

Survey on Influence of Maritime Port Cluster Effect on Offshore Regional Economy Based on Grey Correlation Model

Yanyun Chen^{†‡*}

[†]Institute of Central China Development
Wuhan University
Wuhan 430072, China

[‡]School of Economics and Management
Longyan University
Longyan 364012, China



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ABSTRACT

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Along with further advancement of the integration of regional resources, industrial layout, and the reform on the industrial supply side, the maritime port cluster effect has played more and more distinct function in the economic development of offshore areas. Based on the grey correlation model, this paper describes the interaction between the maritime port cluster effect and the economic development in offshore areas. Here is an instance for testing the economic development level in the offshore areas. Several concrete conclusions come here: the formation of the maritime port cluster effect attributes to the combination of congenital geographical advantages and acquired conditions, it has a dynamic and multi-feedback relationship with the economic development in the offshore areas; per capita GDP and seaport cargo throughput can respond to the clustering development level at the maritime ports, that is, the higher the clustering development level, the greater the per capita GDP growth rate. In return, the offshore economy can provide a strong support for the development of maritime port clusters. The maritime port cluster effect and the economic development in the offshore areas are two-way interactive. This study traces the theory of the economic development in the offshore areas in concert with the port cluster effect profoundly and extensively.

ADDITIONAL INDEX WORDS: *Maritime port, cluster effect, offshore regional economy, dynamics, multi-feedback.*

INTRODUCTION

Today, in response to the growth of commodity exchange, the market economy is in a full swing. Marine economy is regarded as an important stage for developing the country's foreign trade. As there are more and more goods required to be transported by sea, more and more companies take the port as the world's leading trading center (Miller, 2017). With the acceleration of regional integration process, the maritime port clusters play an increasingly significant part in the regional economy since it can not only strengthen industrial competitiveness of companies, but also boost the economy in the whole offshore areas (Knatz, 2013). In today's increasingly sophisticated market economy, guided by the macroeconomic policies, many industries emerged in the coastal areas have been developed dramatically by feat of the port clusters in the offshore areas. Port clusters have driven the economic development there, which, in fact, is achieved by the scale and innovation effects born in the clusters (Lee, Lee, and Chen, 2012; Yudhistira and Sofiyandi, 2017).

China's coastal ports have mostly become the distribution centers for international logistics. There are many service companies sprung up for operating some businesses in port offshore areas, including loading and unloading, transportation, warehouse, and freight forwarding, which have driven

regional economic development (Doldán-García, Chas-Amil, and Touza, 2011). As an important phenomenon derived from the economic development, port agglomeration strongly matters the industrial clusters, that is, it has been an important driving force for integrating offshore resources, rationalizing industrial layout, establishing the innovative system and enhancing industrial images (Dawley, 2014; Karaaslan and Ozden, 2016; Zhang *et al.*, 2017). However, there are many influence factors, of which, some play a great catalytic role in the economic development of offshore areas; some are potential. Grey correlation analysis can calculate the comprehensive index values of various factors. Thus it is concluded the greater the influence of factor, the higher the comprehensive index value (Hamzacebi and Karakurt, 2015). This paper attempts to expound the interactive development between maritime port cluster effect and the economic development in offshore areas based on the grey correlation model. Here also introduces an instance for testing the economic development level in offshore areas.

ROLE OF MARITIME PORT CLUSTER EFFECT ON OFFSHORE REGIONAL ECONOMY

Maritime port cluster effect is derived from the rapid development of the maritime logistics industry based on the integration of logistics resources. It functions as openness and spatial agglomeration effect and sharing infrastructure, public services and labor market (Hsu and Wang, 2009). A three-factor model of the port cluster effect is shown in Figure 1. Maritime port cluster effect is subject to the infrastructure,

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*Corresponding author: 13841737@qq.com

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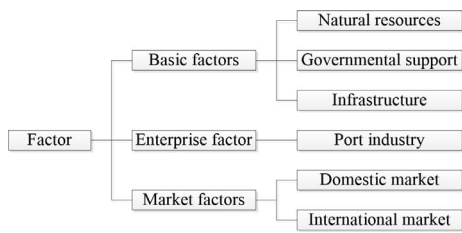


Figure 1. Three-factor model for the formation of port cluster effect.

business and market factors. It can not only develop regional attractiveness for capitals, technologies, talents, and others relevant to regional economic development, but also improve the business efficiency and minimize the production costs of logistics companies within the clusters (Wang, Zhang, and Jiang, 2016). With the maritime port cluster, it is possible to share resource information, integrate the human resources market and offshore regional resources, and boost the offshore economies by accelerating the transformation and consortium of companies in the offshore areas.

