Trade Reorientation and its Effects on Regional Port Systems: The Korea-China Link along the Yellow Sea Rim

Jung-Yoon Lee \textsuperscript{a}, Jean-Paul Rodrigue \textsuperscript{b}

\textsuperscript{a} Department of Geography, Seoul National University, South Korea.
\textsuperscript{b} Department of Economics & Geography, Hofstra University, Hempstead, New York 11549, USA. E-mail: Jean-paul.Rodrigue@Hofstra.edu (corresponding author)

Abstract

Owing to its competitive labor costs, its open-market policy and a substantial amount of capital investments, China has become a global manufacturing pole and an export-based economy replicating the conventional Asian model, but at a much wider scale. This is creating acute competition on other Asian export-based economies such as Korea that have to adapt to the “China effect”. Consequently, many Korean manufacturing companies have repositioned their capital and equipments in China to enlarge their market potential as well as to reduce their production costs. Since Korea is adjacent to China – both are sharing the Yellow Sea Rim – this shift is creating a unique geographical dimension with a high level of functional integration of Sino-Korean manufacturing supply chains. This transition has also brought substantial changes in the regional logistic network by organizing new flows of raw materials, parts and final products, most of them along the Yellow Sea Rim. New logistic flows have given substantial influences on regional port competition by creating diverse links. These changes are bringing a reorientation of the regional maritime industry and of the port system.

Keywords: Korea, China, Global Production Networks, Logistics, Port Systems, Yellow Sea Rim.

1. Introduction

Over the last two decades, the rapid integration of China to the global economy has been one of the most significant processes impacting on global production networks. Owing to its competitive labor costs, its policy reforms and a substantial amount of capital investments, China has become a global manufacturing pole and an export-based economy replicating the conventional Asian model, but at a much wider scale and scope. The globalization of economic activities has fundamentally transformed the relationship between international production and trade (Dunning, 1993; Held et al., 1999; Dicken, 2003). Cross-border production activities coordinated by transnational corporations have not only deepened spatial divisions of labor, but also challenged our understanding of international trade patterns (Yeung, 2001). Many empirical researches in geography have shown that transnational production networks have taken place within a regional rather than a global context (Morrison et al., 1991; Levy, 1995; Kozul-Wright and Rowthorn, 1998; Poon et al. 2000).

\textsuperscript{1} The authors would like to thank anonymous referees for useful comments.
There is ample evidence supporting the reorientation of regional freight flows due to what can be appropriately called the “China effect”. Hong Kong was the first and probably the best known example of such a process. With the opening of the Shenzhen special economic zone in the early 1980s, a wave of investment followed in southern China, particularly along the Pearl River Delta, creating a new regional manufacturing system (e.g. Lin, 1997). The outcome was a symbiotic relationship between Chinese labor and resources and Hong Kong investments and global distribution potential (Chen, 1995). Hong Kong became an active logistical platform as goods were transshipped out of China to compete on global markets. A similar process took place with Taiwan, albeit somewhat complicated by geopolitics. Taiwanese investments and technological expertise poured in, mainly along the Yangtze Delta, to the extent that Taiwanese corporations operating in China account for a dominant share of China’s technological manufacturing. In the case of Taiwan, the reorientation favored the development of logistical functions along coastal central China, notably at Shanghai (Carruthers, Bajpai and Hummels, 2003). More recently and so far receiving less attention, Korean investments started pouring in China, following the familiar rationale of improving competitiveness through manufacturing costs reductions. On par with proximity factors that played in the trade reorientation of Hong Kong and Taiwan, Korea is reorganizing its production system within the Yellow Sea rim. However, unlike Hong Kong and Taiwan, this process implies a significant reorientation of its port system.

There are many factors that may impact on port system development. Issues such as port infrastructure development, concentration/de-concentration, regulation and competition have received a fair amount of attention (e.g. Robinson, 1998; Frankel, 1998; Wang and Slack, 2000; Loo and Hook, 2002; Slack and Wang, 2002; Comtois and Rimmer, 2004; Guo and Notteboom, 2004). Owing to China’s competitive push for global trade and its enormous influence on the world maritime market, East Asia has been a focus in regional port studies. Although these studies investigated the development of regional port systems, they have emphasized on the role and/or the strategies of maritime actors (e.g. shipping companies and/or port authorities), but have overlooked a fundamental and underlying rationale, trade itself, in port system development. The growth in freight volumes caused by regional trade used to be considered as an exogenous variable and, accordingly, other trade characteristics such as its nature, direction and the relationships between the involved countries have been overlooked. Especially, most studies about containerized freight have focused on its volume but a container, as its name indicates, is simply a box that contains a wide variety of goods. Without a more detailed understanding of the regional trade structure, inquiries in regional port systems would lead to partial assessments.

