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Logistics and economic development: Experience from China

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ABSTRACT

Based on the most updated available data on Chinese logistics and economy, we use the dynamic structural model to test the relationship between logistics development and economic growth in both the short and long run from a total output, demand and disaggregate output perspective. The joint short and long-run causality test shows that economic growth Granger-causes logistics output, implying that economic development causes more demand for logistics services and hence leads to logistics development. Land transport infrastructure Granger-causes the economic growth with a feedback effect. Another interesting finding is that railway transport unidirectionally Granger-causes the development of roadway and waterway transport, implying that the railway plays a key role in the transport network in China thus far. However, this trend may not continue in the future as the administrative functions of the Ministry of Railway were merged into Ministry of Communications in early 2013. The policy implications are given at the end of the paper.

1. Introduction

China's economy grew rapidly after opening to the world in 1978 and became the second largest in the world in 2010. According to the National Bureau of Statistics of China, the gross domestic products (GDP)[1] of China increased dramatically from RMB[2] 391.84 billion in 1980 to RMB 3979 billion in 2010. The logistics industry covers transportation, storage, post and telecommunication. Fig. 1 indicates that the total output of this industry had shown an upward trend increasing from less than RMB 20 billion in 1980 to more than RMB 100 billion in 2009.

The growth of logistics output in China can be examined from two aspects. First, the logistics components are broadening. Previously, the logistics industry included only transportation and warehousing. Now it has integrated transportation, inventory management, warehouse management, material handling and packaging and supply chain management. Second, with the development of e-business through the internet and by using software such as Radio Frequency Identification (RFID), the logistics industry in China has experienced rapid development. The impacts of e-business on logistics include: (i) information can be delivered faster so that firms can easily coordinate their production and distribution; (ii) managers can make an accurate forecast based on the current data from the markets and customers. In addition, with advanced technology such as computer networks, bar codes and orientation systems, the operation of traditional logistics has changed into an industry of high aptitude, high technology and high information.

The logistics industry provides a large number of job opportunities in urban areas. The National Bureau of Statistics of China reported that, as of 2007, there were 6.59 million employees in the transportation, storage, postal and telecommunication sectors. Among these, the number of workers in railway transportation was 1.74 million, the number of workers in road transportation was 2.42 million, and the number of workers in water transportation was 0.46 million. For other components, the number of workers in the postal industry was 0.47 million, and the number of workers in telecommunication and other information-transmission services was 0.98 million.

However, there are some problems in the logistics industry of China. According to the Ministry of Commerce of the People's Republic of China (PRC), the ratio of logistics cost to GDP was approximately 18% in 2010, which is approximately twice of that in the United States. Jiang and Prater (2002) stated that the main problems in China's logistics distribution are undeveloped infrastructure, government regulations, regional protectionism and fragmented distribution channels throughout the country. Goh and Ling (2002) documented that aged infrastructure, archaic handling equipment and the lack of qualified logistics personnel cannot meet the vibrant demand in the economy. Bolton and Wei (2003)

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[1] Constant price with the base year at 1978.
[2] Renminbin or Chinese Yuan.

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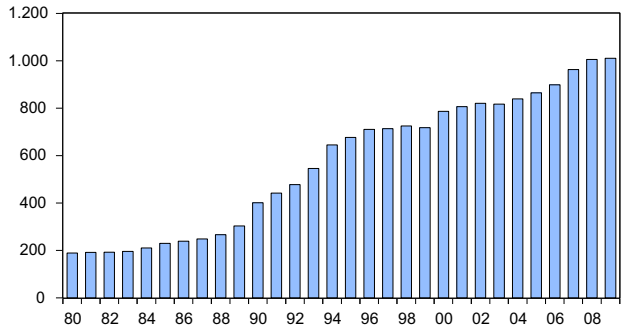

Fig. 1. Plot of output of transport, storage, post and telecommunications (RMB 100 million).

also reported that factors such as undeveloped transportation infrastructure, fragmented distribution systems, limited use of technology in the distribution and logistics sector, dearth of logistics talent, regulatory restrictions and local protectionism restrain efficient distribution. Hong and Liu (2007) found that most of the logistics companies in China provide limited value-added service to customers and society. The industry provides only traditional services, such as transportation, distribution and warehousing. Only a small number of companies have "high-level" activities, such as logistics system design and information management.