INTERACTION MECHANISM BETWEEN THE MARITIME PORT CLUSTER EFFECT AND THE OFFSHORE REGIONAL ECONOMY

The formation of the maritime port cluster effect, as a complex process, attributes to the combination of congenital geographical advantages and acquired conditions. It has a dynamic and multi-feedback relationship with the economic development in the offshore areas (Guo *et al.*, 2013). Figure 2 shows the analysis of the development conditions of offshore industries in relation to the maritime port cluster effect. Non-flowable port location advantage underlies the formation of port clusters (Chen and Chen, 2019). That is to say, it is developed based on the infrastructure invested and constructed by the country, coupled with the location advantages of domestic and foreign markets. As shown in the figure, the congenital location advantage and the postnatal conditions of the offshore areas A and B are different, that is, as the

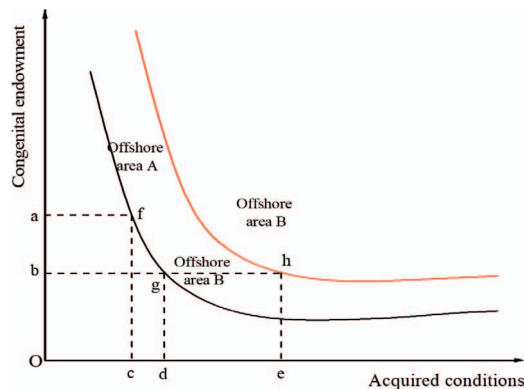


Figure 2. Analysis on the conditions of the development of offshore industry by the cluster effect of maritime ports.

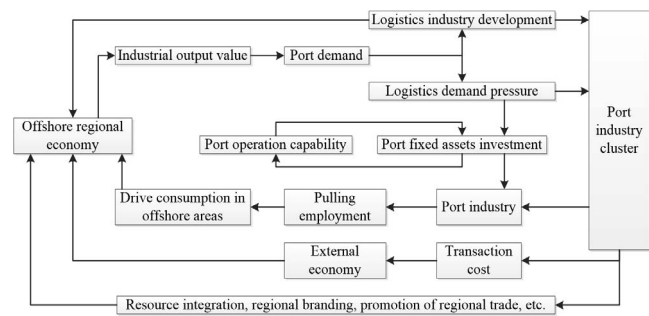


Figure 3. Causal relationship diagram between port cluster and offshore economic interaction.

postnatal conditions are concerned, the infrastructure and government support for A are better than that for B, but the congenital location advantage of B is superior to that of A. It is assumed that the postnatal conditions are improved for B, the port cluster effect in area B is also better than that in area A, and the best at point h in the figure.

Figure 3 gives a map of a causality about the interactive development between the port cluster effect and the offshore economies. The economic development in the offshore areas has led to an increase in the yield of offshore companies, which has fueled the development of the port logistics transport industry. The increased port logistics has also further spawned the port infrastructure construction, thus accelerating the formation of port cluster effect; in turn, the port cluster effect injects the vitality into businesses and funds in the offshore areas, thereby creating jobs, stimulating city consumption, and driving the economic development in the offshore areas. That is to say, the maritime port cluster and the offshore regional economy is a two-way interactive. Figure 4 shows the economic growth subsystem of the offshore areas. The development of the first, second and tertiary industries in the offshore areas facilitated the port cluster effect which in turn also drives the development of the tertiary industry in the offshore areas. Figure 5 shows the offshore port industry subsystem. The marine port infrastructure has accelerated the development of offshore industrial clusters, thereby increasing the total value of fixed assets of offshore industries and indirectly driving the economic development of offshore areas.

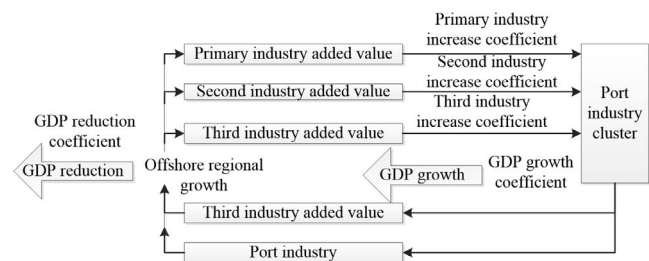


Figure 4. Offshore regional economic growth subsystem.