Previous inquiries on the development of the Chinese port system also did not pay much attention on its effect on the port systems of its trading partners. Although China can be considered as a single entity at the global scale, the impacts of mainland China’s growth on neighboring regions should be examined with more details. As Comtois and Rimmer (2004) mentioned, northern (Yellow Sea region) Chinese trade has been revived through increasing exchanges across the Yellow Sea with Korea and Japan. Therefore, the Korean port system which lies adjacent to the northern Chinese coast and the changes brought by the “China effect” need to be more closely understood in the context of economic growth and increased traffic over the Yellow Sea.
With globalization and its corresponding growth in regional freight flows, ports are increasingly been considered as nodes in global supply chains (Robinson 2002; Carbone and De Martino 2003; Notteboom and Rodrigue, 2005). According to Robinson (2002), the port is an element which delivers value to shippers and other third party service providers in the value driven chain. Moreover, as the time component remains one of the only major strategies left to achieve higher levels of productivity in freight distribution (Rodrigue, 2005), its importance in supply chain management has been more emphasized. Under such circumstances, shorter shipping times become a more important factor in sustaining an effective regional supply chain. Ports having locational advantages within a regional port system will have a greater growth potential. With the rapid economic integration of the Yellow Sea Rim, trans-Yellow Sea supply chains have began to trigger differential growth with the Korean port system.

The purpose of this paper is thus to give an assessment of the reorientation of South Korea’s trade and its impacts on the Korean port system.

2. Development of a Transnational Supply Chain between Korea and China

A Transition in Manufacturing

During the 1960s and 1970s, Korea had a very competitive manufacturing sector and was a typical example of an export-based economy, somewhat modeled after Japanese post-WWII development strategies. Based on cheap, plentiful, and skilled labor, the Korean economy developed many labor-intensive industries and accumulated a substantial amount of capital and technological expertise. The emergence of Korean multinational corporations (a.k.a. Cheabols) such as Samsung, Hyundai, Daewoo and LG is a good indication of such a process where a select group of corporations received preferential treatment, such as subsidies for exports, not unlike Japanese keireitsus. This economic success was based on successive waves of industrial accumulation towards higher level of capital and technical intensity. However, as labor costs increased in the 1990s, on par with the growing leverage of labor unions, Korean manufacturing gradually lost its international competitiveness. In this context, several Korean companies started to seek alternative production locations. China, geographically adjacent to Korea, became the preferred destination of this manufacturing exodus. This transition coincided with the much noticed entry of China on the global economy as well as with improved Sino-Korean relations.

Labor cost differences are certainly a powerful force shaping transnational investments and the case of Korea is not different in this respect. According to JETRO (Japan External Trade Organization, 2003), Korean minimum labor costs were about 7.6 times higher than Chinese labor in 2002. Besides the labor sector, Korean companies have several other costs disadvantages compared with China, mainly related to logistics and land costs. This is further substantiated by a survey of FKI (the Federation of Korean Industries) in 2003, which underlined the ongoing deindustrialization of Korea. In addition, a recent report from the IMD (International Institute for Management Development) also indicated that Chinese labor-management relations and the flexibility of its labor market are more advantageous than Korea (Table 1). This unfavorable comparative production environment has compelled
Korean companies to relocate segments of their manufacturing base, as their counterparts in North America, Western Europe and Japan did. Although the current situation underlines significant Chinese cost advantages, it does not reveal the efficiency and reliability of the underlying freight distribution system. China still has substantial limitations in transport capacity, forcing coastal industrialization nearby main port sites.

### Table 1: Industrial Competitiveness between Korea and China

<table>
<thead>
<tr>
<th>Country</th>
<th>Legal Minimum Wage/month</th>
<th>Average Labor Cost/hour&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Factory Land Cost&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Logistical Cost share in Total Sales&lt;sup&gt;1&lt;/sup&gt;</th>
<th>World Ranking of IMD National Competitiveness&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Manufacturing</td>
<td>Management</td>
<td></td>
<td>Relationship of Labor and Capital</td>
</tr>
<tr>
<td>Korea</td>
<td>$ 426.09</td>
<td>$ 7.75</td>
<td>$ 149/m²</td>
<td>8.75%</td>
<td>47</td>
</tr>
<tr>
<td>China</td>
<td>$ 56.18</td>
<td>$ 0.92</td>
<td>$ 1.15</td>
<td>4.67%</td>
<td>38</td>
</tr>
</tbody>
</table>

Sources: 1) JETRO (Japan External Trade organization, 2003); 2) FKI (Federation of Korean Industries, 2003); 3) IMD (International Institute for Management Development, The World Competitiveness Yearbook 2002)

