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Participation of Private Investors in Container Terminal Operation: Influence of Global Terminal Operators

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Contents

Abstract

Private container terminal operators have begun to participate in the port business in Asia since the late 1980s. Terminal operators decide whether to invest in terminal infrastructures, and the enhancement of the quality of service level. The paper analyses the influence of global terminal operators and the port ownership structure on the container terminal's efficiency. Two hundred and sixty container terminal data for China, Korea, and Japan were collected. The paper applies a negative binomial regression analysis. The paper finds that the port restructuring has contributed to productivity gains. It is found that the influence of GTO on the efficiency is evident and positively related to the port efficiency. The paper also finds that the country effect prevails over a terminal operator group effect.

Key Words : Container Terminal Operator, Port Industry, Port Efficiency, Global Terminal Operator, Privatization of Port

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I. Introduction

Ports account for transport of international trade and trade chains. Growth of trade volume demands efficient port management and investment in container terminals. On the other hand, increased vessel size has resulted in a move of power in favor of shipping companies. They exert pressure on ports to improve productivity and to develop new facilities. However, investment costs for port infrastructure and facilities are extremely high. Ports and terminals were therefore privatized in order to finance the investment in ports, and to boost economic growth.

Private container terminal operators have begun to participate in the port business in Asia. Removing terminal assets and operational functions from government hands has allowed specialized entities; Global Terminal Operators (GTOs) to concentrate on terminal operations and cargo handling services. Concessions and leaseholds have attracted new investment from global terminal operators, shipping liners, and private cargo handlers. This has also promoted intra-port competition between multiple service providers within a port (Cheon et al., 2010).

In fact, terminal operators decide whether to invest in terminal infrastructures, and the enhancement of the quality of service level. GTOs, as private companies, by definition, will maximize profit, and they should try every method to increase efficiency levels including cost efficiency. Since the beginning of the global financial crisis, major containership operators have been confronted financial challenges. However, there has been little attention paid as to the terminal operators were which assure and secure the management of the terminal as well as their impact of GTOs on the port efficiency.

This paper examines the influence of GTOs and the restructuring of ports on the terminal performance. One common approach in port efficiency study is the use of SFA, DEA, and survey. The paper uses a parametric analysis via negative binomial regression to generalize the functional relationship between a response variable and explanatory variables. The study develops empirical models that describe the main features of the relationship entirely from data. This paper is organized as follows. The next section introduces a literature review and formulates hypotheses. Section III provides an empirical study and Section IV discusses the result. Finally, concluding remarks are presented in Section V.

II. Literature Review and Hypothesis Formulation

1. Global Terminal Operators

Ports are characterized by their geographical and operational settings. Each port has many terminals, which are operated by one or several operators (Yip et al., 2011). The emergence of global terminal operators is a profound organizational change in the development of container terminals. Container terminal operators are firms which operate one or several container terminals at a port. They provide a logistics center and container freight stations. They know that the transport chain will make it possible to offer door-to-door and one stop services. The provision of these logistics services permits cost saving through sharing resources and enhanced visibility and market power by diversifying the business activities (Araujo De Souza et al., 2003).

There are two categories of private investors in container terminals, the one is pure stevedores such as HPH, PSA, and DP World, and the other is global shipping companies who wish to integrate terminal operation into their business activities. Pure stevedoring companies acquire terminals privatized and conceded by governments to increase a business activity span. The integration of terminal by global shipping companies is not a new phenomenon (Pawlik et al., 2011). When a shipping company integrates the functions of stevedore into its business, it effectively coordinates calls by its various ships through a terminal which is wholly dedicated to its own operations. The container terminal operators make technical decisions for their own objective. This, however, requires substantial investment, which would be justified by a high enough volume of traffic throughput (Pawlik et al., 2011).

Cheon et al., (2010) argue that partial privatization allows specialized entities to concentrate on terminal operations and cargo handling services. Optimized operation of container terminals creates technical efficiency gains. In effect, the roles of terminal operators and cargo handlers have become much stronger in the port industry over the last decade. Notteboom and Rodrigue (2012) show that terminal operators have varying degrees of involvement in cargo handling and that business cycles and the geographical orientation of investment strategies depend on changes in world economic geography.

