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Data analysis for metropolitan economic and logistics development



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ABSTRACT

Logistics industry is an integral sector encompassing transportation, warehousing, handling, circulation and processing, delivery and information technology. With the progress of economic globalization and integration, logistics industry has become a new momentum driving the fast development of national and regional economy. The close relationship between economic development and logistics advancement receives wide attention from the academia. However, current research on the coordination between economy and logistics mostly focuses on concept interpretation, and qualitative discussions. Very rarely do scholars conduct quantitative analysis on the coordination of metropolitan economy and logistics. To fill this gap, we first examine whether there exist interactions between metropolitan logistics and economy by building evaluation index systems for metropolitan logistics and economy. Then we introduce the entropy method and Granger causality test to evaluate and test the level of logistics and economic development in five cities: Beijing, Shanghai, Guangzhou, Chongqing, and Tianjin from 2009 to 2013. From the dimensions of regional economic investment, regional economic capacity and strength, we finally test the relationship between three economic subsystems and three logistics subsystems to further validate the relationship between metropolitan economy and logistics.

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1. Introduction

With the globalization of the world's economy, metropolises have played an increasingly important role in the international economic competition and cooperation. The booming metropolitan economy and the rapid development of modern commodity markets both contribute greatly to the rise of metropolitan logistics, which refers to "the logistics activities both within the metropolis and across metropolitan borders". Metropolitan logistics, as an important constituent of metropolitan economy guarantees the smooth operation of metropolitan economy by managing the flow of things between the point of origin and the point of consumption. Efficient metropolitan logistics can act as a strong driving force to the development of metropolitan economy. However, it can also lead to a waste of governmental and social resources, if the economy cannot generate enough demand for logistics capability and further investment are still flowing into the logistics industry. In other words, the development of metropolitan economy and logistics should be coordinated. Thus attentions should be paid to the research on coordinated development of metropolitan economy and logistics, which can maximize the stakeholders' benefit.

However, current research efforts mostly focus on the influencing effects of metropolitan logistics on metropolitan economy and fail to consider the reverse influence, let alone the mutual effects between the two using the quantitative methods. The systematic study on the Coordinated Development between Metropolitan Economy and Logistics is beneficial to understanding the mutual effects between the metropolitan logistics and economy, and is conducive to clarifying whether metropolitan logistics develops harmoniously with its economy.

This paper attempts to make quantitative analyses of the impact the metropolitan economic development has on logistics development, as well as the impact the latter casts on the former. The development of logistics industry has a far-reaching influence on the optimization of metropolitan industrial structure. With the support of information technology, the modern logistics industry has widely adopted many new information technologies. Judging from the various effects that economic growth has produced, it has exerted a positive and profound impact on logistics. It not only affects the growth of the logistics demand, but also boosts a qualitative leap for its progressing [18].

In order to prove the rationality of the above discussions, the authors, by using of data from China Statistical Yearbook, quantitatively analyzes the coordinated development between metropolitan economy and logistics. Beijing, Shanghai, Guangzhou, Chongqing and Tianjin are taken as research objects. Each group

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of analyses involves an economic development index and a logistics index. Corresponding indexes are selected to conduct the calculation of coordinated development degree. Exploring the interaction between logistics industry and economic development, and correctly grasping the direction of logistics development, will cast a positive influence on logistics industry and national economic development.

The paper is organized as follows: Section 2 reviews the related research literature; Section 3 describes the appraisal model of the coordinated development of metropolitan logistics and economy and leverages the Granger causality test to examine the interactive relationship between logistics and economy of five metropolises; Section 4 explores the relation between economic subsystems and logistics subsystems from three economic forms at a microscopic level to achieve a systematic and in-depth investigation; and Section 5 provides brief concluding remarks.

2. Literature review

Logistics industry, as an important industry in the national economy, attracts attentions from both the academia and industry. Extensive research has been conducted in this regard. For example, Wiengarten et al. [27] explored the impact of a country's logistical capabilities on external supply chain integration of a company, to provide insights for companies to deal with economic globalization. Among the literature, much attention has been paid to metropolitan logistics. At present, the studies concerning logistics mainly focus on the construction planning, influencing factors and related action mechanisms.

