

Post-Panamax-effects on Major U.S. Ports

Jonghoon Park* and JiYoung Park**

ABSTRACT

The role of large U.S. port cities has been affected by mega transportation infrastructure, such as seaports or navigable ports through rivers or lakes. Adapting to the globalization process, which has brought speedier changes, requires developing strategic operation in order for port management to survive in the internationally competitive urban systems. The port-dependent urban areas need to integrate their economic activities into the scope and complexity of city services and commodity activities in order to convey international trade more efficiently. This paper delivers what components need to be considered to understand the maritime shipping route changes and what types of methods have been applied to measure the changes from the Panama Canal expansion. While it is still important to build a sophisticated state-of-the-art model to conduct empirical analysis, this paper only discusses what the expected changes would occur on both the West Coast and South East Coast ports, specifically the Port of New York and New Jersey (PNYNJ) with various limitations. Simultaneous responses to the economic impacts on the other states of the U.S. made it difficult to forecast the economic effects on PNYNJ of the Panama Canal expansion. While the West Coast ports or major ports in Southeast Asia may experience a potential reduction in trade volume, they may inversely improve the utility of these ports; still, it is not easy to predict the change quantifiably. The international port authorities and policy makers, at national and local levels, who are responsible for developing seaport plans on the new realities of the Canal expansion and in the context of global maritime shipping, also need to understand changes in various inter-connected behaviors related to shipping, trucking and rail-related companies. This is because these behaviors may affect the choice of logistics, labor costs, and the status of economic and transport hubs. Finally, this study demonstrates the necessity of developing plausible scenarios that account for the investment strategy of the PNYNJ.

Keyword: Post-Panamax-effects, Panama Canal expansion, maritime shipping, economic impact, Port of New York and New Jersey

* Ph.D. Candidate, Program in Regional Information, Department of Agricultural Economics and Rural Development, Seoul National University

** Associate Professor, Department of Urban and Regional Planning, University at Buffalo
228 Hayes Hall, Buffalo, NY 14214-3087, Tel: 716-829-5331, Fax: 716-829-3256, E-mail: jp292@buffalo.edu

1. INTRODUCTION

The role of many U.S. cities has been critically affected by large transportation infrastructure, such as seaports or navigable ports through rivers or lakes (Park and Park, 2016). To improve or maintain the economic positions of port cities, various labor-oriented facilities are important because they generate domestic- and foreign-jobs and participate in the international marketplace successfully (Rondinelli et al., 1998). Indeed, adapting to the speedy changes of the globalization process requires developing strategic operation in order for port management to survive in the internationally competitive urban systems. Port-dependent urban areas need to integrate economic activities into the scope and complexity of city services and commodity activities, so that port cities can engage in international trade efficiently. By doing so, strong urban agglomeration would appear, and hence, would lead to technological innovation to grow the city.

Understanding the expansion of the Panama Canal can provide how a global trade facility could affect various countries and U.S. states. Since the Panama Canal Authority decided to invest the Canal expansion in 2006 in order to increase container shipment capacity, the newly expanded canal is now accommodating larger post-Panamax vessels of 13,000 TEUs that could not traverse the facility earlier. Along with the capacity expansion, the Panama Canal expansion project is expected to impact U.S. water and ground carriers significantly, including transportation networks and systems relating to cargo distribution, port development, supply chains, and logistics especially for the North American East Coast ports (Park and Park, 2016). It is highly expected to induce a larger flow of container trade between Northeast Asian countries and the U.S., and shift the congestion experienced in the West Coast ports (WCPs) to the East or Gulf of Mexico ports.