Yan, Sun and Liu (2009) assessed the efficiency of container terminal operators from among the world's major container ports by using the Markov Chain Monte-Carlo simulation. They found that the level of efficiency was in the range of 70-90% of their full efficiency capacities. They also found that the efficiency level increases with time and highly efficient operators were increasing.

The increase in the participation of private investors in managing ports and the entrance of new ports have increased pressures on the port efficiency (Bergantino et al., 2013). Container terminal operators are compelled to provide high quality service levels at competitive prices (Araujo De Souza et al., 2003). They should invest in facilities, service system and management system to gain and sustain competitiveness. They should increase expenditure on cranes, information technology, transshipment facilities and shorten vessel turnaround times (Notteboom, 2002).

This gives raise the following hypothesis:

Hypothesis 1: the presence of global terminal operators is expected to be positively related to the performance of container terminals.

2. Ownership of Container Terminals

Since the late 1980s, many national governments have adopted institutional reforms in relation to the port industry. They had launched privatization programs and the first target was liberalization of terminal operation functions. The reforms were aimed at increasing port efficiency, and enhancing service standards to cope with demands from shipping firms.

Many of the private sector investments in terminals have been based on facilities leased from public port authorities (Pawlik et al., 2011). Ports leased the property to carriers and terminal operators of all kinds. Ports then outsourced the operation of these facilities to private firms on a long term basis. The tenants in these terminals complied with port regulations and paid ground rent on the terminal as well as the tariff for goods moved through the terminal. The supply of potential investment opportunities for terminal is diminishing (Olivier et al., 2007). The diminishing level of supply of terminals and the global expansion in demand even after the financial crisis will lead to increase prices for terminals.

A number of authors have recognized that ownership regimes and policy changes played an important role in determining ports' performance (Tonzon and Heung, 2005; Cullinane and Song, 2006; Wang and Cullinane, 2006; Trujillo and Tovar, 2007; Yan et al., 2009; Cheon et al., 2010). Where seaports are privately owned, their obligations differ from public agencies. Their opportunities for financing and use of publicly provided services are limited. The primary obligation for private ports is to maximize the value of stakeholders. Port managers retain an obligation to their constituent-owners.

Cullinane et al. (2002) assessed the relative efficiency of selected Asian container ports by employing both cross-sectional and panel data versions of stochastic frontier models. They concluded that privatization should have positive impacts regarding improvement in efficiency. Focusing on the US, Haarmeyer and Yorke (1993) stated that the US public port systems suffered from inefficient operation, mainly due to political interference and risk aversion. Their view is that private sector participation can broaden capital sources and increase port performance.

Tongzon and Heng (2005) investigated the quantitative relationship between port ownership structure and port performance. They found that private sector participation in the port industry was useful for improving port operation performance. Moreover, they contended that privatization has become a necessary strategy to gain competitiveness in the current marketplace. However, they believed that full port privatization did not necessarily increase port operation performance indefinitely. They suggested that the relationship was not linear.

It is hypothesized that:

Hypothesis 2: private ownership is likely to be positively associated with the performance of container terminals.

3. Infrastructures of Terminals

One of the major challenges for container ports is the upgrading of facilities in order to satisfy increasing size of vessels and the corresponding pressures this placed on the spatial and time aspects of cargo handling (UNCTAD, 2014). As the size of ship increases, more investment is needed in bigger cranes which can reach out to collect the furthest container from the berth. Ports are pressed by shipping companies to invest in the equipment or be excluded from major East-West trade lanes.

Ports need not necessarily build longer berths, unless they want to cater for multiple ships simultaneously, but must construct deeper access channels, wider turning basins, more pilotage facilities, strengthened quays, larger storage areas and more sophisticated terminal operating systems within the port (UNCTAD, 2014).

