Catalytic Function of Coastal Economy Development on Inland Economy

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ABSTRACT

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China is striving to realize the regional integration development of coastal and inland economies. It is a key strategy for economic development at present stage in China. To scientifically lead the synergetic development of regional economy integration, this paper attempts to analyze and conclude the driving forces the coastal economy can play on the inland economy from the theoretical and practical perspectives. Based on the theories of port-Hinterland interaction and regional division of labor, it is investigated about how the economies in coastal port and inland cities in Liaoning Province are developing now. With data of GDPs and location quotient available for real cases as reference, the interactive synergy between coastal and inland community economies is measured quantitatively using the Logistic model in an attempt to conclude the push-pull powers between the two with the marginal and elastic analysis. In addition, a synergistic development strategy is also made for coastal and inland community economies. A quantitative and qualitative study is indeed significant for leading the synthetic development of regional economies.

ADDITIONAL INDEX WORDS: *Port-hinterland, logistic model, economy in Liaoning province, case analysis.*

INTRODUCTION

There is a big gap in the coastal economy development between coastal and inland areas, so that the imbalanced development between the regions is increasingly highlighted. In order to fill this gap, the inland economy development should be primarily driven by the coastal economy, this has become a key topic for improving China's overall economic level and balancing the gap between the rich and the poor (Jiang, Sun, and Liu, 2010). After the birth of the economic development strategies such as regional economic integration, regional and urban-rural synergies, the development relationship between the coastal economy and inland community economy started to arouse a wide public concern (Kahrl and Roland-Holst, 2009).

For example, in the United States, there are areas along the northeast Atlantic coast and along the Great Lakes that have been developed first. Subsequently, with the stimulation of loose policies and guided by the economic measures of adaption to the local conditions, the disparities between coastal and inland cities are gradually shrunk, so that there are several economic development zones formed in the east, central and west China (Li *et al.*, 2015). In the domestic practice, the Yangtze River Delta, the Pearl River Delta and other areas have enjoyed the priority in development to accelerate regional economic mobility, and coordinate the allocation of HR and other resources. In this way, a development pattern formed with the eastern coastal development areas as the core that radiates out to inland has started to be popularized (Li, 2003). Some scholars have concluded the key elements for resource,

talent and policy interactions in regional economic development; some scholars have revealed advantages and disadvantages of coastal economy and inland community economy, concretely to the present stage; but there is lack of profound study qualitatively and quantitatively on the synergic interaction between coastal economy and inland community economy (Gilerson *et al.*, 2010).

This paper focuses on the intrinsic relationship between coastal economy and inland community development. It is also analyzed that the coastal economy may be a catalyst for inland economy development (Lowry *et al.*, 2008). With a view of the slowdown in the development and the geographic entity in the three northeast provinces of China in recent years, taking data about economy in coastal and inland hinterland cities in Liaoning Province as sample, we conduct a survey on relevant areas under the premise of fully analyzing the theoretical foundations for economic development.

THEORETICAL FOR THE COORDINATED DEVELOPMENT OF COASTAL AND INLAND ECONOMIES

Port-Hinterland Interactive Development Theory

Ports develops the logistics industry clusters that can drive the development of hinterland economy. Rather, the hinterland economy reversely moves the port economy to develop (Zhang, *et al.*, 2017).

The function the ports play in the hinterland economy is reflected in: (1) The port-vicinity industry will stretch to the hinterland after developing to a certain size. For example, large-scale manufacture industries such as automobiles and shipbuilding, all of which will be a very strong driving force for the development of hinterland machinery, steel, metallurgy and other industries. It could be said that port industries will

Table 1. *The coastal city GDP of Liaoning province from 2013 to 2017.*

Y/Region	Dalian	Dandong	Jinzhou	Yingkou	Panjin	Total	GDP of Liaoning	Ration
2013	2431	489	506	409	578	4413	9824	44.9%
2014	2680	621	689	521	720	5231	11670	44.8%
2015	2936	738	830	650	932	6086	13950	43.6%
2016	3329	920	997	798	1176	7220	16579	43.5%
2017	3885	1135	1280	947	1366	8613	19842	43.4%

promote the rise of relevant industries; (2) Due to excellent regional advantages, port acts as a medium and gateway for economic exchanges between the inland and external world. Guided by the policies such as bonded ports, the ports lead the hinterland into the world to expect a more open and international development; port cities mostly enjoyed preferential development policies to have the huge edge in talents, information technology, culture, etc. With the inputs of these resources into the hinterland, the economy there gets developed.

