



Strategic investments in accessibility under port competition and inter-regional coordination



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ABSTRACT

This paper analyzes the incentives for and welfare implications of collaboration among local governments in landside port accessibility investment. In particular, we consider two seaports with their respective captive markets and a common inland market for which the ports compete. The ports and the inland belong to three independent regional governments, each making investment decisions on accessibility for its own region. We find that there is a conflict of interest between the port governments and inland government in terms of their jointly making accessibility investment decisions, and that each region's preference over various coalitions is highly affected by ownership type of the competing ports. For public ports, the inland may compensate the port regions to achieve the grand coalition that maximizes total welfare but requires a sizable investment in the port regions. For private ports, however, the port regions benefit from coordinating with the inland and hence may be able to compensate the inland to form the grand coalition.

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1. Introduction

As a node in the global supply 'chain' (Heaver, 2002), a port connects its hinterland – both the local and interior (inland) regions – to the rest of the world by an *intermodal transport* network. As it is the intermodal chains rather than individual ports that compete (Suykens and Van De Voorde, 1998), it is argued that hinterland accessibility has been one of the most influential factors of seaport competition (e.g. Notteboom, 1997; Kreukels and Wever, 1998; Fleming and Baird, 1999; Heaver, 2006; Zhang, 2008; Talley and Ng, 2013) and there is also empirical evidence supporting this argument (e.g. Yuen et al., 2012; Wan et al., 2013, 2014). The cost of moving goods between the hinterland and ports is largely determined by the transportation infrastructure around the ports as well as the transportation system in the inland. Consequently, plans on local transport infrastructure improvements, such as investment in road capacity, rail system and dedicated cargo corridors, are critical for local governments of major seaport cities as well as inland regions where shippers and consignees locate.¹

Studies using a game-theoretic approach to discuss port competition and infrastructure investment issues are emerging. Many papers focus on facility investment decisions within the competing ports but ignore the role of investment in

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¹ De Borger and Proost (2012) have comprehensively reviewed a large body of literature that focuses on strategic behavior of governments (rather than on port competition) in determining transport infrastructure pricing and capacity.

hinterland accessibility (e.g. Anderson et al., 2008; Basso and Zhang, 2007; De Borger and Van Dender, 2006; Luo et al., 2012; Ishii et al., 2013; Xiao et al., 2013; Chen and Liu, 2016). De Borger et al. (2008), Zhang (2008), and Wan and Zhang (2013) then study the strategic investment decisions made by local governments of two competing port cities on roads linking the ports to a common inland market. However, the analysis in these three papers abstracts away the coexistence of captive local markets and competitive inland market, which is the case for many seaports. For example, Los Angeles/Long Beach (LA/LB) port complex and New York/New Jersey (NY/NJ) port complex compete for cargos located in the central United States (US) while each has its own local captive market. In particular, containers exported from Asia usually have two ways to reach the central US (e.g. Pittsburgh, Pennsylvania): they can enter the US via the west coast (LA/LB) and then are shipped to the inland by rail. Alternatively, they enter the US via the all water route through the Panama Canal and the east coast (NY/NJ), and then are shipped for a relatively short distance further inland by truck/rail. Due to the geographic distance, cargos destined in the west coast would seldom go through the all water route and enter the US via the east coast, and vice versa for cargos destined in the east coast. Thus, each port complex does have a captive market. Another pair of large ports in China, Shanghai and Ningbo, also fits this situation. Both ports have been competing fiercely for many years (Xiao and Liu, 2016), but each has its respective captive market. Shanghai has a better access to the Yangtze River inland waterway, and hence the shippers located along the downstream of the River (together with almost all Shanghai's own external trade) tend to choose Shanghai to export their goods. Ningbo, on the other hand, is the best choice for shippers located in the eastern, central and southern Zhejiang Province. Since ports in general do not price discriminate shippers from different markets, the shipping demands in the local captive markets and the inland market are interdependent. As a result, accessibility investment decisions made by individual local governments can affect the well-being of other port regions as well as the inland region through the mechanism of port competition. While Basso and Zhang (2007), Czerny et al. (2014) and Takahashi (2004) have also modeled this feature, they did not investigate the competition and coordination between the captive and inland regions in accessibility investment. Basso and Zhang (2007) and Takahashi (2004) focused on investment in public facilities shared by both the inland and local users, whereas Czerny et al. (2014) examined the privatization game between two competing ports and abstracted away the investment issue from their analysis.

