The positive externality of port calling
- A case study of Busan Container Port -

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ABSTRACT

This paper considers the problem of externality from additional port calling at New Port in Busan Container Port. This externality topic differs from the conventional literature on the externality of transportation, in that the latter focuses on environmental issues but the former deals with the problem of non-correspondence of cost-bearing subjects. Inter alia, this paper highlights that, owing to the big gap between the bargaining powers of involved economic agents (i.e. ocean-going companies and short-sea container shipping companies), the transaction cost would be too high to reach an agreement with mutual benefits and thus that the port authorities, especially Busan Port Authority among them, should implement the policy to subsidize the short-sea container shipping companies in order for the externality problem to be resolved. Furthermore, this paper shows the expected effects from the internalization of this externality.

Key words: externality, non-correspondence of cost-bearing subjects, short-sea container shipping

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1. Introduction[1]

In 2008, Busan Container Port[2] handled about 13,000,000 TEUs and thus was ranked as the 5th global container port. However, owing to the effects of the global financial crisis in 2008, the cumulative throughput of Busan Container Port through July, 2009 was about 6,630,000 TEUs, which meant that there was a 17% reduction, compared to the same period of last year. Therefore, there has been more probability that some problem would be brought out in the near future by the fact that some port equipment and infra-structure should be idle. Furthermore, external factors for more competition among North-East container ports are now accelerating. For example, China has been investing a huge amount of money in their container ports in order to handle their cargoes directly and not allow them to be handled in a Korean hub port. Also, Japan has changed its port development policy from a decentralized local investment strategy to the centrally-organized strategy of bringing up so-called "Super Hub Ports". Therefore, facing with this environmental change of port industry, Korea's port authorities should develop a responding strategy to enhance the competitiveness of its container ports. In this paper, the authors will suggest a plausible strategy which could induce more transshipment container cargo by using (or internalizing) a positive externality from a 'short-sea container shipping company' (in hereafter 'SSCS company') calling at New Port in Busan Container Port.

Relating the problem of externality, there are two classic and seminal papers : Pigou (1920) and Coase (1960). As will be mentioned in section 4, the former advocated a famous measure for negative externality, called 'Pigovian tax' ; the latter is related with 'Coase Theorem'. Coase (1960) deals with the social costs in devising and choosing between social arrangements, especially relating to negative externality. That is, it argues that we have to i) bear in mind that a change in the existing system which will lead to an improvement in some decisions may well lead to a worsening of others and furthermore ii) take into account the cost involved in operating the various social arrangement (whether it be the working of a market or of a government department), as well as the costs involved in moving to a new system.

Polinsky (1979) considers three different approaches to the externality problem : i) the property right approach, ii) the liability approach, and iii) the tax-subsidy approach (with marginal or lump-sum compensation). It also divides the information situation into the two cases, i) the government has full information and ii) the government has limited information. In order to solve the externality problem, Varian (1994) suggests a

1 This paper is a revised and updated version of the part of the research, Korea Shipowners' Association (2009). Its main policy implications were also published as Ko, Byoung Wook (2009). whose journal is not a refereed one.

2 The official name of "New Port", which is referred to in the paper, is Busan New Port. However, for simplicity, we call it as "New Port (in Busan Container Port)".

compensation mechanism, which induces an efficient outcome and achieves desirable distributional goals. For the design of mechanism, he uses a two-stage game situation in which the subgame-perfect equilibria implement the desirable outcomes

This paper does not fully incorporate the implications of the above literature. While the full application of Coase (1960), Polinsky (1989) and Varian (1994) to the externality problem in the shipping industry is left as a topic for future research, this paper focuses on the case study of additional calling at New Port in Busan Container Port with positive externality.

However, there is another distinguished literature on externality. McKean (1958), Prest and Turvey (1965) and Price (2007) used the terminology, “pecuniary externality”, compared with the technological externality. The latter may exert physical, physiological and psychological influences on human well-being, so it should be included in the cost-benefit analysis for project evaluation. But the former stems from price movements. For example, when a road is constructed, the resulting rise in the price of nearby house is a kind of pecuniary externality. McKean (1958) said that a pecuniary externality should not be included in the cost-benefit analysis. Following this terminology, the externality, which will be treated in this paper, is classified as technological one because additional port calling affects the (physical) cost of other economic agents.