The innovation of port economy boosts the structural optimization and industrial upgrading of the hinterland economy which in turn functions as a reverse catalyst for port economy, specifically reflected in: (1) The hinterland economy provides logistics support and consumer market for port import and export trade; (2) The hinterland provides a development space for the port economy. When port industrial agglomeration develops to a certain stage, the port development is subject to space constraints, while the hinterland provides a broad and low-cost space for the port to expand out.

The port and the hinterland economies stimulate and restrict one another, that is, the port needs the support from the hinterland, while the hinterland is a leader for the port. Only when the two continue to optimize the industries and move forward the economic reform on the premise there is a certain gap in economic development can they benefit from each other to realize the regional economic integration.

Regional Division Theory

(1) In general, the theory of comparative cost is just the idea of "best of all superior and inferior". A country or area, regardless of the degree of its development, can always find a relatively dominant industry, and concentrate the advantages to develop it. In doing so, social production efficiency can be improved while the national or regional economic development will be driven (Yun, Bae, and Kim, 2012). This theory believes that the regional economy advantage must not require an absolute advantage, and the relative advantages of other industries in the competitive regions can be targeted in regional development.

(2) Product life cycle theory. The development of regional economy is analogous to the product development process. It can be divided into three phases, i.e. product development; product growth; product maturity. In the product development phase, the product production is in the innovation phase, and the target market localization is in process; in the product growth phase, the product market is basically embryonic and gradually expands to the outside world; in the product maturity phase, the production reaches a standard level and the market

pattern generates. In the product life cycle, everything is not static, whether it is the product, technology, or market. The product is exported to the world within the market area to form the regional division of labor (Gorniak, 2010).

The study of existing theories shows that the coastal economy and the inland community economy are inextricably correlated to each other, and there is a synergistic relationship between them. Only by well doing the synergistic development of the two can we realize better market optimization and industrial structure.

EMPIRICAL ANALYSIS OF THE INTERACTION BETWEEN COASTAL AND INLAND ECONOMIES
Current Situation of Economic Development in Liaoning

The economy in Liaoning is a typical mixture that has both features of coastal areas and inland. The coastal economic belt is formed in such a way that the Bohai Bay area is embraced by coastal cities such as Dalian, Panjin and Huludao, and the inland city economy is formed with the provincial capital Shenyang as a center, including Liaoyang, Fushun and Anshan (Jiang and Zhang, 2012)). In Liaoning, there are eximious port resources and sound industrial foundation. The economic revitalization in Liaoning matters the success of economic development in the three northeastern provinces. Therefore, it is significant to explore the interactive synergy and mutual promotion between the coastal and inland economies in Liaoning.

(1) Data Analysis of Economic Situation of Coastal Cities in Liaoning. The statistical list of GDPs from 2013 to 2017 in five major coastal cities in Liaoning is shown in Table 1. Data in the table, in RMB 100 million, is available from the 2017 Statistical Bureau Yearbook of Liaoning Province. It is obvious that the GDP of each coastal city is on the rise year by year, while the GDP of coastal cities as percentage of the total GDPs of Liaoning Province shows a little downward trend (Dong *et al.*, 2016). The

Table 2. *The coastal city urbanization rate.*

Region	Total Population		Urban Population		Urbanization Rate	
	2016	2017	2016	2017	2016	2017
Liaoning	4542	4607	2337	2384	51.5%	51.8%
Dalian	610	615	354	363	58.0%	59.0%
Dandong	245	248	112	119	45.7%	47.9%
Jinzhou	321	327	123	128	38.3%	39.1%
Yingkou	233	241	108	115	46.3%	47.7%
Panjin	128	136	109	120	85.1%	88.2%
Coastal City	1537	1567	806	845	52.4%	53.9%

