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The empirical research on the coordinated development of container feeder port and industrial transfer

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ABSTRACT

The industrial transfer would result in the economics of transfer destination blooming, especially obviously in the container feeder port area. The empirical analysis of Granger causality test is conducted for the dynamic equilibrium relationship between the container port throughputs and the region's GDP based on the 2009-2013 quarterly data from Zhanjiang and Shenzhen government. The result shows that if the industrial transfer not affects well, the feeder port's cargo mainly from the local but the port could not develop only by lightering business. The feeder port should plan the reasonable layout and conduct the strategic cooperation with the hub port to promote the industrial development.

KEYWORDS

Container feeder port; Industrial transfer; Coordinated development; Granger causality test.



INTRODUCTION

After nearly 30 years of rapid development, China’s eastern coastal areas faced a series of problems, such as labor shortages, rent and raw materials cost rises. More and more labor-intensive industries are now transferring to the underdeveloped areas, where the labor and resource costs are lower, and the governments there are raising a lot of attractive policies and improving infrastructure. Among them the areas, where near the coastal hub ports and own a variety of transport modes, are the first choices of industrial transfer destination. In these areas, through combining different logistics modes, the increasing mileage and changing in policy environment would not result in the soaring logistics cost^[1].

RESEARCH METHOD AND VARIABLE SELECTION

The industrial transfer would reduce the labor cost and rent but rise the logistics cost and prolong the material turnover time while the transport mileage increases. To ensure the rapid circulation of raw materials and products, the use of container is essential. So a region’s container throughput is a positive correlation with its GDP, gross domestic product, an important index to reflect the region’s industry capacity^[2].

Take international processing trade as an example, before and after the industrial transfer, the change of material flow process as Figure 1 and Figure 2 shown (cargo transport in container).

Figure 1 and Figure 2 show that the manufacturing is more dispersed distribution and the route of material flow is more complex after the industrial transfer. The material flow between the industrial transfer destination and the hub port could choose the direct long-distance highway transportation, or first lightering through the feeder port then short-distance highway transportation^[3]. In this paper, the main research is to infer whether the feeder port capacity is positive in promoting the industry transfer to underdeveloped areas, by conducting the Granger causality test and comparing the economic indices of the feeder port and the hub port. The indices include four data series, the quarterly container throughput and region GDP of the feeder port and hub port^[4].

DATA SELECTION AND EMPIRICAL ANALYSIS

The indices in this paper are selected from the quarterly data of Zhanjiang and Shenzhen cities in Guangdong province in the years 2009-2013. Here Shenzhen is considered as hub port and Zhanjiang as feeder port. Actually, Shenzhen port, a hub port serving for the Pearl River Delta, Southern and Southwest China, is the second largest container port in this country. Zhanjiang port, which located in the underdeveloped areas of western Guangdong and about 400-500km to Shenzhen port, is an industrial transfer destination from Pearl River Delta economic circle. Figure 3 shows the different transport-routes from Zhanjiang port to Shenzhen port.

