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The Revealed Competitiveness of Major Ports in the East Asian Region: An Additive Market Share Analysis*

Tae Seung KIM[a]

[a] *Associate Professor, Inha University, Korea, E-mail:todang@inha.ac.kr*

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ABSTRACT

In the single cargo market, the ordinary market share analysis method has been the representative tool for revealed competitiveness analysis. This paper develops and employs an applied market share index called the additive market share (AMS). Data are collected from 15 major container ports for the 1998-2013 period. In comparison to the results of an ordinary market share analysis, the highest AMS is observed for the Bohai Rim port cluster from 2008, not for the Yangtze River cluster or the Pearl River cluster. There are substitutable relationships between Yangtze River and non-Chinese ports and between Pearl River and Bohai Rim ports from 2001. Finally, there is an internal competition at Pearl River and Yangtze River ports, whereas Bohai Rim and non-Chinese ports show internally complementary relationships.

1. Introduction

Ports in the East Asian region experienced sharp increases in trade volume and severe internal competition for their status as hub ports in the 2000s. At the beginning of the century, five of these ports ranked among the world's top 10 as container ports. Here Singapore and Hong Kong, as city-states, served as traditional transit bases for trade, whereas others were simply gateway ports in each hinterland. Since 2012, however, 9 of the world's 10 largest container ports have been located in the region (Lloyd's List of Annual Top 100 Ports, 2013).

Scholars have provided several major explanations for this phenomenon. The most important one attributes it to the dramatic growth of China's economy and trade. Export-driven economic policies of countries in the region, including China, Japan, and Korea, represent a complementary explanation in conjunction with the growth of China's economy. The development of containerization as a tool for maritime cargo in trade is said to originate in East Asia. The long history of a strong maritime industry in the region is another explanation.

However, what should not be overlooked is the effort to achieve competitiveness in port operations by administrative and management sides of ports. In fact, government officials and scholars in East Asian countries have formulated new national development strategies. In particular, those in Korea have proposed the "Northeast Asian Transportation Hub," a strategy including the construction of new port facilities, the development of extended industrial sites in the port hinterland, and the formulation of various measures to increase the

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efficiency of ports and attract international shippers and liners. This indicates that they have not considered a port as a simple transit point for cargo and passengers. Instead, they have viewed a port an anchor for the economic development of areas near ports as well as for the development of the national economy, as conceptualized in Notteboom et al. (2005) and Langen et al. (2012).

Given existing efforts and outcomes of ports in East Asian countries, it is not surprising that almost a third of port studies between 1997 and 2008 have focused on Asian ports and related areas.[1] This paper contributes to the literature by evaluating the performance of East Asian ports from a different perspective, focusing on container handling and revealing port competitiveness. For this, data on container-handling volume are obtained from 15 major ports in East Asia based on their ranking among the top 50 world container ports for the 1998-2013 period.

The rest of this paper is organized as follows: Section 2 provides a review of previous research on port competitiveness and performance. Section3 discusses the methodology, the ordinary market share analysis, the revealed competitiveness advantage (RCA), and the additive market share (AMS) and describes the data. Section 4 presents the empirical results and their policy implications, and Section 5 concludes with a summary and some suggestions for future research.

2. Literature Review

Talley (2007) raises three issues for the evaluation scope of port competitiveness: evaluation over time (a single-port approach), evaluation relative to other ports (a multi-port approach), and evaluation from an engineering or economic perspective. A single-port approach compares actual performance to optimum performance and traces them over time. Here the major performance indicators include throughput, employment, value added, and the investment level, which are precisely investigated and suggested for improvement in Langen et al. (2007).

A multi-port approach compares performance indicators used in a single-port approach between ports in a competitive environment. However, this method is seriously limited in that it may mislead results as a result of ports operating in different economic, social, and fiscal environments (Talley, 2007). Therefore, multi-port comparison methods have evolved into the data envelopment analysis (DEA) technique for a comparison of ports' relative efficiency and the analytical hierarchy process (AHP) technique for giving weight to port choice criteria for shippers and liners.

For a comparative analysis of ports in the Asia-Pacific region, Liu (2008) uses the DEA method, whereas Yeo et al. (2008), the AHP method. Other methods have been used to estimate the efficiency of ports in a similar region as well. For example, Tongzon et al. (2005) use the stochastic frontier analysis model (SFM). Although the DEA method is flexible in accounting for multiple input and output variables, it is criticized for being non-statistical because it takes into account no measurement error in estimating efficiency. On the other hand, the SFM is a statistical technique that can address the limitations of the DEA method, but it is less flexible in accounting for multiple output variables.

Pallis et al. (2010) and Pallis et al. (2011) provide a collective literature review on ports by considering a total of 395 papers published in major journals during the 1997-2008 period and classifying them based on research communities, subfields, citation frequency, and sub-periods. According to their statistics, the fields of research, particularly during the 2002-2006 period, have concentrated on port (or terminal) competitiveness. Here the main research themes include port efficiency and choice, as explained earlier. This implies an increase in port competition since the 2000s, and the major sources of competitiveness include the promotion of efficiency and the attraction of shippers and liners.

However, despite the importance of port competitiveness, few studies have developed the methods of evaluation for them during this period. Several ordinary performance indicators such as throughput and the growth rate have been used as indices of ports' revealed competitiveness. It is just after the collective works by Pallis et al. (2011) when researchers have focused on developing new indicators of revealed competitiveness.

Low et al. (2009) use the port connectivity index and the port cooperation index to assess the hub status of major Asian ports. The port connectivity index is a ratio of the number of O-D pairs for a port connected to other ports in the region to the total number of O-D pairs for ports in the network. The port cooperation index of two ports is a sub-index of the port connectivity index and computed as a ratio of the number of O-D pairs for two competing ports serving together to the total number of O-D pairs for ports in the network. With these two indices, they identify the hub competitiveness and cooperative relationships of major ports in Asia. One serious limitation of their study is that they use data from anonymous liners, which means that the method may not be applicable to other studies with no confidential data from liners.

Another approach is the network analysis method in Notteboom (2009), who investigates the number of calls of liners at major ports in Northern Europe and analyses the complementarity and substitutability of those ports. He assumes that two ports have a substitutable relationship if they are called simultaneously in the same loop, whereas they have a complementary relationship if neighbouring ports are called selectively in the loop. In addition, he computes the share of port calls and the hinterland market share of each port in the region and identifies the competitiveness of substitutable ports. However, his research is limited in that competitiveness cannot be compared across all ports considered.

Tsamourgelis et al. (2013) introduce the generalized method of moments (GMM) to evaluate the relationship between port throughput and GDP in the hinterland. With exogenous environmental variables such as world fleet development and transportation costs controlled for through appropriate proxy variables, they analyse the level of synchronicity between port throughput and GDP and examine the effects of trade intensity, world fleet development, and the transportation cost on this synchronicity, demonstrating a positive relationship between GDP and port throughput and thus suggesting that ports function as trade gateways for their hinterlands. However, their study does not focus on the competitiveness of a port itself, instead showing the competitiveness of port hinterlands.

3. Methodology and Data

3.1. *Methodology*

This paper takes a more direct approach to evaluate the competitiveness of ports by using a data set that is easier to collect than those in the literature.

As discussed earlier, previous studies have focused mainly on three fields: the efficiency of ports, port choice criteria of shippers and liners,

[1] These statistics are based on Pallis et al. (2010) and Pallis et al. (2011).