Table 3. *The inland city GDP of Liaoning province from 2013 to 2017.*

Y/Region	Shenyang	Anshan	Fushun	Benxi	Liaoyang	Total	GDP of Liaoning	Ration
2013	2789	782	629	535	676	5411	9824	55.1%
2014	3247	891	774	654	873	6439	11670	55.2%
2015	3893	1069	958	789	1155	7864	13950	56.4%
2016	4449	1310	1263	960	1377	9359	16579	56.5%
2017	4977	1596	1670	1341	1645	11229	19842	56.6%

urbanized and city populations as percentage of total population are used as indicators to evaluate and data of 2016 and 2017 is available for analysis. The urbanization rate shown in Table 2 is available. Data in the table, in 10,000 people, is available from the 2017 Statistical Bureau Yearbook of Liaoning Province. The figure shows that the overall urbanization level of Liaoning Province was increased slightly by 0.3% in 2017, compared with 2016, while the urbanization level of coastal cities increased by 1.5%. It is showed that the overall urbanization level of coastal cities is higher, and as the development trend, the self-development of coastal cities drives the development of the inland cities (Zhang, Wei, and Cheng, 2010).

(2) Data Analysis of Economic situation of Inland Cities in Liaoning. The statistical list of GDPs from 2013 to 2017 in five major inland cities in Liaoning is shown in Table 3. Data in the table, in RMB 100 million, is available from the 2017 Statistical Bureau Yearbook of Liaoning Province. It is obvious that the GDP of each inland city is also on the rise year by year, while the GDP of inland cities as percentage of the total GDPs of Liaoning Province shows a little upward trend (Dong *et al.*, 2016). The inland urbanization development level refers to coastal city standards. The urbanization rate shown in Table 2 is available from statistical data. Data in the Table 4, in RMB 100 million, is available from the 2017 Statistical Bureau Yearbook of Liaoning Province. It is obvious from the evolution trend of urbanization rate in inland cities that the GDP of each inland city shows a backward trend year by year, and the decline of city population loss and city development attraction is the bottleneck of the current inland urban development in Northeast China and the urban development issue to be solved currently.

(3) Quantitative measurement of coastal and inland cities. Urban flow is a flow phenomenon relevant to economic activities such as logistics, information flow, capital flow, and technology flow between cities. The power of urban flow derives from the interactive agglomeration and radiation development between cities. The urban flow is measured by the urban flow intensity. The urban flow intensity is calculated by Formula 1.

$$F = N \cdot E \qquad (1)$$

where, N represents the functional efficiency of the city; E represents the urban outward function. Urban function is the general term for urban service and production activities, and urban outward energy is the reflection of urban flow in the connection between cities. The urban function efficiency is determined by the per capita GDP of employees in various industries in the city, while the urban outward function is measured by the employer's location quotient (Fraga, Cea, and Puertas, 2013; Yu, Ge, and Huang, 2010). The location quotient is calculated by the Formula 2.

$$L_{q\mathrm{ij}} = \frac{G_{ij}/G_i}{G_j/G} \ (\mathrm{i} = 1, 2, 3 \ldots \mathrm{n} \ \mathrm{j} = 1, 2, \ldots \mathrm{m}) \qquad (2)$$

where, G_{ij} represents the number of employees in the industry j of the city i; G_i is the total number of employees in the city; G_j is the number of employees in the industry j countrywide; G is the total number of employees countrywide. If the location quotient is less than 1, the city's outward function is zero, then the outward function of each sector in the city is shown in Formula 3.

$$E_i = \sum_{j=1}^{m} E_{ij} \qquad (3)$$

where, K_i represents the urban flow tendency; $K_i = E_i/G_i$ is the response of the city's outward total energy.