Many trade flows in cross-continental trucking and railway networks are expected to change as a result of the Canal expansion. At the same time, it is important to consider how much the traffic and congestion in the ports prior to the expansion could be reduced. For example, WCPs of the U.S. will become less busy due to the increased freight shares of the East Coast and Gulf ports of the U.S., resulting in the better operability among WCPs. Another point worth considering is the global port locations and the use of the expanded Panama Canal. Still, several major Southeast Asian container ports, including the Port of Singapore, may sail via the Suez Canal because the sailing routes are closer to the northeastern American ports. For example, considering the Port of Singapore is the busiest transshipping port as well as the second largest tonnage port, it is also necessary to investigate if the enlarged canal may threaten the current sailing route choices of transshipping and/or the shipping volume via the Port of Singapore or other Southeast Asian ports. This is because many competitive contexts are involved in forecasting the future of ports in the Southeast Asian region.

The reduced volume of trade to use the WCPs or Southeast Asian ports will greatly improve the utility to use these ports, although it is not easy to predict the change quantifiably. This paper introduces which components need to be considered

to understand the maritime shipping route changes and what type of methods have been applied to measure the post-Panamax-effects. The international port authorities and policy makers, at national and local levels, who are responsible for developing seaport plans for the new realities of the Canal expansion and the global maritime shipping context, also need to understand changes in various inter-connected behaviors related to shipping, trucking and rail-related companies. This is because these behaviors may eventually affect the choice of logistics and their labor costs, and the transport and economic hub status that was maintained via traditional port development strategies. Along with studies that analyzed various port impacts (Park et al., 2014; Park and Park, 2016; Richardson et al., 2017), this study focuses on plausible impacts on the Port of New York and New Jersey (PNYNJ).

2. BACKGROUND

2.1 The Panama Canal and the Recent Trade History of U.S. Ports

Before introducing various economic impacts of the widening of the Panama Canal on the ports of the U.S., it first needs to overview the history of the Panama Canal and the Canal's development. The Panama Canal was built in 1914 and originally planned to re-open in 2006 to celebrate its 100th anniversary in 2014. The Canal was supported by the rationale that the only 48-mile waterway connecting the Pacific and the Atlantic Ocean could avoid the 8,000-mile waterway sometimes resulting in hazardous travel around South America.

Although the construction period had experienced several physical and financial impediments, the Canal construction remains one of the largest projects in the world history. The excavation of the Canal that started in the early 1880s by a French company could be begun constructing in 1904 by American ownership. In the early years of construction, fatal infectious diseases were the potential risk. Another risk was to dig a ditch through desert sand, causing huge costs for canal locks to accommodate height differences. Based on the rapid improvement in engineering and medical components, both risks have been resolved. A reason supporting to construct the Canal was its influence on the city economies trading via WCPs. After some political conflicts between Panama and the U.S. in 1999, Panama and Panama Canal Authority could completely manage the Canal. In 2007, the project plan to widen and deepen the Panama Canal started. The estimated cost was about \$5.2 billion. The post-Panamax size was to double the potential size of the Pana-Max tankers at least (Richardson et al., 2017).

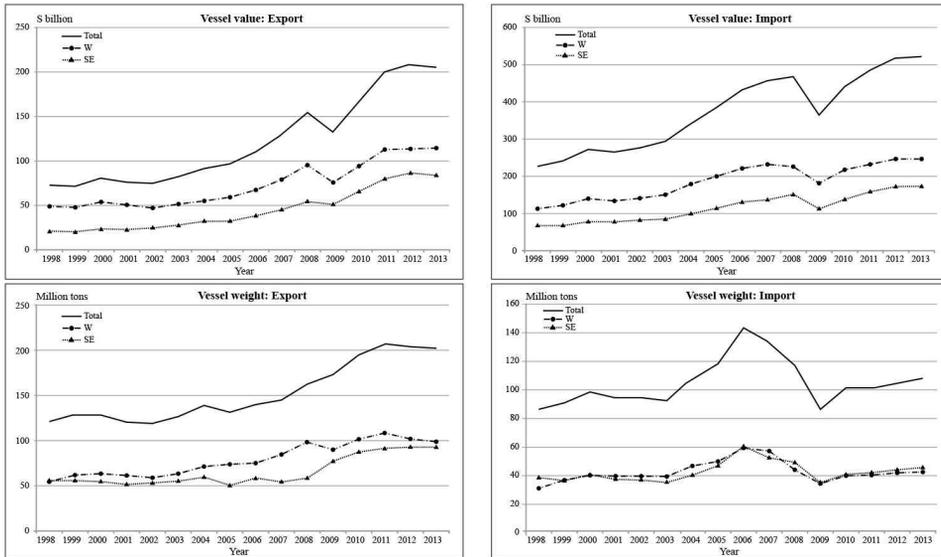
Because most U.S. ports will be affected by the Canal expansion, it would be important to overview the history of major U.S. WCPs, focusing on the changes in recent trade of U.S. ports and some statistics that help forecast the future trade of the ports. Figure 1 depicts the general trade history of U.S. ports. Based on dollar and tonnage values of exports and imports for U.S. ports, the entire U.S. export patterns have increased consistently except in 2009 when dollar values dropped down