As for the planning and construction of metropolitan logistics, Taniguchi et al. [25] has proposed the concept of metropolitan logistics and elaborated on the importance of setting up urban logistics nodes with considerations of energy reservation, congestion alleviation, environmental protection, and labor cost reduction. Visser et al. [26] put forward related topics regarding urban logistics transportation and policy design, including development policies for freight forwarding in Netherlands, France, Germany and Japan. These policies were primarily about setting up freight transportation center based on cooperation between the authorities and transport enterprises.

Some scholars have illustrated the influencing factors of metropolitan logistics, such as the interpretation of metropolitan logistics development method from the perspective of policies. Dablanc et al. [7] analyzed how the Paris government influenced regional logistics. The article introduced freight transportation in Paris and evaluated its effects on policies regulating freight transportation. Loo and Hook [17] analyzed the logistics industry in Hong Kong ports. They arrived at the conclusion that Hong Kong ports were under multiple influencing factors, among which market factors and political factors are the most profound ones. Fisher [9] comprehensively analyzed logistics nodes in cities with three different logistics purposes, namely for production, for consumption, and for transshipment, and studied the location and scale of the logistics nodes.

Some elaborate on metropolitan logistics development by taking infrastructure construction into account. Gandlur [11] maintained that a scientific and effective transport network will speed up optimal resource allocation. The transport network for logistics is made of multiple logistics infrastructure. The author construed a model which comprises of multiple nodes and transportation routes. On the basis of the model, the author analyzed trade and logistics costs under different network status. Carruthers et al. [5] chose Hong Kong and Singapore as the study subjects and analyzed how modern logistics has driven economic growths in Hong Kong and Singapore. The article pointed out that investments in

fixed assets in logistics will have direct impact on improving supply capabilities in the regional logistics, thus increasing logistics demands and promoting regional economic growth.

However, those works seldom explores the influencing indicators that can comprehensively indicate the development level of metropolitan logistics, which is important for policy making and investment planning. Also, the effects of metropolitan economy are not fully considered to promote the logistics development.

Meanwhile, more and more scholars attach more importance to the influence of economic development on logistics. Based on the most recent available data on Chinese logistics and economy, Lean et al. [15] tested 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 result shows that economic growth Granger-causes logistics output, implying that economic development causes more demand for logistics services and hence leads to logistics development. Lee and Yang [16] analyzed the development strategy of the Korean Incheon International Airport. The result showed that economic prosperity in the East Asian region was the main driver behind the enormous logistics demands. The article also pointed out the potentials and influences of the airport and offered suggestions on its future development. Fujita and Mori [10] proposed an evolutionary model of spatial economic development. From the evolutionary model, it can be determined that in the development of big cities, there exist interactions between clustering economies and the hub effects of transportation nodes. Arvin et al. [1] analyzed causal relationships among transportation intensity, economic growth, CO₂ emissions, and urbanization using data of the G-20 countries.

As the study on metropolitan logistics deepens, more and more scholars conduct special studies on roles that metropolitan logistics plays. Among them, the topic on how metropolitan logistics promotes economic growth has become a hot research spot. Skjøtt-Larsen et al. [23] took the "Oresund" bridge, built by the Danish and Sweden governments, as a model of logistics development and fully demonstrated what role logistics infrastructure has played in economic development. Talley [24] put forward a model illustrating the relation between regional economic growth and regional transport infrastructure investment, which served as the basis to clarify the influences that regional transport infrastructure investment exerts on regional economic production and service. Based on the model which showed the relation between regional transport infrastructure investment and economic production, the authors proved that the relation between the two is complicated. Different from the previous research, the formula in the model, through evaluating spatial accessibility and transport service quality, probed into how regional transport infrastructure investment influenced economic production and transport service. Debbage [8] analyzed the correlation between airfreight and regional economy, and concluded that airfreight was positively driving regional economic growth. Ham et al. [12], based on mathematical model, probed into regional material movements and multi-mode transport system versus regional economic growth in both direct and indirect ways.

In summary, the relationship between regional logistics and economy has become closer and has attracted wide attention from scholars. However, current research still has shortcomings in the following aspects: Firstly, the existing research taps more on logistics' influence on economy and rarely explores the influence of economy on logistics. This reverse effects of economy on logistics make it necessary to re-exam the relationship between metropolitan logistics and economy [14]. Secondly, in the empirical analysis concerning logistics and economic relations, most of them use single indicator to represent logistics or economic development, for example, using total social logistics costs and GDP to indicate the

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