Table 4. *The inland city urbanization rate.*

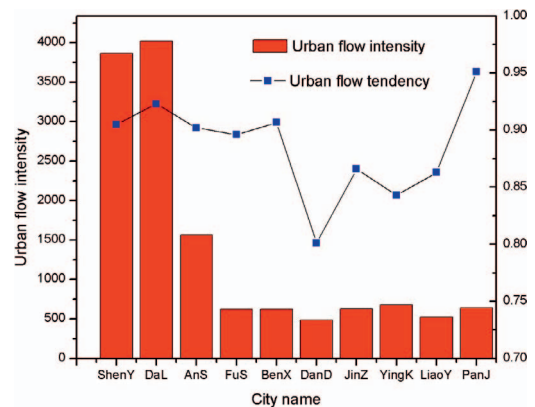| Region	Total Population		Urban Population		Urbanization Rate	
	2016	2017	2016	2017	2016	2017
LiaoNing	4542	4607	2337	2384	51.5%	51.8%
ShenYang	1593	1620	**781**	**795**	49.0%	49.1%
AnShan	453	458	**221**	**215**	48.7%	46.9%
FuShun	398	400	**248**	**250**	62.3%	62.5%
BenXi	302	312	**172**	**164**	56.9%	52.6%
LiaoYang	259	250	**109**	**115**	42.1%	46%
Inland City	3005	3040	1531	1539	50.9%	50.6%

Figure 1. Urban flow tendency and urban flow intensity in major coastal and inland cities of Liaoning.
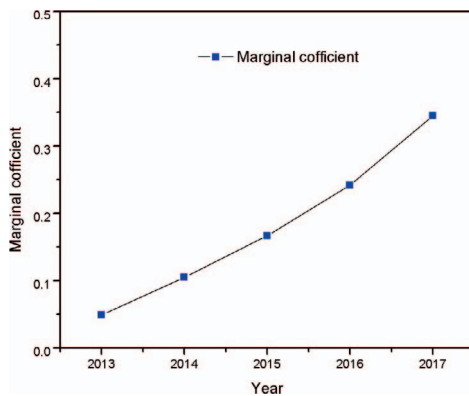
Figure 2. Marginal coefficient from 2013 to 2017.
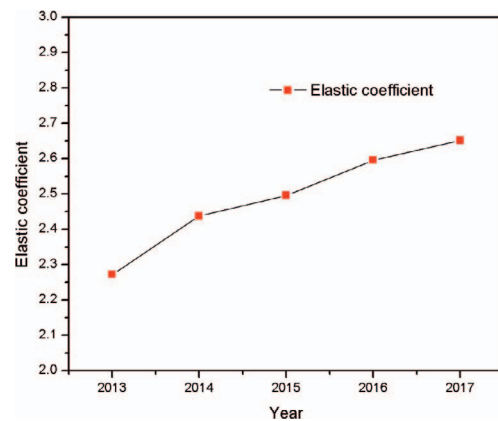
According to the analysis and calculation of data available from the 2017 Statistical Yearbook in Liaoning, the urban flow tendency and intensity of the main coastal and inland cities in Liaoning are shown in Figure 1.

As shown in the figure, Shenyang and Dalian are far ahead of other cities in terms of urban flow intensity and tendency, while other cities can be ranked into two classes with urban flow intensity 600 as the boundary line. As in all things, the economic development situation of major coastal cities can be divided into three levels: L1: Dalian and Shenyang; L2: Anshan, Fushun, Benxi, Jinzhou, Yingkou, Panjin; L3: Dandong and Liaoyang. As a leader in the development of coastal economic belts, Dalian depends on Dalian Port to play an important function in the coastal and inland economies; Shenyang, as a provincial capital, has predominant geographical location and economic development space, and depends on its radiating capacity to stimulate the economic development of the whole province.

