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Analysis of the impacts of different modes of governance on inland waterway transport development on the Pearl River: The Yangtze River Mode vs. the Pearl River Mode

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ABSTRACT

Different modes of governance will certainly have different impacts on the development of the inland waterway network and inland shipping economy on the Yangtze River and Pearl River in China. The inland waterway transport (IWT) economy on both rivers has recently been considered part of the national economic strategy, and it is necessary to analyze the differences between the two modes of governance applied on the arteries of the Yangtze River and the Pearl River and to explore their different impacts on the development of waterway systems. First, this paper considers the Pearl River Economic Belt as an example for comparing the effects of different modes of governance on the development of IWT systems. Second, from the perspective of systems theory, the economic structures of IWT systems under different modes of governance are described. Third, data are collected from inland shipping industries in the Pearl River system, and system dynamic (SD) models of the IWT system are constructed using the Vensim PLE software suite. Finally, the SD models are employed to compare the differences in the development of spatial patterns of waterway systems under two modes of governance and different investment structures.

1. Introduction

As two of the most important navigable waterways in China, the Yangtze River and the Pearl River traverse the central and southern regions of the mainland, respectively, from west to east. Both rivers run through developing inland provinces in the upstream and midstream regions and ultimately reach the developed downstream regions of the Yangtze River Delta and the Pearl River Delta. In Europe (except the Netherlands) and the United States, the central government is in charge of inland waterway transport (IWT); specifically, IWT is governed by special administrations (Dong and Le, 2008). Unlike in Western countries, in China, the Ministry of Transport (MOT) governs IWT, and the waterway and port administrations of each province or municipality take responsibility in their administrative regions. Port safety and maritime management are supervised either by direct maritime administrations or local maritime administrations (Wang, 2015). Considering the importance of IWT, in 1984, the Chinese central government established two special administrations, the Changjiang River Administration of Navigation Affairs (CRANA) and the Pearl River Administration of Navigation Affairs (PRANA), to promote the rational development of the inland shipping economy.

The modes of governance of waterway transport on the arteries of the Yangtze River and the Pearl River are considerably different from each other. IWT on the artery of the Yangtze River is administered under a unified government (Y-mode), which means that the CRANA is responsible for IWT market supervision. The administration's responsibilities include waterway transport planning, investment and construction of waterways and support and security systems, and waterway law enforcement. By contrast, the IWT on the Pearl River is managed by local governments in the basin (P-mode), and the PRANA acts as an intermediary to supervise the development of the IWT market on behalf of the central government and to coordinate IWT issues among different areas of the basin or different local governments.

Over the past 32 years, the IWT markets and basin economies of both rivers have undergone enormous development. The gross domestic products (GDPs) of the Yangtze River Basin and Pearl River Basin increased from 3422.3 billion RMB and 1130.1 billion RMB in 1998 to 28,464.3 billion RMB and 9271.6 billion RMB in 2015, average annual

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rates of 14.2% and 14.1%, respectively.[1] The inland waterway freights of the Yangtze River Basin and Pearl River Basin have increased from 179.5 million tons and 48.4 million tons to 2060 million tons and 710 million tons, average annual rates of 16.5% and 18.3%, respectively.[2] In 2014 and 2015, the Yangtze River Economic Belt and the Pearl River Economic Belt, respectively, were considered part of China's national strategy to promote the opening and development of inland regions.

IWT is a low-cost and low-carbon mass transport mode but is less developed than highways and railways because of constraints such as infrastructure deficiencies, investment, and institutional weakness, which are caused by the inefficiency of the governance mode (Asian Development Bank, 2016). In China in particular, because of mechanism reform, the different modes of governance applied to the two rivers have exerted different impacts on the development of IWT and the regional economies. On the one hand, under the Y-mode, a vertical governance system (led by the CRANA) is formed that is in charge of the planning, construction and management of IWT on the Yangtze River. Moreover, leaders from both the MOT and waterfront provincial governments have formed an Inter-ministry Coordination Leading Group[3] to promote the unified governance of planning, investment and construction of IWT on the Yangtze River from the perspective of the inland waterway network's development, the IWT demand of the waterfront provinces and the economic power of the waterfront provinces. Because of this consideration of the demands and economic capabilities of waterfront provinces, IWT on the Yangtze River has provided enormous economic benefit to the Yangtze River Economic Belt.