The organization of this paper is as follows. In section 2, the role of SSCS companies in Busan Container Port is summarized. Especially, the division of North Port and New Port is explained and the transshipment volume of SSCS companies will be shown. Section 3 will show two methods of handling transshipment cargoes from New Port to North Port and thus compare them in terms of incurred costs. The main difference of their cost structure is whether there are some significant (avoidable) fixed costs or not. Section 4 focuses on the reason why there is externality and how to tackle it. Then in section 5, the expected effects from the internalization of externality will be calculated based on some plausible assumptions. Finally, Section 6 concludes with the suggestion of future research topics.

2. Role of SSCS companies in Busan Container Port

2.1 Division of North Port and New Port in Busan Container Port

The history of container terminal in Busan Port commenced in 1978 as the Jasungdae container terminal opened.[3] The construction of this terminal was financially supported by the government, which borrowed the fund of IBRD (International Bank for Reconstruction and Development, or called as World Bank). Since then, the Korea government established the Korea Container Terminal Authority in 1990, by which various sources of funds have been used for the construction of container terminals, especially in Busan Port. As the result of continuous efforts of Korea's port authorities, in late 2005, there were 33 berths only for container cargo and ships in Busan North Port. And in the same year, 2005, the three container berths of Busan New Port opened and since then 9 more container berths have been added. So, now in 2009, 12 container berths are being operated in Busan New Port. The throughput of Busan Port is as shown in the following table.

Table 1. Throughput of Busan Port (2009.1~2009.9)

(Unit : TEU)

Classification \ Port	Total of Pusan Port	Busan North Port	Busan New Port
Total	8,675,185	6,814,530	1,860,655
Export + Import	4,768,710	3,823,667	945,043
Transshipment	3,906,475	2,990,863	915,612

Source : Busan Port Authority

2.2 Role of SSCS companies in Busan Container Port

Most of SSCS companies, which are calling at Busan Container Port, are operating within East-Asian service routes in Japan, China and South-east Asian countries.[4] However, two of them are participating in Australian or the Mid-East service routes. On shorter routes as Japanese and Chinese routes, most of them deploy the container ships below the capacity of 1,000 TEUs. However, on the longer routes to South-East Asian countries, the Mid-East and Australia, they deploy the container ships above the capacity of 1,000 TEUs. End of 2008 service routes to-and-from Busan Container Port are summarized as follows.

3 In 2009, Jasungdae container terminal is called Hutchison Busan Container Terminal.
4 Based on the number of services, 95% are operated within this East-Asian region.

Table 2. Some statistics on services of SSCS companies calling at Busan Port

(As of the end of 2008)

Classification		Number of services	# of shipping companies	Number of ships to be deployed			
				A	B	C	D
South-East Asian routes	Weekly	8	3	6	13	0	5
	Biweekly	8	1	8	12	5	0
	Triweekly	0	0	0	0	0	0
Far-East Russian routes	Weekly	2	2	1	1	0	0
	Biweekly	0	0	0	0	0	0
	Triweekly	0	0	0	0	0	0
Japanese routes	Weekly	20	8	28	0	0	0
	Biweekly	18	6	23	0	0	0
	Triweekly	3	3	4	0	0	0
Chinese routes	Weekly	14	7	17	0	0	0
	Biweekly	3	2	1	3	0	0
	Triweekly	0	0	0	0	0	0
Mid-East routes	Biweekly	1	1	0	0	5	0
Australian routes	Weekly	1	1	0	5	0	0

Notes : A-below capacity of 1,000 TEU, B-1,000~2,000 TEU, C-2,000~3,000 TEU, D-above 3,000 TEU
Source : Busan Port Authority

As of June, 2009, the share of Busan Container Port in national container throughput is about 75%. That is, in terms of cumulative throughput until June, 2009, the national container throughput is about 7,493,000 TEUs and that of Busan Container Port is about 5,613,000 TEUs. The transshipment cargo of Busan Container Port in the same period is about 2,539,000 TEUs. Its share is about 45%, which implies the importance of transshipment in Busan Container Port.