A significant amount of research has been dedicated to the study of port productivity. These studies are focused on the identification of factors influencing port competitiveness (Tongzon, 1995; Ha, 2003; Notteboom, 2006; Cullinane et al., 2002; Parola and Sciomachen, 2009). Those factors are generally physical factors, such as berth depth, CT area, CFS area, number of cranes, and CT space. They found a positive association between differentiations of port service provided and the productivity gain. Investment in terminal infrastructure is supposed to increase productivity level.

Based on the previous argument, it is assumed that:

Hypothesis 3: port infrastructures are likely to be positively related to the performance of the port.

4. Direct Calls

Shipping firms should determine which ports to serve with direct calls by large vessels and which ports to serve by feeder vessels from transshipment ports. Generally, some ports are used for both direct calls and transshipment of containers to and from other ports by small feeder vessels, whereas the remaining ports only have direct calls for moving containers to and from their hinterlands (Jensen and Bergqvist, 2010). However, routing all freight through a hub port is not necessarily appropriate for all situations.

Freight originating in feeder ports must be trans-shipped through a hub, and incur extra shipping distance, shipping time, port charges and loading/unloading charges. Since container shipping firms operate in an increasingly competitive and market-driven environment, they not only aim to lower their shipping costs, but also to enhance their services in order to increase their competitiveness.

Container shipping firms generally enhance their shipping services by providing a high sailing-frequency service, using fast container ships, and planning shipping routes so as to shorten shipping time (Hsu and Hsieh, 2007). For example, most of shipping companies have increased orders of large vessels in 2013 to improve efficiency and reduce operational cost per TEU (UNCTAD, 2014). The containership order book grew from 41 million dwt at the beginning of 2013 to 43 million at the beginning of 2014 representing about 20% of the fleet in service.

Delay costs related to the container shipping process are crucial factors affecting the quality of service provided to shippers. The delay costs incurred by the waiting time of cargo to be shipped at a loading port depend on the sailing frequency, whereas those due to cargo being on a ship along the shipping route are related to ship speed and choice of shipping route.

The number of ship calls is an important factor because it influences the volume of cargo which can be moved through a port. Frequency of ship call is attractive to both importers and exporters. The more port users are likely to choose it as their port of call, which will make the port gain more market shares (Tonzon and Heung, 2005). Therefore,

Hypothesis 4: it is expected that the number of direct calls at a port is positively related to the performance of terminals.

5. Hinterland Connection

Ports play a significant role in the global supply chain management. Each port has different role to play within supply chain systems. One port may provide facilities consistent with the needs of hub-and-spoke transport modes, whereas another port provides feeder transport modes. The accessibility to hinterland is port-specific. It is correlated to the degree of infrastructure endowment available to port users (Bergantino et al., 2013). Quick and safe access to inland transport system becomes a basic requirement for port users to evaluate their port selection options (Yeo, 2010). A port is situated in the middle of the multimodal transportation service. Ports form parts of value-chains that cross and link hinterlands. Most of the major container ports share the interrelated hinterlands. This means that operators have to compete not only with other operators located within the same port but also with operators located in other ports.

Turner, Windle and Dresner (2004) examined the impact of hinterland and maritime accessibilities on port performance. Parola and Sciomachen (2009) examined multimodal container flows at an Italian maritime terminal by focusing on the connectivity between different modes of transport. They found that a low level of connectivity generates problems of congestion and compromises the overall terminal competitiveness.

The providers of terminal services, whether private or national, should offer sustainable value to their users as compared against competing value-driven supply-chains that encompass different ports or terminals (Yap et al., 2011). A high degree of connectivity between container terminals and hinterland permits a reduction in the transportation time from provenance to destination, and eventually the transport cost. Thus, it is assumed that:

Hypothesis 5: the hinterland accessibility is positively associated with the port performance.

III. Empirical Study

1. Data Collection

The sample examined in the empirical study consists of container terminals located in Korea, China and Japan. The port and terminal data are from the Containerisation International yearbooks 2009 and 2012 published by Informa Cargo Information. Data needed but not available were obtained from the website of the ports concerned. From these sources 260 container terminal data in which 90 for China, 40 for Korea, 130 for Japan have been collected[1].