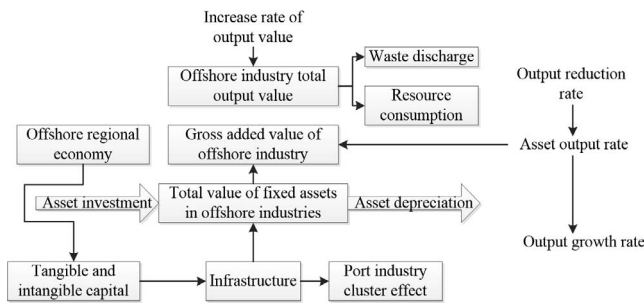


Figure 5. Offshore port industry subsystem.

MEASUREMENT OF INTERACTIVE DEVELOPMENT BETWEEN MARITIME PORT CLUSTER EFFECT AND OFFSHORE REGIONAL ECONOMY

Empirical Test

Analyzed by the gray correlation model, the maritime port cluster effect and the offshore regional economic development are complexly interactive. The development of port cluster effect is strongly associated with the national policy, but it is required to further find out whether the port cluster effect is subject to the important factors driving the economic development of the offshore areas. The object selected in this section is the Pearl River Delta, the Yangtze River Delta and the Bohai Rim Economic Zone, as the three maritime port concentration zones. The gray correlation model is used to study how it boosts the economy in the offshore areas (Ling *et al.*, 2014).

So far, there are many indicators for measuring the maritime port cluster effect. The commonly used one is the location quotient (LQ), expressed as shown in Formula 1:

$$LQ = \frac{I/T}{I_t/T_t} \quad (1)$$

where, I represents the total value of a certain industry in the offshore area; T represents the total value of the industry

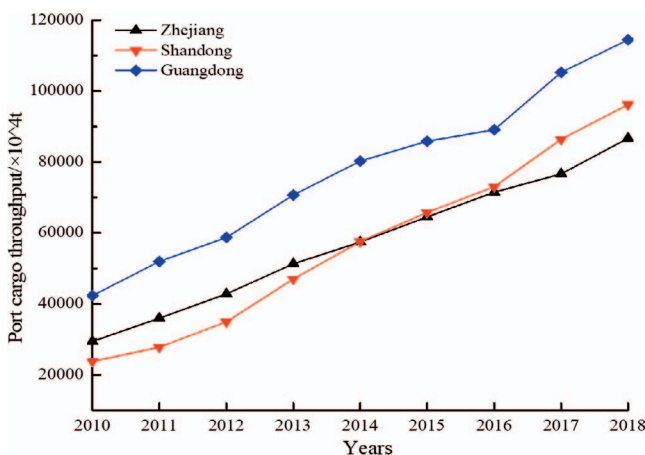


Figure 6. Shipborne throughput of maritime ports in offshore provinces.

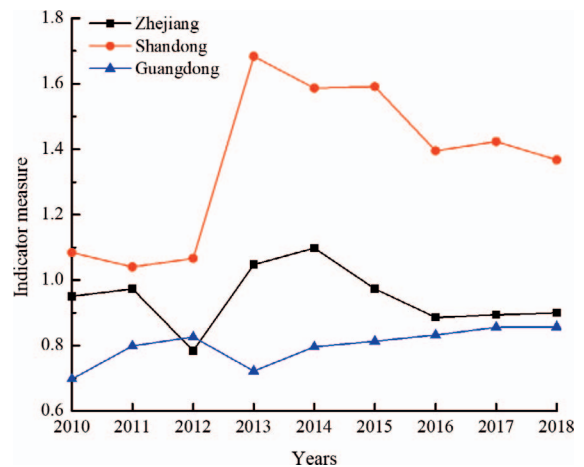


Figure 7. Indicator measure of port industry clusters in offshore provinces.

countrywide; I_t represents the gross value of all industries in the offshore areas; T_t represents the total value of all industries countrywide.