due to the economic recession, but rebounded instantly in 2010 to the level greater than 2008 (Richardson et al., 2017). Because WCPs and South and East Coast ports (SECPs) are expected to be differently affected, additional detailed trade patterns were suggested.

The trade value pattern of WCPs in the graph is similar to the pattern of total trade value of both foreign exports and imports. SECPs increase consistently in exports while they still experience a similar drop in imports in 2009. Consistently, dollar values of the WCPs are greater than those of the SECPs. Based on the weight patterns that are somewhat different from the value patterns, the total weight pattern in foreign exports has constantly increased since 2005. However, the weight of foreign imports curved down from 2006 and could not recover to the 2006 level. Interestingly, there have been consistent gaps between the WCPs and the SECPs in dollar values for both imports and exports; however, the weight pattern of foreign imports between the WCPs and the SECPs is close for the given years while the export weight pattern of the WCPs is still greater than that of the SECPs.

According to the American Association of Port Authorities (AAPA) which is the primary data source of port statistics (www.aapa-ports.org), rankings of top ten ports varied by types of cargo. In this study, only top three leaders were suggested in three main categories for the year of 2011; tankers, containers, and dry bulk. For vessel calls by tankers, Houston, New York-New Jersey, and Los Angeles were the top three. For container ships, the three leading ports were Los Angeles-Long Beach, New York-New Jersey, and San Francisco. However, the dry bulk carrier leaders were very different and New York-New Jersey was not included even in the top seven ports. Considering all trade, the three leading ports were Houston, Los Angeles-Long Beach, New York-New Jersey. In terms of trade dollar ranking, Los Angeles-Long Beach, Houston, and New York-New Jersey were the top three leaders, respectively recording \$382 billion, \$243 billion, and \$208 billion out of \$1,729 billion for the total U.S. value of foreign trade.

Figure 1. The Change of trade value and weight patterns of West Coast ports and Southeast Coast ports in the U.S.



Notes: 1. Total = All U.S. ports
 2. W = Customs Districts of Columbia-Snake, Los Angeles, San Francisco, and Seattle
 3. SE = Customs Districts of Baltimore, Charleston, Houston/Galveston, Miami, Mobile, New Orleans, New York City, Norfolk, Philadelphia, Savannah, and Tampa
Source: Richardson et al. (2017)

Furthermore, port calls by post-Panamax vessels increased by 78% between 2006 and 2011, generating the increased share of larger than 5,000 TEUs by 10% from 17% for the same period. In addition, ships' age was becoming younger on average; from 11.2 years in 2006 to 9.7 years in 2011. Finally, the ranking of U.S. share of global vessel calls was second, accounting for 7.3% in 2011 behind China; Japan, Singapore, South Korea, and Brazil followed in the global share of vessel calls. From these facts, it would be important to understand global port strategies including New York-New Jersey ports in liaison with the Panama Canal expansion. Various discussions on the impacts affecting Los Angeles-Long Beach can refer to Richardson et al. (2017). They well explain the history of the twin ports of Los Angeles-Long Beach, which are separately managed but the largest seaport complex in the U.S.

