supplemented in further study. This study employed market concentration as a market structure variable and price as a market performance variable. However, market structure can not be explained by market concentration alone. Likewise, market performance can not be explained by price alone. Further research with more comprehensive factors including entrance barrier, innovation, and efficiency is needed.

It is unreasonable to conclude that market structure simply affects market performance. Marker behavior factors also might have had a great impacts on market performance. In this paper, however, market behavior factors were not employed for empirical analysis due to its difficulty to measure or express by certain indicators. Even if this study imply consider the relationship between market structure and market performance, market conduct is a very important and interesting subject. Further study on the process of market structure-market conduct-market performance is needed.

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