Conventional international trade theory indicates that the main reasons manufacturing corporations undertake Foreign Direct Investments (FDI) are to improve their market potential as well as to reduce their production costs (Dunning, 1993; Dicken, 2003). This often takes place in several stages where factors behind the process may change; mainly from labor-intensive to technological-intensive. In the initial stage of the manufacturing transition, Korean activities tended to be focused on labor-intensive segments such as footwear and garment. This meant that the initial rationale of manufacturing investments lay in reducing production costs, a common pattern well explained by international trade theories (e.g. comparative advantages) and the setting of export oriented zones. However, as the Chinese market potential and the expertise of its labor expanded, Korean investments reached a technological-intensive stage. Thus, many additional manufacturing sectors such as electronics, metal and machinery industries embarked in this transition to improve their market share in China as well as to increase their global competitiveness using China as an export base, like their Taiwanese and Hong Kong counterparts did in their respective sectors of specialization. According to a recent survey of the top 700 Korean companies that invested in China in 2003 (FKI, 2004), market expansion was on par with cost reductions as the most important reason behind the decision to perform a manufacturing FDI (Figure 1).
Nature of Korean FDI in China

A geographical transition in manufacturing is often accompanied with an equivalent growth of FDI. An analysis of Korean FDI in China over the last 15 years is quite revealing (Figure 2). In 1991, China accounted for less than 4% ($42 million) of total Korean FDI, underlining the yet limited importance of China for then a fully globally geared and competitive export-based Korean economy. However, the 1990s saw a steady growth of Korean investments as diplomatic relations improved and the Open Door Policy started to bear fruits. International investments were starting to flood China as multinational corporations were positioning themselves in the fastest growing market in the world. Many realized that the Chinese market itself turned to be illusive but export-based opportunities thrived. The wave of Korean foreign investments in China was not uniform in time, their fluctuations corresponding to two major macro-economic events. The first was the financial crisis of 1997, which revealed throughout East and Southeast Asia over investment in many export sectors (automobile, electronics, etc.), and rampant real estate speculation. Debt and misallocation of capital triggered a retrenchment of FDI both in absolute and relative terms. Since its currency was devaluated, Korea gained in competitiveness and used its FDI to expand its exports to North America and Europe. China temporarily fell off favor.
The second macro-economic event that shifted the FDI landscape was China joining the WTO (World Trade Organization) in 2001. With the Chinese currency pegged to the US dollar since 1994 (China started de-pegging its currency in 2005), the temporary boost in Korean competitiveness ended as China was in a full export-oriented mode of its own using jointly low costs and monetary policy as opportunities for capital investment. A wave of Korean FDI in China followed. By 2004, Korean investments in China increased rapidly to $2.2 billion, accounting for about 38% of all Korean FDI.

Besides their rapid increase, another specific attribute of Korean FDI in China is their high orientation towards manufacturing. It is certainly not unusual to have manufacturing ranking first among FDI, but the very high allocation to manufacturing is something remarkable in this case. From 1989 to 2004, about 86% of Korean FDI in China accumulated in the manufacturing sector compared with figures of 59% for other foreign investors (1993-1998). During the same period, only 54% of Korean FDI bound to countries other than China went to manufacturing (Figure 3). This indicates that the current strategy of Korean enterprises is to use China as a manufacturing base with limited intention yet to penetrate the Chinese consumption market. The fact that Korean products have already high levels of market penetration in American and European markets reinforces this assertion.
The Korea-China Link

Manufacturing is thus the most important economic integration force between the two countries with the creation of several vertical production networks. This underlines a strategically focused rationale behind Korean investments and possibly, due to geographical proximity, the intention to maintain control of the supply chain and keep post-manufacturing logistical activities in Korea. Korean enterprises thus try to retain as much value added activities as possible in Korea. Furthermore, according to a survey by the Korean Federation of Small and Medium Business (KFSB, 2003), about 30% of Korean small and middle-sized manufacturing companies were seriously considering investment or equipment transition to China over the 2003-2008 period. Therefore, it is expected that the shift of manufacturing activities from Korea to China will accelerate and the transnational supply chain will become increasingly complex and to a fair extent mainly in control by Korean interests. The Yellow Sea Rim is thus experiencing the development of a new global production network focused on the China / Korea chain, which on one side relies on the expansion of the Chinese manufacturing base and on the other on the expansion of the Korean logistical base.

Geographical Proximity and the Importance of the Yellow Sea

The rapid industrialization of China has mainly been clustered along the coast, which has been the recipient of the majority of FDI. The development of China remains so far a coastal process, although inland provinces accounted for a growing share of manufacturing in very recent years. While most FDI tended to focus on the southern and eastern coastal provinces of China, Korean FDI shows a different geographical dynamic. Most of them take place along the Yellow Sea Rim, including Shandong, Jiangsu, Beijing, Tianjin, and Liaoning provinces. Southern and eastern coastal provinces such as Guangdong, Fujian, Zhejiang, and Shanghai accounted for about 50% of the accumulated international FDI, but the Korean share of investments in that region was much less; only 16% in 2004. On the opposite, the Yellow Sea Rim accounted for 76% of the total Korean FDI in China, a remarkable share compared to those performed by other countries (about 35%). This distribution pattern corresponds to a level of geographical proximity, where functional integration goes on par with geographical integration (Figure 4). Thus, the Yellow Sea Rim is the most important sphere in the process of a bilateral (Sino-Korean) economic integration, its issuing global production network and the focus of most supply chain movements.
3. Korean Trade Re-orientation