2. Variable Definition

Global Operator is a dummy variable coded one if there is at least one GTO at a terminal, and zero otherwise. GTO measures the number of

1) China data include such ports as DALIAN, FUZHOU, GUANGZHOU, HONGKONG, LIANYUNGANG, LONGKOU, NANJING, NINGBO, QUINGDAO, QINHUANGDAO, QUANZHOU, SHANGHAI, SHANTOU, SHEKOU, TIANJIN, XIANMEN, YANTAI, YANTIAN, YINGKOU, ZHANJIAGANG. Korean ports include BUSAN, GWANGYANG, INCHEON, ULSAN, Japanese ports are located at FUKUYAMA, HAKATA, HIROSHIMA, KAWASAKI, KITAYUSHU, KOBE, MAIZURU, MITAJIRI-NAKANOSKI, MIZUSHIMA, NAGOYA, NAHA, NIIGATA, OITA, ONAHAMA, OSAKA, SAKATA, SENDAI, SHIMIZU, SHIMONOSEKI, TAKAMATSU, TOKYO, TOMAKOMAI, WAKAYAMA-SHIMOTSU, YOKKAICHI, YOKOHAMA.

GTOs present at a port. Terminal refers to the number of container terminals at a port. Pownership measures the Port ownership regime, and is a dummy variable which is coded one if the port is privately held, and zero otherwise.

Berth depth, CT area, CFS area, number of cranes, and CT space can measure the level of port infrastructures. These variables are highly correlated one another, because any variable can be used for a proxy of port infrastructures. The paper applies the CT area and CFS area to measure port infrastructures. CT area and CFS area refer to the total area of the container terminal, and the container freight station respectively. These variables are transformed into a logarithm form in the regression analysis. CFS operator means the number of CFS operators in each terminal.

Direct Calls measure the number of shipping firms using a given terminal for the call service. Hinterland accessibility is a dummy variable coded one if a container terminal has a railroad system connecting the terminal with hinterland, and zero otherwise. Variables such as Electronic Freight forwarder service, Electronic Cargo tracking service, and English website availability were gathered to measure the level of electronic trade. These variables are coded one if the terminal integrated an electronic trade service system, and zero otherwise. Port Performance can be measured by costs, production level (throughputs), revenue or whatever criteria the organization is assumed to pursue (Yip et al., 2011). The paper measures the throughput level due to the constraint of data access to each terminal.

3. Descriptive Statistics

The summary statistics of the explicative variables are shown in <Table 1>. Japan presents 52% of the total sample, followed by China with 34%, and Korea with 15%. The variable Direct Calls ranges from 0 to 45 with the average being 7.6 calls. The mean CFS area is 12.36 ranging from 9.74 to 15.72. The presence of GTO at a terminal is not a general phenomenon yet. Less than 25 percent of the total sample terminals have at least one GTO at their terminal. 59 percent of terminals have direct access to a hinterland from the related terminal. The number of terminals varies largely ranging from one to 11 terminals with the average of 2.52.

IV. Results

1. Univariate Analysis

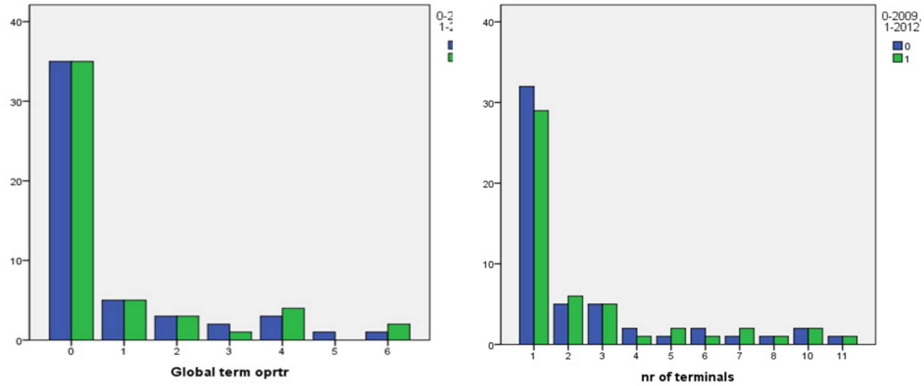
Changes in the distribution of container terminals and GTOs at a port are illustrated in <Figure 1>. It also shows that the general figure for Northeast Asian ports is that a port has one terminal operated by a non-GTO. This trend has not significantly changed in three years.

