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Port infrastructure investment and regional economic growth in China: Panel evidence in port regions and provinces

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ABSTRACT

China's seaports belong to the largest in the world. The question is to what extent port infrastructure investment in China also contributes to growth of the regional economies involved, through mainly direct and indirect relations. We estimate the output elasticity of port infrastructure through production function, applying panel data analysis for the period of 1999–2010, and calculate the model at the level of four port regions as well as the port province level. The results indicate clear positive effects of port infrastructure investment in all regions, however, the strength varies considerably among the four regions, with the Yangtze River Delta region (Shanghai) at the strongest level, followed by the Bohai Rim region (Tianjin), the Southeast region (Guangzhou) and the Central region, where the influence is the weakest. The analysis indicates that differences are related to the character of the port (land or sea), stage of economic development of the region, international network connectivity, and the spillover effects from adjacent regions. Overall, the weakest relation tends to be with landside transport infrastructure density. The paper closes with some policy implications.

1. Introduction

1.1. China's seaport in the world

Ports are traditionally seen as economic catalysts for the regions they serve, where the agglomeration of services and manufacturing activities generate economic benefits and socio-economic wealth (Warf and Cox, 1989; Pettit and Beresford, 2009; Zhang et al., 2009; Danielis and Gregori, 2013). Chinese ports play a key role in the world port system of 2011, as indicated in Table 1. The 10 Chinese ports rank high with a share in total cargo volume and container traffic of the top-20 world ports of 52.9% and 53.0%, respectively. In both rankings, China is present with three ports among the five largest ones in the world, with Shanghai in first place. The rankings also show differentiation between cargo and container traffic. For example, Tianjin port enjoys a higher rank (rank 3) in cargo volume and a relatively lower rank in container traffic (rank 11), reflecting the port's specialization in raw materials like coal and mineral. However, the rankings are only a description of relative size of transport flows, while this is just one part of port activity in a situation of manifold and systematic relationships between ports and ports' regional economies. Accordingly, the relation with local industries, economic characteristics of the port regions, and transport network connectivity of the region, etc. could also have an impact on port activity, as well as on regional economic growth (Berechman et al., 2006; Banister, 2012; Ducruet et al., 2013).

The important position of Chinese ports indicates that China has made substantial capital investment in its port facilities in recent years. What is actually less known is to what extent the port investments contribute to growth of the regional economy through various multiplier effects, including the direct, indirect and induced effects, and whether there are large regional disparities in these effects.

1.2. Port infrastructure and the regional economy: a literature review

Over the last decades, a large number of studies has focused on the impact of transport infrastructure and accessibility in general on regional economic growth, most of which were concerned with transport investments, aiming to assess whether positive economic impacts are a sufficient rationale for traffic infrastructure investments (Ozbay et al., 2003; Canning and Bennathan, 2007). However, in the recent literature, impacts on the regional economy are increasingly seen as influenced by the level of traffic infrastructure

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Table 1
Top 20 world ports in 2011.
Source: Institute of Shipping Economics & Logistics, Containerization International Yearbook 2012.

Rank	Port, Country	Cargo volume (thousands of tons)	Rank	Port, Country	Container traffic (TEUS)
1	Shanghai, China	590,439	1	Shanghai, China	31,739,000
2	Singapore, Singapore	531,176	2	Singapore, Singapore	29,937,700
3	Tianjin, China	459,941	3	Hong Kong, China	24,384,000
4	Rotterdam, Netherlands	434,551	4	Shenzhen, China	22,570,800
5	Guangzhou, China	431,000	5	Bushan, South Korea	16,163,842
6	Qingdao, China	372,000	6	Ningbo, China	14,719,200
7	Ningbo, China	348,911	7	Guangzhou, China	14,260,400
8	Qinhuangdao, China	284,600	8	Qingdao, China	13,020,100
9	Bushan, South Korea	281,513	9	Dubai Ports, United Arab Emirates	12,617,595
10	Hong Kong, China	277,444	10	Rotterdam, Netherlands	11,876,920
11	Port Hedland, Australia	246,672	11	Tianjin, China	11,587,600
12	South Louisiana (LA), U.S.A	223,633	12	Kaohsiung, Taiwan	9,636,289
13	Houston (TX), U.S.A	215,731	13	Port Kelang, Malasyia	9,435,408
14	Dalian, China	211,065	14	Hamburg, Germany	9,014,165
15	Shenzhen, China	205,475	15	Antwerp, Belgium	8,664,243
16	Port Kelang, Malaysia	193,726	16	Los Angeles, U.S.A	7,940,511
17	Antwerp, Belgium	187,151	17	Tanjung Pelepas, Malaysia	7,302,461
18	Nagoya, Japan	186,305	18	Xiamen, China	6,454,200
19	Dampier, Australia	171,844	19	Dalian, China	6,400,300
20	Ulsan, South Korea	163,181	20	Long Beach, U.S.A	6,061,091