2.2 The New York and New Jersey Seaport

New York City (NYC) is located on the East Coast of the U.S., and connected to the river of which condition is easy to collect and distribute trade goods and cargo for a long distance. The NYC's geographical advantage has contributed to generating the economic gain of the city and growing as a trading city. Historically, New York State benefited from the Hudson River and the Atlantic Ocean. The Erie Canal construction was finalized in 1825, which linked directly NYC with the Great Lakes.

This Canal allowed inland ports and producers to load and carry goods far distant more quickly and cheaply, reducing freight costs from 20 to 1.5 cents per ton mile (O'Sullivan, 2009).

NYC could be considerably advantageous in trading by being placed as an ocean-going port accessible via water from various ports located in the Great Lakes. NYC could be greatly thrived due to the port capacity supplying the city and the neighboring regions of the U.S. with goods produced across the country. Both the transportation advantages and technological innovations in production process had made NYC become the first coastal city to establish trading routes with the interior of the U.S. before the highway 90 route was constructed. Currently, the New York and New Jersey port is the third busiest port in the U.S. Considering the historical experience of transportation improvement, the geographical location of NYC as a gated city of the East Coast States, the Panama Canal expansion can lead to prospering PNYNJ. Considering the changes in the port's status in line with the Panama Canal expansion, the PNYNJ is ready to accommodate larger freight volume from the post-Panamax vessels. The PNYNJ has built multimodal networks, specifically including rail and airport, that contributes to moving the freight more efficiently (Wang and Pagano, 2015). Also, the PNYNJ has planned to raise the Bayonne Bridge which restricted the access of large vessels to pass due to the low level of height (Snyder et al., 2013; Wang and Pagano. 2015).

Figure 2. Port locations on New York and New Jersey



Note: Blue marks indicate the Port of New York and New Jersey

Source: <http://www.zdnet.com/article/new-jersey-port-to-be-powered-entirely-by-five-wind-turbines/>

Some recent research reports and articles have discussed plausible implications on economies and environments stemming from the Panama Canal expansion while many uncertainties still need to be resolved (Park et al., 2014; Park and Park, 2016; Richardson et al., 2017). This study only analyzes the economic impact on the PNYNJ, utilizing the study conducted by Park and Park (2016) to find a meaningful strategy for the port and develop appropriate strategies of the PNYNJ needed to prepare the global route changes.

3. Economic Impacts of the Panama Canal expansion on U.S. ports

Measuring the economic impacts of the Panama Canal expansion on PNYNJ is complicated. Without a proper quantitative approach, it is not easy to capture the change of trade structure and its economic impacts. In terms of economic impact analysis, one of the most widely applied methods is to use a spatially disaggregate Input-Output (IO) model. For the U.S. case, the National Interstate Economic Model (NIEMO) which is a U.S. version of spatially disaggregate IO model has been applied for the economic impact analysis on the Panama Canal expansion. Since 2003, NIEMO has been applied in many case studies of economic impact analysis (Richardson et al., 2014; 2015). Especially, because the NIEMO includes all interstate trade relations among the U.S. states, estimating the economic impacts resulting from reduced costs associated with redirecting larger ships that now pass through the Canal requires a supply-side IO model (Park, 2008)¹.

The change of maritime shipping route will lead to the changes of multimodal transportation costs, the price of goods delivered via the vessels passing through the expanded canal, etc. Because residents would keep the spending pattern similar to the prior, the cost and price changes would ultimately affect the structure of trading in the region unless consumers could change the budget at the same rate as the change in the costs and prices. Also, port capacity and port congestions should be considered because the currently busy ports such as the WCPs that may improve the quality of port operation would experience an increased level of port utility stemming from the redirection of shipping routes. Considering that all conditions require very complicated economic modeling and scenario development process, it is more reasonable accounts only for transportation and warehousing activities reduced in the WCPs and increased in the SECPs. Therefore, many of the post-Panamax vessels which could not use the canal beforehand can now pass through the Panama Canal instead of being sent the freight from WCPs via inland transportation to the South and East region.