Table 3. Trends of container throughput - national and Busan Container Port

(Unit : 1,000 TEU)

Classification	National				Busan Port			
	Total	Transshipment			Total	Transshipment		
		Sub-total	In-T/S	Out-T/S		Sub-total	In-T/S	Out-T/S
2007	17,409	6,155	3,104	3,050	13,254	5,811	2,928	2,883
2008	17,791	6,185	3,111	3,974	13,445	5,807	2,916	2,891
2009 (~June)	7,493	2,689	1,364	1,324	5,613	2,539	1,282	1,256

Notes : Values below 1,000 are dropped out
Source : SP-IDC

In the past 3 years, the share of 10 main SSCS companies in Busan Container Port was about 22%. In their total cargo, the share of transshipment has been also stable around 40%.

Table 4. Throughput of 10 main SSCS companies in Busan Container Port

(Unit : 1,000 TEU, %)

Classification		2007	2008	2009(~June)
Traffic of 10 companies	Import	901(6.8%)	883(6.6%)	368(6.6%)
	Export	839(6.3%)	831(6.2%)	360(6.4%)
	T/S	1,162(8.8%)	1,251(9.3%)	525(9.4%)
	Sub-total	2,903(21.9%)	2,966(22.1%)	1,254(22.3%)
Total of Busan Port		13,254(100.0%)	13,446(100.0%)	5,613(100.0%)

Notes : 1) ( ) means its share in the total traffic of Busan Port
2) Values below 1,000 are dropped out

Source : Busan Port Authority

As of 2008, the traffic of Korea-China routes is about 2,430,000 TEUs. The share of the export/import cargo is 74% and that of transshipment is 26%. The west-bound cargo is 60% and the east-bound cargo 40%. As shown in the following table, in 2008, owing to the effects of the global financial crisis, the overall volume of Korea-China routes decreased. But, the traffic of the Korea-Shanghai route increased, mainly due to the increase of transshipment cargo. Because the decrease of east-bound cargo was larger than that of west-bound, the imbalance of east-bound cargo to west-bound cargo was lightened.

Table 5. Container cargo movement of Korea-China routes

(Unit : TEU, %)

Classification		Shanhai	Xingang	Dalian	Qingdao	Ningbo	Weihai	Yantai	Others	Total
West-bound	Local	193,720	103,671	44,554	109,364	71,093	36,926	35,770	140,544	735,642
	(CAGR)	-0.06	-11.10	-5.80	-7.55	2.87	0.40	-2.62	0.95	-2.94
	Feeder	40,680	37,579	35,108	42,911	10,456	171	8,369	12,044	187,318
	(CAGR)	78.44	-31.44	-6.53	31.38	-36.27	101.18	11.86	18.86	2.95
	Sub-total	234,400	141,250	79,662	152,275	81,549	37,097	44,139	152,588	922,960
	(CAGR)	8.20	-17.61	-6.12	0.87	-4.64	0.63	-0.17	2.17	-1.80
East-bound	Local	233,711	127,297	84,805	201,726	57,485	67,674	48,612	253,609	1,074,919
	(CAGR)	-2.10	-18.01	-10.49	-14.35	-18.70	-4.09	-4.32	1.58	-7.81
	Feeder	41,664	149,182	108,924	99,680	29,562	563	866	10,047	440,488
	(CAGR)	50.17	-18.56	8.05	-5.49	-25.90	285.62	-17.68	10.31	-5.76
	Sub-total	275,375	276,479	193,729	301,406	87,047	68,237	49,478	263,656	1,515,407
	(CAGR)	3.34	-18.31	-0.93	-11.61	-21.30	-3.50	-4.59	1.89	-7.22

Notes : 1) Others - Dafeng/Dandong/Fuzhou/Hunchun/Lianyungang/Nanjing/Nantong/Qinghuangdao/Quanzhou/Rizhao/Rongcheng/Shantou/Shidao/Wenzhou/Xiamen/Yingkou/Zhangjiagang
2) CAGR means compound annual growth rate

Source : Yellow Sea Liners Committee

In 2008, the traffic of the Korea-Japan routes, which were carried by the short-sea shipping companies, were 1,356,930 TEUs. The share of exports and imports is about 44% and that of transshipment is about 56%. The detailed traffic is summarized in the following table.