Figure 6 shows the cargo throughput of the maritime ports in the offshore provinces. It is obvious that the cargo throughputs of the maritime ports in the three provinces (Zhejiang, Shandong and Guangdong) are increased year by year, namely, by 1.95, 3.05 and 1.70 times higher than 2010. Thus Shandong's seaport has seen a maximum growth rate of cargo throughput, which means that the development and transactions operated in the companies of Shandong offshore areas increase at a maximum rate. If the location indicator is higher, it means that the maritime port cluster is higher. Figure 7 shows the indicator measurement of the port industry clusters in the offshore provinces. The maritime ports in Shandong Province have a higher clustering level, followed by Zhejiang and Guangdong provinces. The change law of location quotient coincides with that of seaport cargo

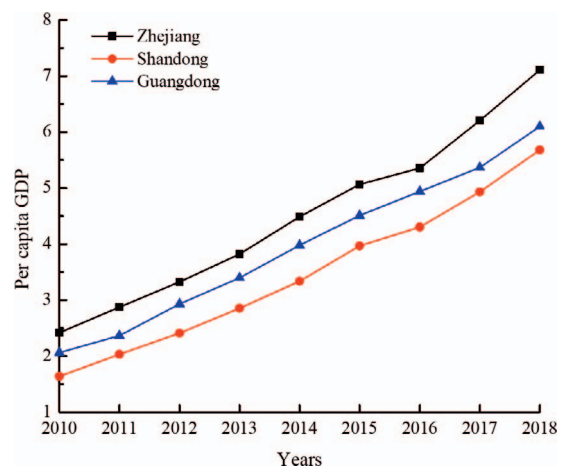


Figure 8. Per capita GDP of offshore provinces.

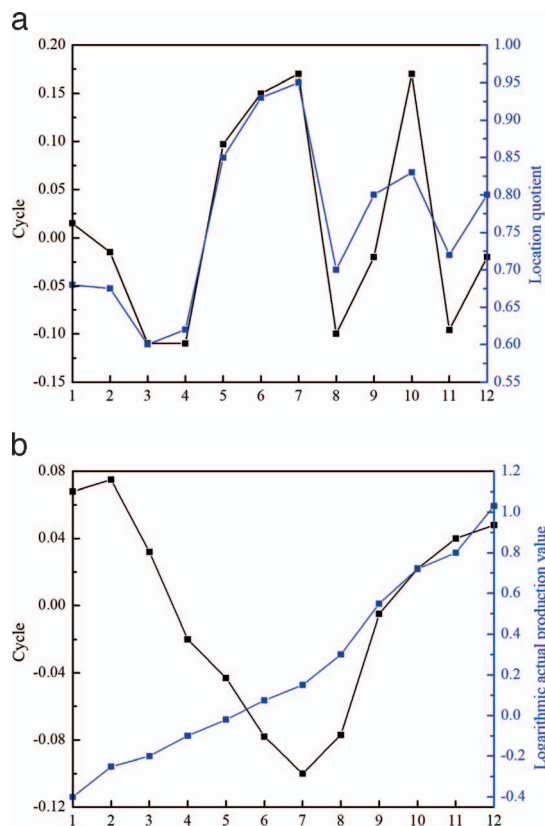


Figure 9. Shandong province port cluster and offshore regional economic growth filter curve. (a) Port cluster (b) Offshore regional economic growth

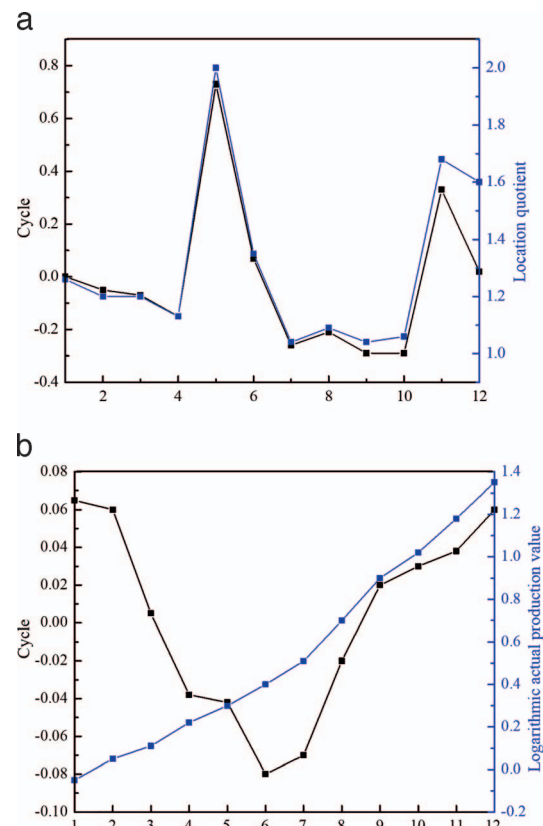


Figure 10. Zhejiang province port cluster and offshore regional economic growth filter curve. (a) Port cluster (b) Offshore regional economic growth