According to Park and Park (2016), California (CA) would experience the largest reduced impacts resulting from the negative impacts on transportation and warehousing

1) Because Previous articles that applied NIEMO have been widely cited in delivering the mythological approach to measuring economic impacts it is highly recommend to read various books and articles for the methods including Park(2008) and Park and Park (2016).

values. As suggested in Table 1, approximately \$4.9 billion and \$1.2 billion would be the negative economic impacts, respectively for imports and exports of CA. Comparatively significant economic impacts on CA are explained by the twin ports that play a hub function in the WCPs. Table 2 provides another piece of information on economic impact by industrial sector. For imports, Transportation and Postal and Warehousing sectors are reduced significantly by \$3.1 billion and \$0.8 billion, respectively. For exports, while the same sectors as in the imports case are impacted, the impacts are slightly smaller than that of imports, showing less than \$1 billion for both sectors.

Table 1. Economic impacts of reduced transportation and warehousing activities in the West Coast side for the most impacted three states in the U.S.

(Unit: Million dollars)

State	Imports	Exports
California(CA)	-4925.82	-1189.68
Washington(WA)	-295.96	-347.53
Oregon(OR)	-211.96	-133.31
Others	-360.97	-185.45

Note: Top three states are only shown.

Source: Park and Park (2016)

Table 2. Economic impacts of reduced transportation and warehousing activities in the West Coast side by industrial sectors

(Unit: Million dollars)

Industry	Imports	Exports
Transportation	-3109.08	-915.83
Postal and Warehousing	-817.89	-234.45
Utility	-144.05	—
Coal and Petroleum products	—	-111.24

Note: The most negative impacted three industries are only shown per imports and exports.

Source: Park and Park (2016)

The economic losses of WCPs would generate economic gains of the SECPs side when the Panama Canal expands. Shifting transportation modes and new warehousing activities for trade are the main cause. Individual state of economic benefits from the shift of imports ranks Texas (\$1.7 billion), New York (\$1.4 billion) and New Jersey (\$1.1 billion) in order. If combining the economic impacts of New York and New Jersey, the total impacts are much higher than that of Texas. If focusing on exports, the economic gains were substantial in New York (\$4.9 billion), accounting for 42% of total U.S. gains. Indeed, the Panama Canal expansion can significantly induce sizable positive impacts on New York and New Jersey states. The economic benefits for both states are greater than 40% of the entire economic benefits of the U.S. Therefore, it would be important that New York and New Jersey should prepare appropriate strategies to handle the increased port activities.

Table 3. Positive impacts of transportation and warehousing activities on the East Coast side for the most impacted states in the U.S.

(Unit: Million dollars)

State	Imports	Exports
Texas(TX)	1716.79(27.2%)	1908.53(16.5%)
New York(NY)	1412.83(22.4%)	4902.23(42.3%)
New Jersey(NJ)	1140.19(18.1%)	504.07(4.4%)
Pennsylvania(PA)	383.70(6.1%)	1386.89(12.0%)

Note: The four states are only selected by authors.
Source: Park and Park (2016)

Table 4 provides the economic benefits by top industry sectors, where transportation is the most highly impacted from the Panama Canal expansion, increasing \$3.5 billion and \$6.6 billion, respectively for imports and exports. This is due to the fact that the transportation industry is highly connected with trade activities.