Table 6. Container cargo movement of Korea-Japan routes in 2008

(Unit : TEU)

Classification	Local	Own T/S	Feeder T/S	Total
Export	319,336	261,098	179,667	760,101
Import	283,547	150,911	162,371	596,829
Total (CAGR)	602,883 (-2.6%)	412,009 (1.1%)	342,038 (-7.0%)	1,356,930 (-2.7%)

Notes : CAGR means compound annual growth rate

Source : Korea Nearsea Freight Conference

3. Port calling versus trucking for transshipment : Implication of fixed costs

For handling transshipment from New Port to North Port, there are two methods. One method is moving the cargo by truck and the other is calling at New Port by sea, as shown in the following figure. The former is type 1 and the latter is type 2 in the remainder of this paper.

Source : Google

Figure 1. Two types of handling transshipment cargoes

The two methods differ in the cost structure. The existence of fixed cost in the type 2 method allows the utilization of scale economy, which makes the type 2 method more attractive in terms of costs, given that the volume of transshipment is above the threshold level.

In the following argument, let the number of the container cargo be "α". Furthermore, for simplicity of analysis, i) the loading and discharging of transshipment, ii) tallying, and iii) lashing costs would be dropped out in our following analyses.[5] As a result, this paper analyzes the additional costs as the handled cargo increases, without the above three cost items.

For the type 1 method (trucking shuttle), the calculation of costs is very simple. The cost function is a simple linear function of the amount of shuttled cargo without any constant term, as the following equation.

Cost function (type 1) = (α×TF) won

where TF means the trucking fee per one container box

However, the type 2 method (additionally calling at New Port) is more complicated than that of the type 1 method because there are some fixed cost items.[6] The fixed cost items are as follows : i) Cost of chartering a containership, i.e. the time value of the ship, ii) berthing fee, iii) fuel cost, iv) line handling charge, v) tug fee, vi) pilot fee, vii) use cost of pilot ship. Among these items, except the cost of chartering the ship, all of these need to be considered whenever a containership enters into a port. So, the costs appear as a constant in the cost function. However, the time value of the ship (i.e. cost of chartering a ship) increases as the amount of handled cargo increases. The reason is that as the cargo amount increases, the dwelling time of the ship also increases because of the time required to load and discharge container boxes. As a result, the cost function of type 2 is as follows :

Cost function (type 2) = (α×TVS/box) + BF + FC + LHC + TC + PF + CPS

where TVS/box means the time value of the ship per one container box handled,
BF means the berthing fee per one calling,
FC means the fuel cost from additional sailing to New Port,
LHC means the line handling charge,
TC means the tug fee,
PF means the pilot fee,
CPS means the use cost of the pilot ship

Given the above cost function, we can assume the values of individual items and then calculate the cost. So, based on the interviews with the workers in Busan Container Port, this paper uses the following values[7] : TVS/box=6,417 won, BF=323,748 won,

5 These three costs are all included in both methods. So only for the comparison of cost structure, these costs can be dropped out.

6 However, the form of cost function also appears to be linear.

FC=1,700,000 won, LHC=200,000 won, TC=2,450,000 won, PF=3,314,373 won, CPS= 838,420 won. The resulting cost function of type 2 is as follows :

Cost function (type 2) = [(α×6,417)+10,109,875] won.[8]

In the situation which is described in the above section, there is a threshold level of throughput which makes the type 2 method (additional New Port calling) more cost-effective than the type 1 method (trucking shuttle). The value of threshold level is calculated as 159 FEUs, which makes the cost function of type 1 equal to that of type 2.

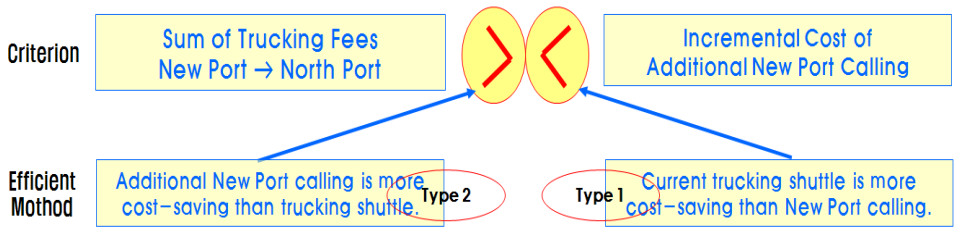

Figure 2. Comparison between the two types of handling transshipment

In this calculation, especially the fact should be emphasized that whenever there are more transshipments than the threshold level, there is an efficiency gain by utilizing the economy of scale from the existence of fixed costs. For example, for an additional transshipment exceeding the threshold, the type 2 method saves 63,583won, compared to the type 1 method.