throughputs. That is to say, the seaport throughput can be used to reflect the port clustering level. Figure 8 shows the per capita GDP of the coastal provinces. The per capita GDPs in the three provinces are increased by 1.96 times, 2.47 times and 1.94 times, respectively, higher than 2010. The per capita GDP and the seaport cargo throughput show a similar change law. Therefore, per capita GDP and seaport cargo throughput can correspond to the maritime port clustering level, that is, the higher the maritime port clustering level, the greater the growth rate of per capita GDP. It is also proved that maritime port clusters can facilitate the economic development of offshore areas.

Proposals on the Interactive Development between the Maritime Port Cluster Effect and the Offshore Regional Economy

Figure 9–11 shows the economic growth filter curves of port clusters and offshore areas in Shandong, Zhejiang and Guangdong Provinces, respectively. *Cycle* shows the cyclical fluctuations. It is known that the location quotients of the three provinces are subject to the cyclical fluctuations. The maritime port clusters and per capita GDPs in the three provinces all show an upward trend. Maritime port cluster is subjected to different areas, so does the economic development level. However, there is a different benign interaction

on the whole. In order to improve the port clustering level, companies should improve the innovation learning capacity and actively integrate into the regional value chain system; the government should also develop its location advantages to improve the market environment, expand the infrastructure inputs and strengthen the integration of resources in the offshore areas.

CONCLUSION

Based on the grey correlation model, this paper describes the interactive development between the maritime port cluster effect and the offshore regional economy. Then the economic development level in the offshore areas is also demonstrated by an instance. Now several conclusions come here as follows:

- (1) The maritime port cluster and the economic development in the offshore areas are two-way interactive. The formation of the port cluster effect has poured into the vigor of businesses and funds in the offshore areas, thereby creating jobs, stimulating city consumption, and fueling economic development there.
- (2) Port cluster effect drives the development of the tertiary industry in offshore areas, similarly, the marine port infrastructure has facilitated the development of offshore

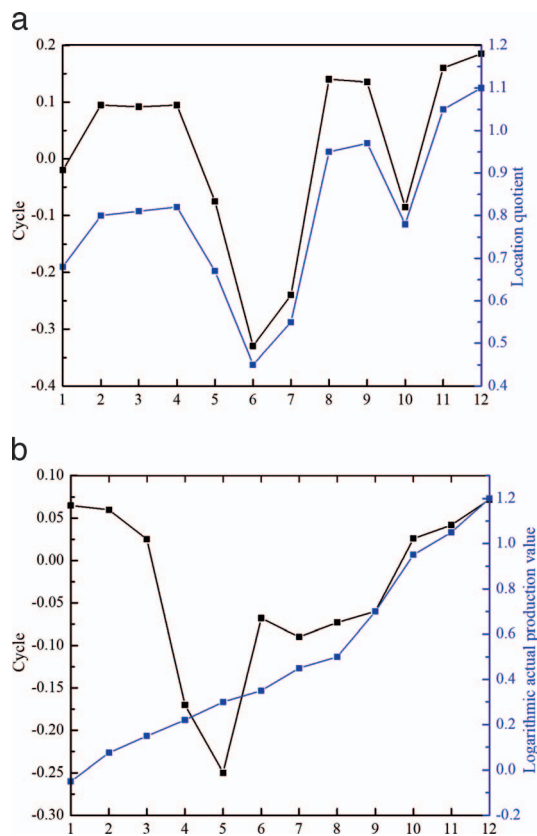


Figure 11. Guangdong province port cluster and offshore regional economic growth filter curve. (a) Port cluster (b) Offshore regional economic growth

industrial cluster, thereby increasing the total fixed assets of offshore industries and indirectly fueling the economic development in offshore areas.

- (3) The change law of the location quotient follows suit with the cargo throughput at the maritime port. The per capita GDP and the cargo throughput at the maritime ports can correspond to the port clustering development level, that is, the higher the maritime port clustering development level, the greater the per capita GDP growth rate.

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