Effects of Transnational Supply Chains on Regional Freight Demand

FDI usually bring substantial changes in regional logistic networks by organizing new flows of raw materials, parts, and final products. Frankel and Wei (1996) underlined the relationships between FDI and trade over three major points. First, FDI can lead to higher exports from the source country (FDI origin) to the host country (FDI destination), especially when the investment is in the retail sector, or when a subsidiary has the potential to import intermediate inputs from the source country. Second, FDI can lower exports from the source to the host, when the aim of the investment is to circumvent trade barriers, so that sales within the host market substitute for shipments from the source country. Finally, FDI can lead to higher imports from the host country to the source country, especially when the rationale for the FDI was to take advantage of cheap labor in manufacturing or of raw materials in extractive industries.

Due to its complex effects on bilateral trade, it is very difficult to generalize the impacts of FDI on regional freight flows. However, they could be considered as direct and indirect. While the former indicates traffic volume and direction changes caused by manufacturing transition, the later implies several related influences such as the adaptation of freight forwarders and shipping networks. Figure 5 illustrates a simple example of the impacts of a FDI-based transition on supply chains at the regional level, much in light of the situation along the Yellow Sea. Several shifts in freight flows take place as production facilities are relocated from the source country (Korea) to the host country (China), including raw materials, energy, parts, and final products.
Figure 5: Regional Supply Chain Changes due to Manufacturing Transition

It can be assumed that: 1) the commodity chain consists of several parts which have differential technical levels and the volume remains similar after the transition (this volume, however, tends to increase in most cases); 2) raw materials and energy are mainly provided by third regions, 3) the general technical level of the source country is higher than that of host country. This leads to three major outcomes:

- First, most of raw materials and energy flows related to the commodity chain would shift. Although the source country still needs some materials and energy for technical parts, this shift would bring a decline in its imports, compensated by an increase of imports at the host country. However, the overall regional flows would remain relatively unchanged.

- Second, among final products flows, exports to other countries might have a similar transition pattern as those of raw materials and energy flows. Exports from Korea would be substituted by new exports and domestic flows from China. Meanwhile, re-imports towards Korea would increase regional freight volumes. These demands are mainly for domestic sales in Korea, but some of them might be re-exported to other markets after value-added activities such as labeling and packaging.

- Finally, a complex regional supply chain would emerge. While labor-intensive parts flows from China might decrease, new technical parts flows from Korea would increase. The share between labor-intensive (decreasing factor) and technical parts (increasing factor) would vary according to the type of goods resulting in a wide array of freight flows. However, this transition would favor an increase of traffic because the new supply chains are mainly controlled by the interests of the source country. Many final products do not necessarily require labor-intensive parts but most of them usually need a substantial amount of technical parts which are produced by established subsidiary networks in the source country.

As Morrison and Roth (1992) underlined, regional-scale manufacturing allows for faster delivery, greater customization and smaller inventories than would be possible under a globally-oriented supply chain. In this context, the geographical proximity between Korea
and China and their role in the World economy are a driving force to create substantial regional freight flows.

The “China Effect” on Korean Trade

In the first stages of Chinese industrialization in the late 1980s and early 1990s, southern China provinces, especially the Pearl River Delta, were the major core of accumulation. At that time, the “China effect” caused by trade reorientation did not impact much on the regional logistical flows and the Korean port system. The Pearl River Delta is not far from the established Korean trade routes to Southeast Asia, the Middle East and Europe, so any growth of the traffic would simply imply additional port calls, but no changes in the destination port; Busan. However, Chinese industrialization was heading north along the coast with Shanghai becoming the new economic hub of the mid 1990s (the Pudong special economic zone opened in 1992). Development is now moving towards the Yellow Sea rim where there has been limited trade with Korea before.

While China accounted for only 2.9% of the total Korean trade in 1991, a manufacturing transition increased this figure substantially during the 1990s with the strengthening of transnational supply chains along the Yellow Sea Rim. With the admittance of China to the WTO, Sino-Korean economic integration accelerated, as the advantages of geographical proximity coupled with cost differences could finally be realized. Korean trade with China increased at a rate significantly faster than with its other trade partners. As a result, in 2003 China overtook Japan and the United States to become Korea’s most important trade partner (Figure 6).

From the point of view of Korea, this implies a considerable reorientation of global trade flows from the East (United States, Japan) to the West (China), a process that took place in about a decade. It is uncommon in international trade history to see such a rapid and
radical shift in the orientation of national trade outside any significant and disruptive political events such as wars or trade embargos. This observation alone provides substantial evidence of the scale of scope of the “China effect” on Korean trade and the latent economic forces that have been unleashed. Although this necessarily means neither an absolute weakening nor the demise of relationships with traditional trade partners, it remains a very significant event in the evolution of Korean trade.