<Table 1> Summary statistics of independent variables

	Min.	Max.	Mean	Std. Dev.
China, dummy	0	1	0.34	0.474
Korea, dummy	0	1	0.15	0.354
Japan, dummy	0	1	0.52	0.501
Direct calls, number	0	45	7.63	8.072
CTarea, ln	9.74	15.72	12.36	0.988
CFS area, ln	5.73	13.67	9.10	1.490
CFS operators, nr	0	7	0.47	1.120
Global operator, dummy	0	1	0.24	0.430
Hinterland accessibility, dummy	0	1	0.59	0.493
Terminal, nr.	1	11	2.52	2.624

The presence and influence of GTOs for performance amelioration in the three countries is outlined in this section. <Table 2> shows the changes in terminal numbers and the distribution of GTOs during 2009 and 2012. There are no significant changes with respect to the number of terminals and GTOs by year. It is found that there are many terminals which can ensure deep sea transportation in both China and Japan. However, a striking fact is that there is no GTO among Japanese container ports.

<Figure 1> Distribution of container terminals and GTOs by year



Mean differences between container terminals operated by Non-GTOs and by GTO are presented in <Table 3>. There are two terminals on average at a port regardless of GTO presence. The GTOs have larger CT area and CFS area than their national competitors or small private operators. These variables are highly significant. This implies that GTOs are investing in the infrastructures at their terminal. The terminal performance level is significantly different whether a terminal is operated by a GTO or not. A terminal operated by a GTO presents a higher performance at the p-value=0.01 level.

<Table 2> Distribution of GTO in three countries by year

	China		Korea		Japan	
	2009	2012	2009	2012	2009	2012
Terminal, nr	20	19	4	4	28	27
GTO, nr						
1	4	4	1	1	0	0
2	2	2	1	1	0	0
3	2	1	0	0	0	0
4	3	4	0	0	0	0
5	0	0	1	0	0	0
6	1	1	0	1	0	0
Total	12	12	3	3	0	0

A terminal operated by a Non-GTO has 8 callings from shipping firms, whereas a terminal operated by a GTO has 6 callings. The difference is quite large; however, the variable is not statistically significant. However, the terminals without GTO provide rather easier connection to the hinterland.

The Web services level offered to the shippers varies significantly whether a terminal is operated by a GTO. E-Freight forwarder service is installed in 8% of the terminals operated by a GTO, whereas just 6% for a Non-GTO-terminal. The difference in terms of E-Cargo tracking service level is obvious and statistically very significant. The results indicate that GTO-terminals provide a higher level of web service. The correlation matrix between the explicative variables is presented in <Table 4>.

<Table 3> Mean difference test

	Non-GTO		GTO		t-stat.
	mean	Std. dev.	mean	Std. dev.	
Terminal, nr.	2.59	2.752	2.21	1.762	0.489
CT area, ln	12.14	0.923	13.05	0.85	6.969***
CFS area, ln	8.92	1.55	9.71	1.04	2.603***
TEU, ln	5.88	2.03	7.57	1.162	6.469***
CFS operators, nr.	0.54	1.211	0.29	0.771	1.557
Direct Calls, nr.	8.07	7.931	6.38	8.438	1.399
Hinterland, dummy	0.17	0.375	0.27	0.447	1.626
E-Cargo tracking, dummy	0.01	0.072	0.10	0.296	2.395**
E-Fforwarder, dummy	0.06	0.231	0.08	0.272	0.655
English web, dummy	0.08	0.267	0.10	0.296	0.461

Note : t-values are presented in absolute value. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

2. Multivariate Analysis

As the dependent variable is a nonnegative count variable, a Poisson regression has been conducted. However, the goodness-of-fit χ^2 was extremely significant2). It indicates that the Poisson regression model is inappropriate. Negative binomial regression models should be used when the number of occurrences of an event has an extra-Poisson variation. The original Poisson model is a special case of the negative binomial. Overdispersion comes about if some of the parameters of the Poisson

2) In a modeling process it was found that all the values for the goodness-of-fit X^2 were high. For example, it marked X^2= 172468.88, and this number was one of the lowest values.

processes are unknown.