accumulation in the region at the start of the study period, with an emphasis on a non-linear relationship between transport infrastructure provision and economic growth (Banister, 2012). The idea has been forwarded that below a certain level of infrastructure endowment and above a certain level, the growth effect of expanding transport infrastructure tends to be relatively small (Deng et al., 2013a, 2013b). Threshold values have also been addressed by Hong et al. (2011), but only as a lower threshold. In the remaining section, we discuss the statistical models used in investigations of the relationship between port investment and the regional economy, and studies using a broader network and value chain view on port development, including spill-over effects.

Mainly three empirical methods are used to investigate the relationship between transport investment and regional economy which are Cobb–Douglas production function framework, time series models and structural equation modeling. Most previous research used a Cobb–Douglas production function framework in estimating the impacts of transport investment (Blum, 1982; Biehl, 1986; Nijkamp, 1986; Del Bo and Florio, 2012). The result of these studies is a positive relationship between transport investment and economic growth which is now commonly accepted (Berechman et al., 2006). Yoo (2006) and Jiang (2010) investigated the influence of seaport infrastructure investment on economic growth in Korea and China respectively by applying time series data. A positive impact of port investment on economic growth could be found both in Korea and China. In addition, Jiang's empirical findings also show regional disparities: the port investments in Pearl River Delta have the highest short-term output elasticity, whereas the short-term output elasticity in Yangtze River Delta is the lowest, indicating a larger amount of new construction and related activity in the first region compared to the last one. Another study on China, by Deng et al. (2013a, 2013b), used structural equation modeling to unravel the different influences on regional economic growth related to port investments, by distinguishing between port supply, port demand, and value added-activity in ports. They observed no direct relation between port supply and growth in the regional economy, but port supply was connected to this growth through the relations with port demand and port value added activity.

Many recent studies analyze port activities and relations with the regional or local (port city) economy from wider network perspectives, including territorial embedding of port areas in commodity flows and value chains. Ducruet et al. (2013), in a comparative study of almost 200 port regions in advanced economic areas, argue that port-region linkages develop in subtle interdependencies, while pointing to noticeable differences between traffic volumes, types and local economic structures, as apparent from commodity traffic data and regional economy data. Accordingly, economically and demographically larger and richer regions that are specialized in (private sector) producer services, concentrate larger and more diversified traffic volumes as well as higher valued goods. By contrast, agricultural and industrial regions are more specialized in bulk traffic (Ducruet et al., 2010, 2013). The study of Jacobs et al. (2011) on maritime advanced producer services, fits into the wider network perspective on influences on port activity and traffic flow.

Studies paying attention to spillover effects to nearby regions also fit into the broader perspective. We mention Bottasso et al. (2014) who observed in 13 West European countries that a 10% increase in port throughput gave a growth in regional GDP of the port regions by 0.01–0.03%, while the effect in nearby regions turned out to be larger, namely 0.05–0.18%. Merk and Hesse (2012) found for the port of Hamburg (Germany) not only considerable regional spillover effects, but also large distances involved. Only 13% of the multiplier effects have an impact on Hamburg and its neighboring regions, while almost a third spills over to two large southern regions at a distance from the port and more than half to the rest of Germany.

The previous studies illustrate a myriad of interrelationships between port infrastructure investment, connectivity of the port with land infrastructure, size and type of transport flow, value chains and production networks embedded in the port and stretching (spilling over) in adjacent and more distant regions, and local geographical and historical specificities, like local economic specialization. This situation would mean that each estimation of impacts of port infrastructure investment on the regional economy shows a relatively small impact and shows some differentiation between regions.

1.3. Research aim and questions

Most previous port investment studies have a limited scope that is often neglecting (part of) the above indicated influences, like connected land traffic infrastructures, profile of the regional