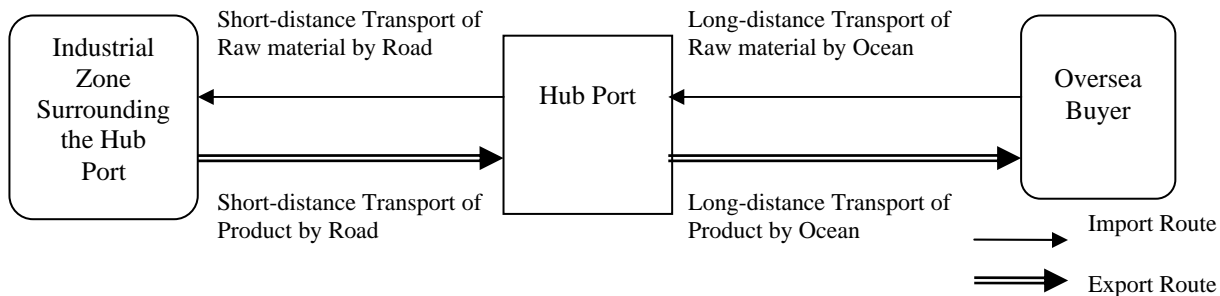


Figure1 : Material flow process before industrial transfer

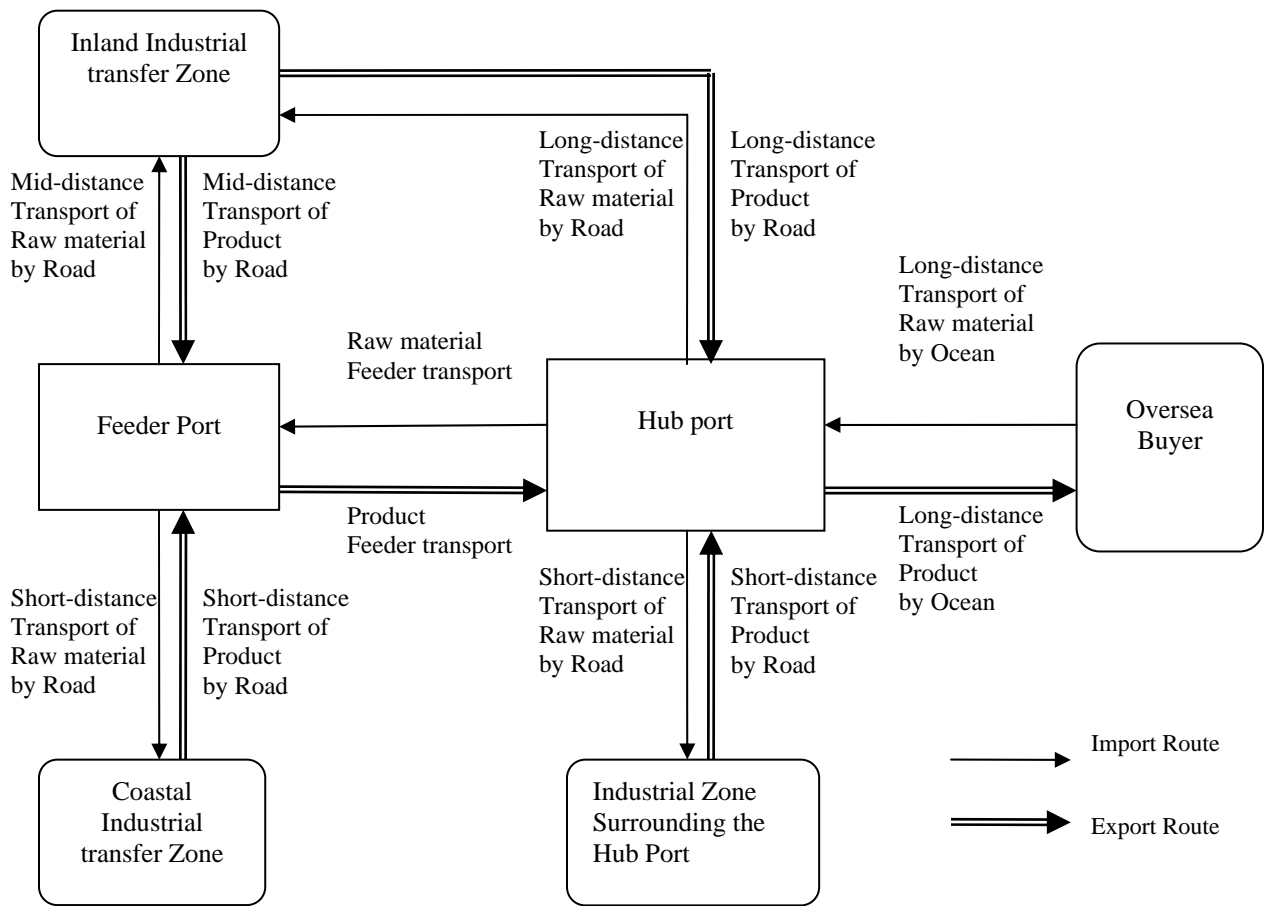


Figure2 : Material flow process after industrial transfer



Figure 3 : Transport-route from Zhanjiang port to Shenzhen port by road and sea (The circle means the Pearl River Delta economic circle)