Table 4. Positive impacts of transportation and warehousing activities on the East Coast side by industrial sectors

(Unit: Million dollars)

Industry	Imports	Exports
Transportation	3466.58(55.0%)	6667.80(57.6%)
Postal and warehousing	820.72(13.0%)	318.72(2.8%)
Coal and petroleum products	88.67(1.4%)	663.81(5.7%)

Note: The most positive impacted three industries are only shown per imports and exports.
Source: Park and Park (2016)

Therefore, the port development strategy can be further discussed. The increase in the freight volume of the PNYNJ is related to container port capacity. The container port capacity is affected by several factors including container yard storage density, operating hours, and the use of vessels and cranes. Utilization of the container yard storage at the PNYNJ reaches to 78% (Tioga Group Inc., 2010). Using this information, various scenarios on container port capacity can be developed in order to account for the accommodation rate of trade diversion. A further study needs to combine with the impact study which has not been conducted so far.

4. Conclusions and Discussion

The Panama Canal expansion may change not only maritime shipping structure, but also port development and port-related industries. The most expected change is maritime shipping routes between Southeast-Northeast Asia and the U.S. The WCPs have had an advantage over the SECPs due to the trade specifically with Northeast Asian countries such as China, Hong Kong, Japan, South Korea, etc. Expecting the

volume of freight would shift from the WCPs to the SECPs after the expansion, much complicated impacts may follow (Jaffee, 2010; Rodrigue, 2010). On the other hand, Southeast Asian ports will be minimally affected from the Panama Canal expansion because maritime shipping route may not change seriously (Snyder et al., 2013). It also relates to the Panama Canal capacity. The Panama Canal can accommodate only post-Panamax, not super post-Panamax. Northeast Asian countries have various multimodal network options including waterway of post-Panamax to convey the freight from West to East. Unfortunately, many Southeast Asian countries are likely to choose the maritime shipping routes to pass through the Suez Canal for super post-Panamax (Rodrigue, 2010; Snyder et al., 2013).

Even though the expanded Panama Canal has limitation on vessel capacity, both the WCPs and SECPs may be affected from significant changes in various factors such as cost, time, industry sector, etc. explicitly and implicitly. Also, it may occur ripple effects on both regions in the U.S. This is because the cross-continental transportation network is densely connected in the regions. As a result, various economic effects on the states involved in these regions can be generated.

It should be noted that simultaneous responses to the economic impacts on the other states of the U.S. from the Panama Canal expansion are difficult to be forecast as conducted for the economic effects on the PNYNJ. While it is still important to build a sophisticated model to conduct an empirical analysis, this study only discusses what the expected changes on both the WCPs and SECPs, specifically New York and New Jersey despite various limitations. Also, this study provides the necessity of developing plausible scenarios that account for the investment strategy of the PNYNJ.

This study discusses the economic impacts based on the result of previous studies. The Panama Canal expansion can affect both the West Coast and South and East Coast regions. The West Coast region is expected to suffer negative economic impacts while the South and East Coast region positive impacts. Many of freight vessels may choose the shipping route to pass through the expanded Panama Canal, reducing the freight volume of the WCPs. Consequently, the distribution system of inland transportation for the WCPs is expected to shrink. Among the ports, California may experience the highest economic losses, while congestion in these ports may improve the port operation and generate somewhat positive gains. On the other hand, the SECPs may gain economically. Among them, the PNYNJ may thrive more than the present, expecting more than \$8 billion. It is highly recommended that the PNYNJ needs to prepare a strategy on the anticipated increase in the port demand. As more comprehensive models need to be built to address the complicated operational issues associated with the Panama Canal expansion, plausible strategies on the PNYNJ still need to be prepared. Richardson et al. (2017) partly addressed economic impacts of the Panama Canal expansion, but various plausible scenarios and simulations need to measure the impacts on the PNYNJ. Advanced scenarios and simulations can suggest rational investment strategy for the port. Numerous NIEMO applications can be referred to measure the advanced scenarios and simulations (Gordon et al., 2009; Park, 2008; Park et al., 2007; 2008; 2011; 2014).

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