4. Port calling with externality and policy recommendation

Mankiw (1998) defines the externality as follows :

(…) An externality is the impact of one person's actions on the well-being of a bystander. If the effect on the bystander is adverse, it is called a negative externality ; if it is beneficial, it is called a positive externality. In the presence of externalities, society's interest in a market outcome extends beyond the

7 The assumptions related with the containership are as follows : i) The ship size is 1,000 TEUs, ii) the charter cost per day is US$7,000, iii) the exchange rate is 1,100 won/$.

8 The term, X ≡ (α×6,417), is calculated by solving the following equation.
X = b×(wh/FEU)×e/24,
where b is the charter cost per day, wh/FEU is the spent time on handling one container box in the berth, e is the exchange rate.

> *well-being of buyers and sellers in the market ; it also includes the well-being of bystanders who are affected. Because buyers and sellers neglect the external effects of their actions when deciding how much to demand and supply, the market equilibrium is not efficient in the presence of externalities. (…) Externalities come in many varieties, as do the policy responses that try to deal with the market failure. (…)*
> (p. 200 in Mankiw (1998))

In the following paragraphs in Mankiw (1998), it says that there can be various solutions for the externality problems. These solutions would take the type of private solution or the type of government solution.[9]

Private solutions for the externality problem include i) moral codes and social sanctions, ii) charities, iii) integration of different types of business, iv) for the interested parties to enter into a contract. On considering the private solution, there is a well-known wisdom, which is called as Coase Theorem after economist Ronald Coase. This theorem says that if private parties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own. That is, whatever the initial distribution of rights, the interested parties can always reach a bargain in which everyone is better off and the outcome is efficient. However, occasionally bargaining does not work, even when a mutually beneficial agreement is possible. The famous cause of this failure is the existence of transaction costs, the cost that parties incur in the process of agreeing and following through on a bargain.

The government solution can be divided into two sub-types. One way is command-and-control policies which regulate the involved persons' behavior. The other one is market-based policies which provide incentives so that private decision-makers will choose to solve the problem on their own. For the command-and-control policies, the government sets environmental limitations on some economic activities by law, act, etc. For the market-based policies, government can internalize the externality by using taxation. The famous taxation solution for negative externality is Pigovian taxes, after economist Arthur Pigou (1887~1959), an early advocate of their use. Also, for the internalization of externality, government can use the implications of the Coase Theorem. For example, the government could issue pollution permits and then allow these permits to be traded among private parties. According to the Coase Theorem, private parties would bargain over these permits and the invisible hand of the market mechanism would appropriately price these permits so as to induce an efficient market outcome, which would achieve a socially desirable equilibrium.

There are some possible reasons why the SSCS companies call at New Port. One

9 The following two paragraphs are excerpted and summarized from Chapter 10. Externalities in Mankiw (1998). Other references textbook are Varian (1992) and Carton, D. W. and J. M. Perloff (1994) among others.

reason is that there is enough local (export & import) cargo for the liner company to make profits on that calling, without feeder transshipment. Or another reason can be that there is enough feeder transshipment cargo for the calling to be profitable, without local cargo. In reality, the distribution of cargo between the local and transshipment lies at some point on the spectrum between the extreme cases.

However, if the SSCS company calls at New Port and handles the feeder transshipment cargo, which otherwise would be shuttled by truck, then there is a positive externality for the mother ship's company, which transfers the feeder transshipment cargo to-or-from the SSCS (feeder) company. The reason is as follows. The mother ship's company as an ocean-going liner collects the cargo which needs to be transshipped in Busan Container Port. When collecting this ocean-going cargo, the company receives the transportation fee including transshipment cost. So, most of the trucking shuttle costs incurred in the route from New Port to North Port are born by this ocean-going company. Therefore, for the SSCS company to additionally call at New Port and directly handle this transshipment cargo means saving the trucking shuttle costs of the ocean-going company. This situation shows the problem of non-correspondence of cost-bearing subjects, i.e. the problem of positive externality.