Zhanjiang port is a typical feeder port and the container routes of Zhanjiang port are mainly short-distance regional transit lines. As the map shows, the foreign-trade cargo of Zhanjiang area could choose both high-way and feeder-ship to Shenzhen hub port then transit by ocean liner to abroad.

TABLE 1 reports the variable ZCTP representing Zhanjiang port's container throughput, ZGDP representing Zhanjiang region's GDP, SCTP representing Shenzhen port's container throughput, SGDP representing Shenzhen region's GDP from 2009 1st quarter to 2013 4th quarter. The data is from Guangdong Provincial Bureau of Statistics.

TABLE 1 : Container throughput and GDP data of Zhanjiang and Shenzhen

Period	ZCTP(*10 ³ TEU)	ZGDP(*10 ⁸ yuan)	SCTP(*10 ³ TEU)	SGDP(*10 ⁸ yuan)
2009Q1	46.92	270.20	3892.10	1740.90
2009Q2	55.38	240.80	4188.40	1890.79
2009Q3	54.73	266.88	5079.10	2233.42
2009Q4	74.59	378.29	5090.60	2336.12
2010Q1	68.14	302.41	4909.50	1977.83
2010Q2	74.04	324.45	5547.00	2237.74
2010Q3	80.18	382.16	6417.60	2506.46
2010Q4	97.80	393.74	5635.60	2788.88
2011Q1	77.69	354.97	5085.43	2350.10
2011Q2	85.44	413.60	5518.78	2686.07
2011Q3	97.24	454.69	6159.46	3213.99
2011Q4	117.76	484.96	5758.60	3251.90
2012Q1	94.13	386.31	5097.26	2523.77
2012Q2	105.40	435.50	5680.12	2966.73
2012Q3	103.48	493.79	6441.43	3649.27
2012Q4	106.76	585.04	5681.50	3826.71
2013Q1	100.25	412.35	5289.16	2750.91
2013Q2	106.10	450.56	5772.29	3262.86
2013Q3	114.81	558.86	6202.66	4069.57
2013Q4	130.44	638.24	5314.17	4416.89

Unit root test

The unit root should be tested in order to determine the stationarity of variables, First the data processing of natural logarithm is conducted to eliminate the heteroskedasticity and avoid the volatility. After natural log transformed the variables are set to LZCTP, LZGDP, LSCTP and LSGDP. Second the test is conducted by ADF method. TABLE 2 reports the test result.

TABLE 2 : Test result of unit root of variables

Variable	Test type	ADF test	5% critical value	Lagging order	Stationarity of sequence
LZCTP	Constant term	-1.702	-3.040	1	No
LZGDP	Constant term	-1.319	-3.030	0	No
LSCTP	Constant term	0.597	-1.960	0	No
LSGDP	Constant term	-1.406	-3.030	0	No
Δ LZCTP	Constant term	-6.687	-3.040	0	Yes
Δ LZGDP	Constant term	-5.581	-3.052	1	Yes
Δ LSCTP	Constant term	-8.926	-1.963	1	Yes
Δ LSGDP	Constant term	-6.522	-3.052	1	Yes

TABLE 2 reports that all the ADF of index variables are bigger than the critical value of 5% significant level and the first-order difference ADF test of index variables are smaller than the critical

value of 5% significant level. Thus, all the four variable series are integrated of order 1. The cointegration test could be applied.

Cointegration test

The unit root test proves that LZCTP, LZGDP, LSCTP and LSGDP are integrated of order 1. Here the cointegration test among the variables is conducted by Johansen and Juselius method. According to the SC guideline, cointegration equation shows a linear trend and has the model of intercept term. TABLE 3 reports the result of conintegration test.