Positive Analysis of the Synergetic Effect between Coastal and Inland Economies

(1) Logistic model. Logistic function, a growth function, is widely used in many fields such as industrial value-added and medical analysis, expressed by Formula 4.

$$Y = \frac{A}{1 + e^{b - kt}} \qquad (4)$$

where, Y represents the indicator to be measured; A is a limit value; k is the growth rate (Pearce, J., & Ferrier, S., 2000). According to the Logistic model, the statistical analysis is made on the synergetic effect between coastal and inland economies in Liaoning. The port throughput (x) and the inland urban GDP (y) are chosen as the two indicators of the Logistic model, and the correction formula is available as shown in Formula 5.

$$Y = \frac{1}{\frac{1}{M} + ab^x} \qquad (5)$$

After determining the parameters in the model based on historical data and regression test, the model is analyzed to represent the pulling function that port

Figure 3. Elastic coefficient from 2013 to 2017.

throughput plays on the total GDP of the inland hinterland. Since the relationship between the port throughput in coastal cities and the total GDP of inland cities is nonlinear, the independent and dependent variables evolve in different degrees, so does the gradient of the function curve. For this nonlinear function, two economic magnitudes are required, namely marginal and elastic economies. The marginal economy means the increment of the dependent variable caused by the increase of the independent variable, and is used to describe the instantaneous gradient of one economic quantity relative to another; the elasticity refers to the attribute that one variable changes relative to the other at a certain ratio.

(2) Marginal analysis. The figures, the port throughput of Liaoning coastal cities and the GDP of inland cities from 2013 to 2017, are substituted into the Logistic model, then marginal coefficient is available, as shown in Figure 2. The marginal function can be intuitively interpreted as the increase in GDP of inland cities in the case when the throughput of coastal ports is added by 1 ton every time. As we see from data in the table, the coastal port cities have marginal effects on the inland economy, which gradually builds up over time.

(3) Elastic analysis. Based on the port throughput of Liaoning coastal cities and the GDP of inland cities from 2013 to 2017, the elastic coefficient changes as shown in Figure 3. The elastic coefficient represents the GDP growth rate of inland cities in the case when the port throughput increases by 1% every time. As we see from data in the figure, the impact of this rate is increasing year by year. By 2017, the ratio of port throughput to inland GDP growth reached 2.69.

(4) Positive Analysis summary and development proposal. From positive data analysis, it is known that the development of coastal port economy has a pulling function on the inland community economy. In recent years, this pulling function has been on the increase. From 2013 to 2017, the marginal and elastic coefficients have somewhat increased, which shows that the devel-

opment of Liaoning port economy has played a more and more powerful driving function in the inland economy in recent years. With the growth of port logistics industry clusters and international ocean transport volume, the rapid development of economy in coastal port cities has formed a driving force for inland economic development. The coastal and inland economies have a relationship of mutual promotion and restraint. Only when this push-pull relationship achieves the mutual adaptation level can they co-develop forward rapidly.

More attention should be paid to regional synergetic development pattern of coastal and inland economies to form the coordinated development among industrial parks, port industrial clusters and economic belts, with market, talent and capital interaction modes as primary targets, to promote synergy between coastal and inland areas more frequently, thus avoiding excessive re-competition in the industry, complementing advantages, and sharing resources.

CONCLUSION

In recent years, the economic downturn in Northeast China has aroused concern of the people at the national level. How to get an economic revival in Northeast China is a hot topic in the economic sphere. This paper makes a profound exploration on the function of coastal economy as pulling inland community economy from the perspective of marine economics. Here takes Liaoning Province as an object for empirical study. After fully analyzing the theoretical basis and calculating statistical data, the interaction between coastal and inland economies is analyzed by the model. This is the content and significance as follows:

(1) The theoretical basis of the interaction between coastal economy and inland community economy is analyzed, and the economic development conditions of major coastal and inland cities in Liaoning Province are investigated.

(2) Based on the Logistic model, the relationship between the throughputs in coastal port cities and the GDPs in the inland cities represents the synergy between the coastal and inland community economies, and the relationship between the two is quantitatively measured by the marginal analysis and the elastic analysis.

(3) This paper demonstrates the pulling function of coastal economy on the inland community economy, showing

that it is feasible to depend on the economic belts at Bohai Bay port to drive economic resurgence of Liaoning province and the Northeast areas.

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