The importance of regional proximity in mutual trade can be verified by examining the share of each Chinese province in global and Korean trade. In doing so, it is possible to find which provinces are more closely related to Korea than to other countries (Figure 7). Provinces where Korean trade dominates are adjacent to the Yellow Sea, with Hebei as an exception. Because of a relative economic concentration along the Beijing-Tianjin corridor, Hebei province has received much less Korean FDI that its geographical proximity would suggest (Figure 8). This is mainly explained by the shadow effect induced by Beijing-Tianjin corridor. Geographical proximity matters much as the location of Korea confers ‘gatekeeper’ or ‘neighborhood’ benefits in the Chinese Trade. This underlines the importance of Yellow Sea logistics to support these trade flows.

Given this circumstance, the conventional Korean port system which has been designed and developed for eastbound and/or transpacific trade, confronts a new reorientation with the extension of supply chains across the Yellow Sea. Considering that the United States and Japan are still major trade partners and that China is too large to be regarded as a single entity, the “China Effect” on the conventional Korean port system needs to be examined in more details.

4. Changes in the Korean Port System

The Conventional Port System
Because the United States and Japan have been the most important trade partners during the later half of the 20th century, an outcome of colonial trade with Japan and of the United States and United Nations assisted reconstruction after the Korean War, Korea has developed its port system mainly along the southeastern coast, which has the proximity advantage, notably towards Japan. This location was favored by the need of the Korean economy to import larger quantities of energy and raw materials from abroad (Middle East, Australia / Southeast Asia, North America) since its national economy lacks many strategic resources. Under military threat by North Korea during the Cold War, the southeastern coast was also a national strategic choice for protection. The development of the Korean heavy industrial sector, such as oil refineries, petrochemistry, iron/steel manufacturing and shipbuilding, could not have occurred otherwise.

The Korean Yellow Sea rim did not see much dynamism during the post Korean War era. Before that, Southern Yellow Sea ports such as Kunsan and Mokpo had been very active because of the agricultural potential of their hinterland and of a well-organized system of coastal trade. Besides the ancient trade with China, the colonial period that lasted until the first half of the 20th century was the peak period of these ports as gateways of grain exports to Japan. Inchon, which has the largest hinterland in Korea, prospered under Japanese colonization. However, after the end of the Japanese occupation and of the Korean War, the agricultural hinterland of the Korean Yellow Sea ports could not attract new trade. The deteriorating regional geopolitical context prevented their development. Despite of close proximity, a political barrier set during the Cold War hindered Sino-Korean economic relations until the early 1990s. While history and geography has favored the integration of the Yellow Sea Rim, geopolitical considerations prevented its development until recently.

Furthermore, natural constraints, namely to be amongst the highest tidal ranges in the world, impair modern port operations. This required additional investment in port infrastructures to cope with this constraint while maintaining appropriate and constant depth. The lock gate at Inchon and the floating pier at Kunsan are good examples on these requirements. Despite of these efforts, unfavorable natural conditions still remain a significant obstacle to port development. Maritime shippers calling to Yellow Sea Rim ports must consider these potential delays and additional costs, factors impairing port competitiveness.

Given these circumstances, southeastern ports, especially Busan, had a prominent and unmitigated position in the Korean port system until recently. Figure 8 illustrates well this conventional situation with limited transshipment activities along the west coast. In the early 1990s, most freights flows were handled at Busan. Yellow Sea ports (Inchon, Pyeongtaek, Kunsan and others) handled less than 10% of the total trade. This port system has been developed in relation with the industrial spatial structure. The Seoul Metropolitan Area (SMA) has traditionally been the most industrialized region as well as the Korea’s largest market, followed by the industrial belt of the southeast. Population distribution and other socio-economic activities in Korea follow a similar pattern. Although this port system inevitably created a corridor of long distance inland flows from the SMA to the southeast industrial belt, it might have been the best solution considering the nature of Korean trade and the corresponding industrial spatial structure. However, from that point, the Korean port system started to be challenged by a substantial reorientation of its trade flows.
Yellow Sea container throughput based on three major ports (Qingdao, Tianjin, and Dalian) increased to about 8.9 million TEU in 2003 (Containerization International Yearbook, 2004). This is 15.2 times more that in 1990. During the same time period, global container flows grew only 1.7 times, underlining the fast growth the Chinese Yellow Sea rim. Owing to the competitive push from China and the Yellow Sea Rim for global trade, Korean container throughput grew 5.4 times during last 15 years. This growth is jointly the outcome of regional trade but also of Chinese transshipments at Korean ports.

**Challenges to the Conventional Port System**

As a consequence of the fast export-oriented economic growth of China, the regional shipping market in Northeast Asia expanded. Busan which is the core of the Korean port system has played a role as a regional hub because of being one of the most suitable locations in Northeast Asia as well as being well-equipped with deep port facilities. Busan has attracted major shipping calls from all around world and has developed diverse regional feeder lines with China as well as with Japan. Therefore, transshipment flows at Busan accounted for 41.7% of its total container throughput in 2004. Most of these flows involve nearby ports (Yellow Sea and Japan). Under such circumstances, a dominant share of the Korean trade, except bulk freight, used to be allocated to Busan, benefiting from economies of scale. Meanwhile, bulk freight such as crude oil, iron ore and steel was allocated to other
eastern and southern coast ports such as Ulsan, Yosu and Pohang because of strategic considerations related to fostering heavy industries and promoting national security.