TABLE 3 : Result of cointegration test among the variables

Variable	Eigenvalue	Trace Statistics	1% Critical Value	Number of cointegration variables under 0 hypothesis
LZCTP	0.907949	75.96440	54.68150	None *
LZGDP	0.685149	33.02690	35.45817	At most 1
LSCTP	0.492871	12.22511	19.93711	At most 2
LSGDP	0.000182	0.003275	6.634897	At most 3

TABLE 3 reports that there is unique and stable conintegration relationship among the four variables series, indicating that within quarterly sample interval in the years 2009-2013, LZCTP, LZGDP, LSCTP and LSGDP have long-term equilibrium relationship.

Granger causality test

The Granger causality test is conducted to verify whether the equilibrium relationship has causality relationship or not. In this research Schwarz Criterion is used to determine the length of lag time and the optimal lag is 3. In the term of lag time 3, TABLE 4 shows the result of Granger Causality Test.

TABLE 4 : Result of Granger Causality Test

Null Hypothesis	F value	P value	Result(5% significant level)
LZCTP → LZGDP	1.03619	0.4180	Zhanjiang port container throughput is not the Granger Causality of Zhanjiang region GDP.
LZGDP → LZCTP	0.77366	0.5348	Zhanjiang region GDP is not the Granger Causality of Zhanjiang port container throughput.
LSCTP → LSGDP	7.36186	0.0068	Shenzhen port container throughput is the Granger Causality of Shenzhen region GDP.
LSGDP → LSCTP	3.29536	0.0662	Shenzhen region GDP is not the Granger Causality of Shenzhen port container throughput.
LZCTP → LSGDP	2.03621	0.1727	Zhanjiang port container throughput is not the Granger Causality of Shenzhen region GDP.
LSGDP → LZCTP	1.77315	0.2156	Shenzhen region GDP is not the Granger Causality of Zhanjiang port container throughput.
LSCTP → LZGDP	4.97917	0.0229	Shenzhen port container throughput is the Granger Causality of Zhanjiang region GDP.
LZGDP → LSCTP	0.15997	0.9208	Zhanjiang region GDP is not the Granger Causality of Shenzhen port container throughput.
LZGDP → LSGDP	0.68525	0.5812	Zhanjiang region GDP is not the Granger Causality of Shenzhen region GDP.
LSGDP → LZGDP	2.75824	0.0977	Shenzhen region GDP is not the Granger Causality of Zhanjiang region GDP.
LZCTP → LSCTP	0.76652	0.5384	Zhanjiang port container throughput is not the Granger Causality of Shenzhen port container throughput.
LSCTP → LZCTP	5.72837	0.0152	Shenzhen port container throughput is the Granger Causality of Zhanjiang port container throughput.

The analysis of test results

1) Since there is no Granger causality between Zhanjiang port container throughput and Zhanjiang region GDP, Zhanjiang container logistics is not well promoted by its GDP growth. The port doesn't make full use of the industrial transfer, while the container business doesn't help the local industry developing. Due to Zhanjiang port focus on the bulk cargo business for a long time, for example iron ore and crude

oil, the professional port facility for container is insufficient. The local cargo owner would rather better choose the container shipped to Shenzhen hub port by road but not waterway.

2) Since Shenzhen port container throughput is the Granger causality of Shenzhen region GDP, the container logistics played an import part in the local business and promote its GDP growth. But Shenzhen area GDP is not the Granger causality of Shenzhen port container throughput, it proves that the cargo source of Shenzhen container business is not mainly from local. In recent years Shenzhen government vigorously promotes the transformation and upgrading of regional industry, which focus from the simple pursuit of quantity to quality transformation of industrial production. When the growth of the local supply slows down, Shenzhen port serves more for the numerous enterprises in South and Southwest China. Shenzhen is consistent with the features as a national hub port.