Results of Negative binomial regression modelling with respect to the performance of container terminals are presented in <Table 5>. All models are statistically significant. The Model 1 and the Model 2 analyze the performance of container terminal without considering a country effect. A stability of Models was tested by using the variable Direct calls. The signs of the variables put in Model 1 and 2 did not change whether there was the Direct calls variable or not in a Model. The models from 3 to 5 examine the influence of one country per model. The Model 6 shows the influence of explanatory variables on the terminal performance by comparing to those of Japan.

It is found that the influence of GTO on the performance is evident and positively related to the port performance. The influence is positively significant with and without the country effect. Thus, the Hypothesis 1 is accepted. It is found that private container terminal operators have the financial strength to cope with the capital expenditure required for container terminal development and the management expertise to ensure the fulfillment of the increased specialization and operational sophistication demanded by shipping companies (Araujo De Souza et al., 2003).

The paper cannot find a statistically significant relationship between the ownership structure of the terminal and the performance. The H2 is not accepted. The result is however consistent with the findings of Liu (1995) who has examined how different types of ownership shaped the technical performance of ports. Liu did not find the prevalence of a particular ownership structure. Notteboom et al. (2000) studied the ownership structure and management system of ports, and suggested that port ownership did not have a significant effect on port performance.

The paper found evidence that infrastructures of container terminal play an important role to enhance the port performance: CT area is positively related to the terminal throughputs. It was also found that the number of CFS operators is positively related to the terminal performance. Container terminals providing a larger space and a CFS operator to shippers perform better. Therefore, the hypothesis 3 for positive relationship between terminal infrastructures and performance is verified.

The number of direct calls at a terminal is positively associated with the terminal performance. It means that a terminal served for direct calls shows greater efficiency levels. The hinterland accessibility variable is also positively related to the terminal performance. The result is consistent with the findings of Turner, Windle and Dresner (2004) who found the impact of inland access connections on terminal competitiveness. An easy inland accessibility allows an expansion of the terminal's hinterland, generating not only an impact on its activity of shipping lines but also facilitating cargo flow.

<Table 4> Correlation matrix

0	China	Korea	Japan	Ownership	lnCTarea	lnCFS	Direct call	CFS operators	Hinterland	Terminal	GTO
China	1										
Korea	-.296	1									
Japan	-.738	-.427	1								
Ownership	-.364	.177	.261	1							
CTarea	.515	.070	-.536	-.338	1						
CFS	.433	.040	-.427	-.506	.619	1					
Direct call	.005	-.094	.062	-.131	.209	.325	1				
CFS operators	-.010	.117	-.073	.007	-.039	-.024	.144	1			
Hinterland	.208	.157	-.308	-.079	.234	.218	.216	.151	1		
Terminal	-.079	.249	-.057	-.148	.170	.374	.365	.639	-.005	1	
GTO	.465	.249	-.587	-.204	.351	.513	.235	.521	.331	.439	1

In other word, the hinterland accessibility allows terminal expansion beyond the seaport limits, thereby enlarging their area of influence to inland terminals, where major cargo volumes are transported by railway. These results suggest that port terminals increasingly seek to improve service quality and hinterland connectivity in order to meet the logistic network demands (Caldeirinha et al., 2013). Thus, the hypotheses 4 and 5 are verified.