Facing the above externality problem, there should be some solution for the market outcome to be socially efficient. First, there is the possibility that the ocean-going company and the SSCS (feeder) company would reach an agreement, by which a portion of the ocean-going company's cost reductions from an additional calling at New Port would be transferred to the SSCS company. If this agreement appears spontaneously among market players, we can say that the Coase Theorem works in the reality of Busan Container Port. However, in the opinion of the authors, the probability of its occurrence is low. The reason is that since there is a big gap between the bargaining powers of the two economic agents (i.e. the ocean-going firm and SSCS firm), the transaction cost would be too large to reach a desirable agreement.[10]

If this gloomy scenario is realized, then what is a plausible solution? This paper suggests a subsidy for SSCS liners of port authorities, especially Busan Port Authority (hereafter, BPA), as the government solution. Here is the rationale for this subsidy : The BPA is responsible for Busan Port to be commercially competitive. If the above externality problem remains unsolved, then the additional callings at New Port will be below the optimal level of callings. This means that there will be some inefficiency in dealing with transshipment cargo in Busan Container Port[11] and thus it will also lose its competitiveness, compared

10 For a rigorous argument, it is necessary to identify the nature of the transaction cost and estimate the amount of existing transaction cost from the difference of bargaining power. Especially, when identifying the nature of transaction cost, the problem of strategic behavior would appear significantly. However, the authors leave this identification and estimation for future research.

11 When the following two conditions are satisfied, there can be no efficiency gain : i) SSS company calls at New Port only for handling feeder cargo and not for local cargo and ii) the ship handles the exact level

to competing Ports, e.g. Shanghai Port, Tokyo Port, etc. When additionally considering the effects of scale economy, the loss will become larger. BPA should be responsible for solving the above externality problem.

Then what can be practical options for BPA? This paper recommends that i) BPA should appoint some dedicated berths for SSCS liners (as a less progressive policy) or ii) BPA should support the SSCS liners' acquisition of dedicated terminals (as a more progressive policy) in Busan Container Port. In the next section, the expected effects of internalizing the externality will be calculated under some assumptions. These positive effects can be additional rationale for the subsidy policy as a proxy for the effects of either of the two recommendations.

5. Expected effects from the internalization of externality

In order to calculate the expected effects from the internalization of externality, there need to be some assumptions, especially for the volume of transshipment from New Port to North Port. For this calculation purpose, first we use the total container throughput of Busan Container Port in 2008, which was handled by SSCS companies, 1,251,537 TEUs, as an assumed total volume of SSCP companies. Second, we assume the ratio of the feeder transshipment (which is transferred from the mother ship to the feeder ship or vice versa) (the total volume is 45.2%.[12]). Finally, we assume that the distribution of transshipment cargo between New Port and North Port is 35.6 : 64.4.[13] Based on these three assumptions, we calculate the cargo, which would be shuttled from New Port to North Port, as 201,387 TEUs.

As the volume, which the ship handles at New Port per one calling, differs, the cost incurred will also differ. So, for simplicity this paper considers two cases of 159-FEU handling (threshold case) and 210-FEU handling (case of handling over-threshold throughput).

First, for the calculation of cost reduction effects of the mother container ship's company,[14] consider the extreme case that satisfies the following two above-mentioned conditions : i) the SSCS company calls at New Port only for handling feeder cargo and not for local cargo and ii) the ship handles the exact level of threshold throughput (e.g. 159 TEUs). In this case, for the assumed cargoes, 201,387 TEUs, the mother container ship's companies (i.e. ocean-going companies) save the trucking shuttle cost of 7,049 million won and the SSCS companies should bear these costs alone.[15] But, in the real case which

of threshold throughput (e.g. 159 TEUs). In this case, there will be just the problem of non-correspondence of cost-bearing subjects. A concrete example of efficiency gain will be shown in the next section.

12 This figure, 45.2%, is based on the traffic of the Korea-Japan route.

13 This ratio is from Jun, C.-Y. and J.-P. Lee (2007).

14 This effect analysis focuses on the case of just handling threshold throughput.

is likely to occur, the SSCS companies calling at New Port would bear a part of these costs for handling the feeder transshipment cargo because there would be a large amount of local cargo. That is, the New Port calling costs of 7,049 million won may spread between the feeder cargo and local cargo.