Busan has certainly been the most competitive port in Korea but this competitiveness may not apply to regional trade flows. The high accessibility of Busan to world markets is not necessarily an advantage in bilateral direct trade with China. As regional trade along the Yellow Sea Rim increased, the prominence of Busan in the port system started to be challenged by this reorientation. There are two main causes behind this change. One is a shipping distance problem and the other is inefficient inland logistics.

From a shipping distance point of view, Busan does not have much trade advantages with Yellow Sea Chinese ports compared with Inchon, the most important Yellow Sea gateway in Korea. Shorter shipping distances could provide frequent services between ports, enabling freight forwarders to have higher turnover levels for their trans-Yellow Sea operations. It means that Yellow Sea ports have substantial advantage of regional trade with (Northern) China as time based considerations come into play.

A more serious problem of Busan in Yellow Sea trade is related to its inefficient inland logistics within Korea, an outcome of spatial differences in industrial and market distribution. The Seoul Metropolitan Area (SMA), about 400 km from Busan, accounts for more than half of the total Korean economy in terms of manufacturing and demographic size. Using Busan instead of Inchon involves additional inland transport costs of about $681 per TEU\(^2\) and delays of at least two days. This undermines Busan’s competitiveness within the emerging Sino-Korean supply chain. Freight forwarders wishing to trade along the Yellow Sea rim have constantly required new regional direct shipping services. As a result, Korean Yellow Sea ports which had been so far ignored have started to attract the attention of several shipping lines.

**Shipping Network Development along the Yellow Sea**

The first freight link between Korea and China was established in 1989; a pendulum service connecting Busan to several Chinese ports such as Shanghai, Tianjin and Dalian. It irregularly called Inchon, but this port call was soon suspended because of its small volume and the emergence of independent trans-Yellow Sea shipping services, which were launched after 1990. The first service consisted of a simple path between Inchon and Weihai, Shandong province, the shortest distance between a Chinese and a Korean port. Because Weihai is located at the edge of the Shandong peninsula, only 440 km (238 nautical miles) away from Inchon, shipping time was about 14 hours. Therefore, this service was well received among the first users.

After this initial success, other trans-Yellow Sea shipping services were expanded to major ports along the region. Tianjin (1991), Qingdao (1993), Dalian (1995) and Dandong (1998) were gradually linked with Inchon and another line from Busan was initiated to link Kunsan to Yantai (1994). However, these direct shuttle services operated by ferry ships could not cope with increasing freight demands. Despite of their frequent services, 2 or 3

---

\(^2\) The round trip fares for 1TEU-FCL (20 foot Equivalent Unit-Full Container Load) are as follows; Busan-Seoul: $854, Inchon-Seoul: $173 (source: [www.schedulebank.co.kr](http://www.schedulebank.co.kr), 1USD = 1,000 Won)
round trips per week, a single ship could only carry about 250 TEU. Owing to small capacities and a lack of specialization towards freight-only services, there were no economies of scale in handling freight.

Trans-Yellow Sea services created a unique trade pattern performed by ‘parcel dealers’; wholesale or small-scale merchants who mainly export good-quality garments, cosmetics and small-size electronics from Korea. They also import substantial quantities of agricultural products, medicinal herbs and inexpensive manufacturing goods such as toys, low-price garments and electronics from China. Despite of their contribution to bilateral trade using these shipping services, the role of trans-Yellow Sea lines was mainly one of passenger ferries rather than of freight carriers. In particular, ferries were the only form of direct passenger transportation between Korea and China at that time, as direct air passenger services only stared in 1994.

Given this circumstance, most of the bilateral freight flows on the Yellow Sea went through Busan until the late 1990s. However, as the trans-Yellow Sea supply chain was consolidated, pressing needs for specialized container shipping services were felt. It was not until 2000 that a regionally focused specialized container shipping services started to operate. The first service was launched between Pyeongtaek, a subsidiary gateway of SMA, and Qingdao. Some additional connections from Pyeongtaek to Tianjin (2001), Dalian (2001) and Shanghai (2002) soon followed. The main reason why these services started from Pyeongtaek instead of Inchon, a more direct and logical choice, was that ferry companies which controlled trans-Yellow Sea routes did not want to compete with container shipping lines. They thus delayed the entry of freight only services calling from Inchon. However, political considerations favoring ferry companies could only delay, not prevent Yellow Sea container shipping from Inchon. In 2003, after launching the first service to Qingdao, a total of six supplementary freight-only lines from Inchon to the Chinese Yellow Sea ports of Weihai, Yantai, Dalian, Tianjin, Dandong, and Shanghai were created.