On the other hand, although IWT on the Pearl River is under the jurisdiction of the MOT, the departments of communications of the waterfront provinces are responsible for the planning, construction, maintenance and governance of IWT within their administrative regions (P-Mode). This governance mode has introduced a series problems, including the lack of unified planning and insufficient investment, that have seriously hindered the development of the inland waterway network, IWT market and basin economy. First, because of the investment source (mainly relying on local governments), the planning and construction of waterways along the Pearl River are in disorder. For example, over the past 30 years, Yunnan did not invest in the waterways of the Pearl River. At the same time, the governance separation between the water-control project and its shipping facilities, together with the diversification of their investment entities, has resulted in different capabilities of the shipping facilities of water-control projects between the upper waterway and lower waterway. For example, the shipping facilities of the water-control projects in Baise, Longtan, Yantan and Changzhou have blocked related inland waterways (Editorial Department of Pearl River Water Transport, 2016). Second, although the annual volumes of both the basin's GDP and the waterborne freight of the Pearl River were one-third of those of the Yangtze River, the investments in the Pearl River (14.9 billion RMB) were less than one-eleventh of those in the Yangtze River (177 billion RMB) during the 12th Five-year Plan period. Considering its role in the development of the basin economy, the investment in the Pearl River is seriously mismatched (Lin, 2009). Simultaneously, unlike that of the CRANA, the role of the PRANA is purely that of a supervisor and coordinator of the governance and development of the IWT; thus, its suggestions and coordination work are more objective from the perspective of the river system and basin economy.

All of these issues stem from the difference in governance mode. Therefore, it is necessary to understand the operational processes of the IWT systems under these two different modes of governance, compare their efficiency and performance, and analyze their impacts on the development of waterway system patterns, IWT market and basin economy to shed light on the development of China's inland shipping economy.

This paper is structured as follows. Section 2 presents a literature review of research on IWT. Then, a systematic introduction to the two modes of governance of China's IWT is provided in Section 3. Subsequently, the performances of these two modes of IWT governance on the Pearl River are explored and compared using system dynamic (SD) models in Section 4. Finally, conclusions are drawn in the last section.

2. Literature review

Although researchers have not previously attached the same importance to IWT as to seaborne transport, as a driver of regional economies and an important component of integrated transport systems, IWT has become a popular topic of research since the dawn of the 21st century. This research includes analyses of including the impacts of IWT on the regional economy (IIRE), the optimization of IWT operational processes (OIOP) and the safety assessment of IWT (SAIT). While a thorough discussion of each aspect is clearly beyond the scope of this paper, it would be sufficient to outline their primary points.

The study of IIRE falls under the classical topic of the impacts of transport on regional economies (ITRE), with existing research summarizing the development of IWT and trying to explore its impacts on the regional (basin) economy; see Comtois et al. (1997), Wang et al. (2000), Iqbal and Hasegawa (2001), Liu (2005), Cao (2002), Yin (2007), Luo (2008), Cao (2010), Pan and Pan (2011), Chen (2013), Wang and Gao (2013), Keuken et al. (2014), Li et al. (2014), Witte et al. (2014), Long (2015), Debrie and Raimbault (2016) and Li et al. (2016) for related evidence.

Research on the optimization of IWT's operational processes considers the line design, fleet scale and structure and River-Ocean Combined Transportation system; see Konings (2003, 2006, 2007), Notteboom and Konings (2004), Taylor et al. (2005), Konings (2006, 2007), Notteboom and Wu (2006), Ruan et al. (2012), Yang et al. (2014), Zhang (2010), Zhang (2014), An et al. (2015) and Deng and Liu (2015) for related evidence.

Because of the natural constraints and the density of traffic flow on the waterway, traffic congestion and related vessel accidents will be more frequent than those in ocean shipping; the assessment of IWT safety is thus a popular topic; see Roeleven et al. (1995), Zhang et al. (2013), Zhang et al. (2014a, b), Zhang et al. (2014a, b) and Zhang et al. (2016) for related evidence.

However, the development of IWT has produced varied outcomes in different regions across the world, partly because of the implementation of different governance modes, which connotes differences in the role of government and its policies and institutional frameworks. In fact, the governance mode of IWT is expected to serve as an important intermediary that promotes the positive interaction between the development of IWT and the basin economy. The study of different modes of governance and their impacts on the development of both the IWT system and the basin economy thus appears more important and fundamental. The waterways in Western countries can be considered very mature, and their IWT markets are competition-driven. Western countries thus only need to regulate the IWT market and maintain the infrastructure in good physical condition. To examine the growth patterns of waterway systems, identify commodity flows and describe the operation of waterway transport in the U.S., Clark et al. (2005) focused on four main river systems, including the Mississippi and Ohio River Basins, as examples. In the U.S., the governance of the entire IWT system, including the operation and maintenance of waterway infrastructures, is under the jurisdiction of the United States Army Corps of Engineers (USACE). Mihic et al. (2011) took the Danube River as an example to analyze the development of IWT systems in Europe; the authors summarized the corresponding promotion policy, PLATINA project, RIS

[1] Data source: China Port Yearbook and Year book of China Transportation & Communication (1999, 2015)

[2] Data source: China Statistical Yearbook (1998, 2015)

[3] Data source: http://www.moc.gov.cn/sj/shuiyj/xinwendt_shyj/201412/t20141210_1741115.html