3) Since there is no Granger causality between Zhanjiang port container throughput and Shenzhen region GDP, their relationship is low. Zhanjiang container cargo is mainly from the local and surrounding area, but not Shenzhen region in the Pearl River Delta economic circle. The industry growth in Shenzhen region would not significantly promote the container business of Zhanjiang feeder port. Zhanjiang is consistent with the features as a regional feeder port.

4) Since Zhanjiang region GDP is not the Granger causality of Shenzhen container port throughput, Zhanjiang region is not a main cargo source of Shenzhen port yet. It proves that the industry transfer intensity from the Pearl Delta to Zhanjiang is not high at present. Therefore, the industrial transfer layout should be planned to ensure the logistics routes from the hub port to the transfer destination open and not decreasing the efficiency. Shenzhen container port throughput is the Granger causality of Zhanjiang region GDP, it proves that the growth of Zhanjiang economic depends on Shenzhen hub port, the latter plays an import part in promoting the vast economic hinterland industry developing.

5) There is no Granger causality between Zhanjiang region GDP and Shenzhen region GDP. It proves that both sides of the industry connection are not tight yet. One region's economic could not obviously effect the other's developing.

6) Since Zhanjiang port container throughput is not the Granger causality of Shenzhen container port throughput, Zhanjiang's throughput is too low and impact little on the Shenzhen's. According to the above throughput data, in the first quarter of 2009, Shenzhen's was about 82.95 times of the Zhanjiang's. In the fourth quarter of 2013, Shenzhen's was about 40.74 times of the Zhanjiang's. The gap is huge. But Shenzhen port container throughput is the Granger causality of Zhanjiang container port throughput. It proves that the containers of Zhanjiang feeder port are mainly transited through Shenzhen hub port.

CONCLUSION & POLICY IMPLICATION

This paper, taking the port Zhanjiang and Shenzhen in Guangdong Province as the research objects, by Granger causality test of the port container throughput and area GDP, comes to the conclusion that: As a feeder port, Zhanjiang port cargo is mainly from the local area, but the cargo which lightered to Shenzhen hub port is not accounted for the major portion. As a hub port, Shenzhen port cargo not only comes from the local area but also the vast coastal and inland hinterland.

When faced with the opportunity of industrial transfer, the feeder port of transfer destination should make full use of the existing foundation and promote logistics service level to achieve the coordinated development of port and regional economy^[5]. The measures are as follows.

The feeder port and hub port should carry out strategic cooperation to increase the lightering efficiency and change the situation of excessive dependence on highway transportation.

The efficient transport range of highway is about 200 km, while Zhanjiang port is more than 400 km far from Shenzhen port. If excessive depending on highway, the logistics cost would increase greatly and offset the labor-cost and rent savings of industrial transfer. Now the major shareholder of Zhanjiang

port and Shenzhen port is the same, China Merchants Group. It could take this opportunity to integrating both ports' information and decision-making system and reach their depth of cooperation in the form of contracts. In terms of port dispatching, Zhanjiang port should increase the number of feeder ship to Shenzhen while Shenzhen port prior handling the cargo from Zhanjiang port. In terms of port charges, the relevant handling fees should be reduced or cancelled, for example Shenzhen port frees the container discharging fee from Zhanjiang and the loading fee to Zhanjiang. The better lightering service would attract more cargo flow, while the excessive highway transport, especially in section of Humen Bridge, a famous traffic blackspot of the Pearl River Delta, would be relieved to run in smooth operation and low-carbon.

The government should plan for regional industrial transfer clusters and play the scale advantage of the similar industries

Taking Zhanjiang as an example, the city government is now promoting the professional-town construction of industrial transfer, such as Longtou town for electronic components processing, Mazhang town for animal feed. A mass of small enterprises which produce similar goods cluster in an area, the flows of raw material and product have the same import and export place. It would provide convenience for the LCL business and improve the local cargo containerization ratio. In addition, the construction of main road and information system between professional-towns and the port should be well conducted to ensure the material and information flow running rapidly.

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