Logistics infrastructure leads to economic growth through the following mechanisms. First, investment in infrastructure increases demand for goods and services. Second, logistics infrastructure improvement reduces travel time, and passenger and freight transporters gain directly from time and cost savings (Gunasekera et al., 2008). The time savings yield economic consequences as producers gain access to distant markets, draw inputs from a larger area and stimulate local production. In addition, infrastructure investment can generate benefits by lowering firms' inventories (Shirley and Winston, 2004). Third, a better infrastructure attracts foreign direct investment (Hong, 2007), which is an important engine of economic growth in China. Last, a lower transportation and trading cost can accelerate industrial cluster (Baldwin and Forslid, 2000; Krugman, 1991), and the concentration of economic activities increases labor productivity (Ciccone and Hall, 1996). Banister and Berechman (2000) depicted a general framework that describes the relationship between the transportation system and economic growth, in which improved transportation accessibility reduces travel time and cost, increases traffic volume, and leads to a spatial redistribution of economic activities. This further leads to pecuniary externalities and allocative externalities in the environment, transport network economies, labor market and firm agglomeration, and hence spurs economic growth.

This paper analyzes the relationship between logistics demand, total and disaggregate logistics with economic growth in China. We also examine the causal relationship between logistics development and economic growth in both the short and long run. With the findings, we hope to shed some light on the gaps in the development of the logistics industry and provide some policy recommendations for promoting the development of logistics and the economy in China.

This paper contributes to the existing literature as follows. First, we use the dynamic structural model for three factors: demand, total output and disaggregate output. With the dynamic structural model, we can capture the changes over time in the relationship and make our estimation more accurate. In addition, we look at the relationship from three aspects that are missing from the literature. Second, previous studies normally focus on a certain type of transport infrastructure such as roadway (e.g., Gunasekera et al., 2008) or airports (e.g., Yamaguchi, 2007). In this paper, we examine three major logistics components, which allows us to compare the impacts of various types of infrastructure. Third, we examine the causal relationship between logistics development and economic growth in both the short and long run. The relationship may differ over time. By looking at both the short and long run, the market players and policy makers may have better insight into their decision making process. To our knowledge, there is currently no study that has examined the relationship between logistics development and economic growth in China with such a comprehensive structure.

The structure of this paper is as follows. Section 2 is the literature review. Section 3 explains the data and methodology used. Section 4 reports the empirical results. Section 5 discusses the results, and the last section concludes the paper.

2. Literature review

In theory, the perception of the role of infrastructure as an engine of economic growth has changed over time. Solow's (1956) neoclassical growth model used an aggregate production function approach and assumed exogenous technical changes. The work of Romer (1986) began a set of theoretical research on the endogeneity of economic growth. Rietveld (1989) reviewed multiregional economic models, which relate infrastructures and regional development, and found that the improvement of infrastructure is not a sufficient condition for regional development and that many other factors play a role in economic growth and can be formulated in models. Another finding is that the improvement of transport infrastructure decreases transportation costs, and the relationship between the growth of the private sector and infrastructure is interactive.

Numerous empirical studies have documented a positive relationship between infrastructure and economic growth. Following the pioneering study by Aschauer (1989), some economists have estimated a neo-classical production function and have treated infrastructure investment as an input (e.g., Berechman et al., 2006; Evans and Karras, 1993; Gillen, 1996; Lall, 2007; Otto and Voss, 1996; Seitz, 1994). Alleman et al. (1994) found a positive relationship between infrastructure and economic development in South Africa. Fernald (1999) reported a causality relationship from changes in road stock to changes in productivity in US industries from 1953 to 1989. Groote et al. (1999) showed that transportation infrastructure caused economic growth in the Netherlands. Roller and Waverman (2001) found a positive relationship between telecommunication infrastructure and aggregate output in 21 OECD countries. Using data from 47 prefectures in Japan, Yamaguchi (2007) found that there were significant productivity gains from improvements in air transport accessibility, particularly in agglomerated areas such as the Tokyo metropolitan region.

Some studies have attempted to investigate the impact of transport and logistics infrastructure on economic growth in China. Mody and Wang (1997) found that roadway transport infrastructure was an important engine of economic growth in coastal China between 1985 and 1989. Fleisher and Chen (1997) did not find a significant impact of transport infrastructure on economic growth during the period of 1978–1993. Demurger (2001) found that infrastructure endowment did contribute to economic development based on panel data from a sample of 24 Chinese provinces from 1985 to 1998. Cheng and Peng (2006) used freight turnover as variables to analyze the relationship between the logistics industry and economic growth in Anhui. Liu et al. (2006) found unidirectional causality from logistics to economic growth. Their results showed a positive relationship between the logistics industry and regional economic growth. Zhu et al. (2008)