Second, for the calculation of efficiency gain (or improvement),[16] consider another extreme case that satisfies the following two conditions : ⅰ) SSCS company calls at New Port only for handling feeder cargo and not for local cargo and ⅱ) the ship handles the over-threshold throughput (e.g. 210 TEUs). In this case, for the cargo exceeding 159 TEUs, there is the cost reduction from scale economy for one TEU, 63,583 won. So, the total of cost reductions for handling the assumed 201,387 TEUs is 1,555 million won. As a result, the ocean-going companies save the truck shuttling cost of 7,049 million won and the SSCS companies bear only 5,494 million won.

This section shows the effect of inducing T/S cargo when the reduced (shuttle) costs are used for reducing the cost of handling T/S cargo in Busan Container Port. For calculating the incremental effect of the reduction of cargo handling charge, we use the concept of price elasticity.[17] First, we should know the value of price elasticity of T/S cargo. As shown in the below table, in general the value of price elasticity of container cargo may be assumed over 1. So, we assume that the price elasticity of T/S cargo in Busan Container Port is unitary, 1.

Table 7. Price elasticities of Northern European Ports

Ports	Elasticity
Hamburg	3.1
Bremen Ports	4.4
Rotterdam	1.5
Antwerp	4.1
Le Harve	1.1

Source : Haralambides, He (2002) p.328

Second, for using the price elasticity, we should know the change of handling charge for T/S cargo. As of the1st quarter in 2009, the cost of discharging can be assumed to be 65,000 won/FEU, cost of loading 69,000 won/FEU, cost of trucking shuttle 70,000 won/FEU. Then, by using the T/S cargo from New Port to North Port, 201,387 TEUs, we can derive the price change in both cases that : i) 7,049 million won is used for reducing the cost of handling T/S cargo (Case 1) and ii) 1,555 million won is used for the same

15 In this case, the SSCS liners call at New Port 633 times per year.

16 This effect analysis focuses on the case of handling over-threshold throughput, e.g. 210 FEU/calling.

17 The price elasticity of demand is calculated by the formula,

$\eta = \frac{\Delta Q}{Q_0} / \frac{\Delta P}{P_0}$, where $\Delta Q = Q_1 - Q_0$ and $\Delta P = P_1 - P_0$.

purpose (Case 2). For Case 1, the price change is 34.3% and then the resulting incremental T/S cargo is 34,538 TEUs. For Case 2, because the price change is 7.6%, the increase of T/S cargo is 7,653 TEUs. Furthermore, if we calculate the increase of stevedoring companies' income from additionally handling this cargo, for Case 1, the income increase is 4.6 billion won and, for Case 2, the increase is 1.0 billion won.

6. Conclusions

To this point, we have considered the problem of externality (i.e. non-correspondence of cost-bearing subjects) from additional port calling at New Port. While there is a possibility that the Coase Theorem will work well so that there is no need of port authorities' intervention to solve externality, this paper highlights : i) that, owing to the large gap between the bargaining powers of involved economic agents (i.e. ocean-going companies and SSCS companies), the transaction cost would be too high to reach an agreement with mutual benefits and thus, ii) the port authorities, especially BPA, should implement the policy to subsidize the SSCS companies in order for the externality problem to be resolved. Furthermore, this paper shows the expected effects from the internalization of this externality.

However, in this paper there are some questions which are not tackled. Thus these will be future research topics, which can be summarized as follows : First, when implementing "Modal Shift Policy" in Korea,[18] the scale economy from the fixed costs of shipping service supply, compared to the trucking service, has not fully considered. This aspect of research would yield fruitful policy options. Second, after identifying externality in the shipping industry as shown in this paper, there could be delicate policy options by using the implications of Coase (1960), Polinsky (1979), and Varian (1994). Third, when identifying the externality problem in the shipping industry, like the other sectors of the economy, there could be a problem associated with the transaction cost. Owing to this transaction cost, the market mechanism, implied by the Coase Theorem, would not function well so that the government intervention would need to be implemented. So, identifying the nature of the transaction cost and then estimating its amount can become an important policy and research topic.

As a final remark, the authors want to emphasize the importance of the existence of the externality problem in Busan Container Port. Only after perceiving the problem can the relevant remedying policy follow. If one of the recommended policies is implemented in the near future, the authors believe that Busan Container Port will have more competitiveness and continuously develop as a global container Hub Port.

18 The additional calling at New Port as an alternative to trucking shuttle can be considered as one of the modal shift policies.

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