Figure 9 illustrates the development of a regional shipping network among Yellow Sea ports from 1990 to 2004. Most container shipping lines as well as ferry services were developed to service the SMA with the outcome being a hub-and-spoke system. This process indicates that Inchon, the major gateway of SMA, has benefited the most and Pyeongtaek, the new subsidiary gateway, seems to have created its own niche market. However, minor ports which did not have good hinterland such as Kunsan and Mokpo failed to acquire sufficient regular port calls from this emerging maritime distribution system.

Based on market size, it is clear that there is a big gap between ports in attracting shipping services. In other words, network development among Yellow Sea ports reflects the condition of their hinterland. However, the strengthening of the Yellow Sea shipping network does not necessarily imply the weakening of the regional freight traffic from Busan. Besides these trans-Yellow Sea connections, Busan still has the largest and most diverse service lines to China, including the Yellow Sea region. This is caused by its prevailing locational advantage in the Korean trade with Southern China as well as the volume of its own hinterland. As the trans-Yellow Sea network expanded, so did the main network from Busan. Accordingly, the recent intensification of trans-Yellow Sea connections should be understood as an additional expansion due to the integrated supply chain between SMA and
China. As long as the regional economy becomes more integrated, the regional shipping market will grow and the shipping network will expand. It is not a zero-sum game of competition between regional ports but a new fundamental restructuring of the regional port system to accommodate an emerging production network and its additional freight flows.

Figure 5: Regional Shipping Network Development of the Korean Yellow Sea Ports (1990-2004)

**Differential Port Growth of the Korean Port System**

In accordance with the development of the trans-Yellow Sea network, the role of Yellow Sea ports in the Korean trade with China expanded as well. In particular, specialized container services brought a substantial change in the characteristic of freight trade. In the case of Inchon, conventional trade items with China mainly involved bulk cargo such as steel and minerals which were usually transported by unscheduled cargo vessels. However, as containerized cargo experienced a remarkable growth, the portion of bulk freight in the trans-Yellow Sea trade decreased rapidly. As a result, the current major trade items have changed to high value goods such as electronic equipments and machinery (Table 2). The containerization of the trans-Yellow Sea network has become the backbone of the intensification of the Korea-China manufacturing supply chain.
Table 2: Changes in the Main Items of Trade with China at Inchon Port (1995 vs. 2004)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Iron and Steel</td>
<td>16.1%</td>
<td>Raw hide and Skins, Leather 19.5%</td>
<td>Iron and Steel 28.5%</td>
</tr>
<tr>
<td>2</td>
<td>Mineral Fuel, oil, and waxes</td>
<td>12.4%</td>
<td>Electronic Equipments and Parts 14.6%</td>
<td>Mineral Fuel, oil and Waxes 15.5%</td>
</tr>
<tr>
<td>3</td>
<td>Electronic Equipments and parts</td>
<td>11.8%</td>
<td>Mineral Fuel, oil, and waxes 9.3%</td>
<td>Electronic Equipments and parts 9.1%</td>
</tr>
<tr>
<td>4</td>
<td>Raw hide and skins, Leather</td>
<td>9.9%</td>
<td>Reactor, Boiler and Machinery 8.0%</td>
<td>Residues and waste from Food Industries, prepared Animal Fodder 4.0%</td>
</tr>
<tr>
<td>5</td>
<td>Reactor, Boiler and Machinery</td>
<td>4.3%</td>
<td>Knitted or Crocheted Fabrics 4.4%</td>
<td>Apparel and Clothing Accessories, not knitted or crocheted 3.9%</td>
</tr>
<tr>
<td></td>
<td>Total U.S. $ 3,186 million</td>
<td>100%</td>
<td>$ 1,579 million 100%</td>
<td>$ 1,607 million 100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank</th>
<th>Total 2004</th>
<th>Share 2004</th>
<th>Export Share 2004</th>
<th>Import Share 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electronic Equipments and parts</td>
<td>20.0%</td>
<td>Electronic Equipments and Parts 22.5%</td>
<td>Electronic Equipments and parts 17.9%</td>
</tr>
<tr>
<td>2</td>
<td>Reactor, Boiler and Machinery</td>
<td>9.5%</td>
<td>Reactor, Boiler and Machinery 13.6%</td>
<td>Apparel and Clothing Accessories, not knitted or crocheted 13.1%</td>
</tr>
<tr>
<td>3</td>
<td>Apparel and clothing accessories</td>
<td>7.9%</td>
<td>Optical, Photo/cinema-graphic, measuring, checking, precision, medical apparatus and parts 9.8%</td>
<td>Iron and Steel 11.5%</td>
</tr>
<tr>
<td>4</td>
<td>Iron and Steel</td>
<td>7.8%</td>
<td>Knitted or Crocheted Fabrics 5.8%</td>
<td>Apparel and Clothing Accessories, knitted or crocheted 6.7%</td>
</tr>
<tr>
<td>5</td>
<td>Optical, Photo/cinema-graphic, measuring, checking, precision, medical apparatus and parts</td>
<td>5.1%</td>
<td>Plastics and Articles thereof 5.5%</td>
<td>Aluminum and Articles thereof 6.4%</td>
</tr>
<tr>
<td></td>
<td>Total U.S. $ 13,167 million</td>
<td>100%</td>
<td>$ 6,205 million 100%</td>
<td>$ 6,962 million 100%</td>
</tr>
</tbody>
</table>