<Table 5> Results of negative binomial regression analyses

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Constant	-4.968** (1.952)	-4.6502** (2.052)	1.278 (2.081)	1.6728 (2.170)	-4.4116** (1.974)	2.057 (1.610)
GTO, nr.	0.5079*** (0.106)	0.5178*** (0.107)	0.2345*** (0.091)	0.1877* (0.114)	0.5168*** (0.106)	
Governance regime	0.2324 (0.366)	0.2616 (0.370)	-0.1663 (0.306)	0.0757 (0.313)	0.1972 (0.361)	-0.1794 (0.227)
Infrastructure	0.965*** (0.167)	0.9328*** (0.179)	0.370** (0.181)	0.4936*** (0.174)	0.915*** (0.171)	0.280** (0.140)
Hinterland, dummy	-0.0358 (0.334)	-0.096 (0.346)	0.606** (0.288)	0.334 (0.293)		0.628** (0.246)
Direct calls, nr.		0.0085** (0.016)			0.006 (0.015)	
CFS operator, nr.						0.1497** (0.069)
China			2.001*** (0.311)			2.414*** (0.250)
Japan				-1.855*** (0.353)		
Korea					-0.417 (0.451)	0.726** (0.358)
Alpha	1.4313***	1.4278***	1.0476***	1.1292***	1.4193***	1.0044***
Pseudo R^2	0.0458***	0.0460***	0.0701***	0.0644***	0.0465***	0.064***
Log likelihood	-692.63	-692.49	-675.03	-679.16	-692.14	-222.59

Note : 1. Dependent variable is the throughput of container terminal. Alpha measures the degree of dispersion of variance.
2. Standard errors are in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

The paper finds evidence of a country effect with respect to terminal performance. It is observed that signs of the country variable change in different Models. This implies that each country plays a specific role regarding the productivity. It is found that the influence of Japan on the port performance is rather negative in the Model 4. The significance level of GTO is low in the Model 4 compared to other models in which the GTO variable is strongly significant. The influence of Japan is reflected in the Model 6 as the control group is Japan. China and Korea have all positive effects on the terminal performance compared to those of Japan in the Model 6. The result is consistent with the argument stressed by Yip et al. (2011). According to them, operators from different ports within the same country should share a certain similarity in terms of production.

They stressed that two operators, even from different countries, should be quite similar in production performance if they belong to the same terminal operator group. The paper finds that the country effect prevails over a terminal operator group effect.

V. Concluding Remarks

The paper analyses 260 container terminals located in China, Japan, and Korea in order to find the influence of GTOs and the port ownership structure on the container terminal's performance. The paper finds that the investment in terminal infrastructure increases port performance. The paper also finds that the restructuring of terminal operation played an important role in improving terminal performance. The study shows evidence that the roles of container operators have become non negligible. The presence of GTOs contributes to efficiency gains for container terminals. The result implies that terminal operation is a critical element in shipping industry. The privatization engendered organizational restructuring and increased port performance. The terms of the lease could dictate the manner in which the private operator of that terminal conducted his business.

However, due to long-term payback periods and high capital costs in the terminal industry, a total dependence on the private sector could result in significantly delayed investments in the crucial operation of infrastructures and equipment (Cheon et al., 2010). As private investors and operators pursue profit maximization, they may abandon facilities and services that offer more long-term rewards and which are set a broader social context.

The government should establish a long term plan regarding port efficiency gains to create incentives for better port management. Furthermore, as the benefit to the public from investment in terminals is large, infrastructure investment should be provided steadily by the public sector to enhance and sustain efficiency. The participation of GTOs in the operation of terminal can be pursued.

Further study is needed to examine the different influence of individual operators and global operator groups on the terminal efficiency. As carrier operators can use their dedicated terminals, they can perform better than individual operators (Yip et al., 2011). Furthermore, carrier operators are likely to be more sensitive to the market; they have sold freight terminal assets and other peripheral businesses, such as container manufacturing, inland logistics and customer services and restructured the portfolio management to minimize costs and to free up capital for new investment and cumulate cash reserves during the period of recent financial distress. And the ownership structure should be examined in detail to find if there is an optimum level in private or public shareholding. *

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