The main objective of the present paper is to provide a formal analysis of the incentives for, and welfare implications of, collaboration among local governments in landside port accessibility investment. Inter-regional coordination in infrastructure investment is quite common in practice, and the governments involved may form various types of coalitions. For example, as a result of increasing port and road congestion, in early 2006 the province of British Columbia, Canada, embarked on an ambitious Gateway Program administered by the provincial Ministry of Transportation, which includes a set of major transport infrastructure projects primarily for expanding capacities at the port of Vancouver and the port of Prince Rupert and related rail and road facilities in the province.² The Heartland Corridor project started in 2007 that raised capacity and cut travel time on rails linking Port of Norfolk and major inland destinations is an example of coordination between governments of a port region and the inland. The project involved the joint effort of two US inland states, Illinois and Ohio (home states of major destinations of US-bound ocean cargos), and one coastal state, Virginia, which has the Port of Norfolk.³ Although widely observed, incentives to coordinate among governments of port regions and inland region, to our knowledge, have yet been formally studied. The only related study is conducted by Álvarez-Sanjaime et al. (2015) who examine private ports' incentives to offer integrated port-handling and trucking service for shippers located in the inland, and the resulting impact on social welfare. Their study differs from the present paper in two major ways: first, they abstracted away the captive local markets; and second, they did not study government-level investment decisions and coordination possibilities.

More specifically, we consider a generic model that includes two seaports with their respective captive markets and a common inland for which the seaports compete in prices. The seaports and the inland belong to three independent regional governments, each determining the level of investment for its own regional transportation system. We modify the linear city model used by Basso and Zhang (2007), Czerny et al. (2014) and Takahashi (2004), but assume away the capacity constraint at ports and focus instead on landside transport costs within each region. An important feature of our model is that shippers from the captive markets and the inland market do not share the landside transport infrastructure in concern. Thus, although the transport facility in the captive market only affects the cost for shippers in the captive market to access the port, it indirectly affects, via the ports' pricing strategy, the inland shippers and hence inland accessibility investment. Based on this model, we investigate the following questions: (1) how do accessibility investment decisions affect port competition? (2) how does the improvement in accessibility affect each region's welfare? (3) how do the investment incentives differ under various forms of coordination (coalitions) among regional governments? (4) which coalition structures are preferred by

² The port of Vancouver and the port of Prince Rupert, located in the south coast and north coast of British Columbia, respectively, are owned by two local governments (and managed by two separate port authorities). Thus, coordinated by the provincial government, the two port regions are able to cooperate in the investments to a certain extent. In addition, the federal government's Asia-Pacific Gateway and Corridor Initiative, launched in October 2006, was providing additional funds, thereby effectively representing the rest of the country (the "inland") in this "three regions" investment coordination. For more information about the two programs, see www.th.gov.bc.ca/gateway/ and www.apgci.gc.ca.

³ Zhang (2008) discussed seaport competition in the Le Havre-Hamburg (LHH) range and the regional governments' policy initiatives regarding hinterland/corridor infrastructure investments to support their ports in such competition. At a wider level, the Trans-Europe Networks (TENs) project aimed to promote cohesion within entire Europe by improving transportation infrastructure of different regions to a desired level and enhancing urban accessibility (Vickerman, 2007). This (and other policy initiatives) may help enhance the competitiveness of LHH ports vis-à-vis, for example, Mediterranean ports, and thus benefit the entire region.

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