Note: Top 5 trade items between Korea and China
Source: KITA (Korea International Trade Association)

In 1995, when there was only ferry and unscheduled bulk services, Yellow Sea ports accounted for 22.6% of the total Korean maritime trade with China. However, this share climbed to 29.1% in 2000 and to 32.2% in 2004 (Figure 10). The recent decoupling to the advantage of imports provides additional evidence in the emergence of a commodity chain where China performs manufacturing and Korea logistical activities. Commodity-wise, high value containerized trade has been the major underlying factor behind the growth of Yellow Sea ports. According to the intensification of transnational supply chains between the two countries, it is expected that this share will increase. This differential port growth caused by the “China effect” has become the most significant rationale behind the changes in the Korean port system.
Increased bulk trade with China has also been a significant growth factor for Yellow Sea ports. Although its share of the total trade has declined, trans-Yellow Sea bulk freight flows has increased rapidly from 1995 to 2004. In the case of SMA ports, iron and steel, which were the most traded commodities in 1995, increased 4.1 times by 2004. Meanwhile, despite of their poor regular connections, other Yellow Sea ports such as Kunsan and Mokpo have found niche bulk markets as well. Corn, cement and silica at Kunsan, bituminous coal at Mokpo became new major commodities for the Chinese trade. Although these minor ports did not grow as much as SMA ports because of their weak hinterlands, the pace of their growth is much higher than any other minor ports in Korea. Their trade with China increased 2.1 times (Kunsan) and 5.0 times (Mokpo) during the same period.

The fast growth of Daesan has been one of most notable events underlining the “China effects” on the Korean port system. The conventional Korean oil refinery and petrochemical complexes dominated the southeastern region. However, the new Yellow Sea petrochemical complex at Daesan which was opened in 1991, reflects well the new economic regionalization. Although it has been mainly based on the needs of the SMA market, the easing of Cold War tensions and the expectation to take advantage of the Chinese market have promoted this locational change. Daesan has become a major center of petro-chemical trade with China increasing from $192 million to $2,133 million between 1995 and 2004 (11.1 times), accounting for 67.0% of its trade in 2004. This share is very high compared to other petro-chemical export ports such as Yosu (37.7%) and Ulsan (47.9%), underlining the locational advantage of Daesan in the trans-Yellow Sea trade.
As a result, the conventional port system which was dominantly Busan-oriented has experienced a shift since 1990 (Figure 11). In 1991, Busan accounted for 67.3% of the Korean maritime trade. However the “China effect” contributed to a decline in this share down to 45.9% by 2004. Meanwhile the relative importance of the Yellow Sea ports doubled. This shift is also the outcome of the growth of energy-related ports such as Ulsan, Yosu and especially Daesan.

5. Conclusion: A New Equilibrium in the Korean Port System and its Implications

This paper underlined that the reorientation of Korean trade caused by the “China effect”, especially the growth and expansion of trans-Yellow Sea supply chains, is the main factor behind recent changes and differential port growth in the Korean port system. In this context, economic regionalization and trade reorientation can be considered as new explanatory conditions for examining the development of regional port systems. This is a shift away from the conventional perspective related to Korean ports mainly acting as export gateways. They are now acting, notably Yellow Sea rim ports, as important nodes in the Sino-Korean segments of global production networks.

More complex global production networks and a sophistication of products has expanded regional intermodal freight flows along the Yellow Sea Rim. The differential growth in the Korean port system is related to the respective conditions of their hinterland. This inequality underlines that the hinterland is one of the most crucial factors in port growth, an assertion supported by conventional geographical theory in port economics. On the opposite, minor ports that do not have much of an hinterland do not get much benefits.
from the new regional economic environment. However, they tend to find a niche markets such as bulk freight. Consequently, it is expected that a shift of the Korean port system will take place on par with its integration to the Yellow Sea Rim economy.

The emerging regional economic environment centered around China will foster the Korean port system to achieve a new equilibrium. Owing to intensified trans-Yellow Sea supply chains and the increasing Chinese intermodal needs at Inchon airport, the traffic handled by Korean Yellow Sea ports, especially in the vicinity of SMA (Incheon, Pyeongtaek) and Daesan ports, will continue to grow. This challenges the primacy of Busan. However, the extent to which this primacy will change is difficult to assess because Busan still has a significant hinterland and a gateway location for global and regional trade, with the exception of Northern China. In this context Busan will still benefit from the growth of Northeast Asian maritime traffic.

References


KFSB (2003) Investigation of Production Facilities Overseas Transition by the Korean Small and Medium Manufacturing Companies (Korean) [http://www.kfsb.or.kr](http://www.kfsb.or.kr)


