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Analysis on strategies of competition and cooperation between Shanghai and Ningbo port

Yuan Lu

SHANGHAI MARITIME UNIVERSITY

WORLD MARITIME UNIVERSITY

Shanghai, China

Analysis on strategies of competition and cooperation between Shanghai and Ningbo port

By

Lu Yuan

China

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DECLARATION

I certify that all the material in this research paper that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

Lu Yuan

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Supervised by

Associate Professor Shi Xin

Shanghai Maritime University

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ABSTRACT

Title of research paper: **Analysis on strategies of competition and cooperation between Shanghai and Ningbo port**

Degree: **Master of Science in International Transport and Logistics**

The progress of the construction of Shanghai international shipping center and the development of the Yangtze River Delta's ports are concerned by the public and government. As the two most important international hub ports in the maximum port density of the Yangtze River Delta port cluster, Shanghai Port and Ningbo Port, their competition and cooperation mode choice is related to the development of the entire port group in the Yangtze River Delta. The dissertation describes the current situation of port of Shanghai and Ningbo. We summarize the existing successful model of competition and cooperation in regional ports throughout the world and test the model by empirical analysis. After comparing the result, we choose the most appropriate model based on comprehensive benefits. To achieve the best benefits of the two ports, we give policy recommendations to the two ports considering the reality.

KEYWORDS: Shanghai Port, Ningbo Port, competition, cooperation

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Chapter one: Introduction

1.1 Backgrounds

The progress of the construction of Shanghai international shipping center and the development of the Yangtze River Delta's ports are really concerned by the public and central government. As the two most important international hub ports in the maximum port density of the Yangtze River Delta port cluster, Shanghai Port and Ningbo Port, their competition and cooperation mode choice is related to the development of the entire port group in the Yangtze River Delta planning, functional integration and maximize the regional benefits.

The dissertation describes the current situation of port of Shanghai and Ningbo. We summarize the existing successful model of competition and cooperation in regional ports throughout the world and test the model by empirical analysis. After comparing the result, we choose the most appropriate model based on comprehensive benefits. To achieve the best benefits of the two ports, we give policy recommendations to the two ports considering the reality.

1.2 Literature Review

According to the research and study of competition and cooperation strategy among ports, we can summarize several parts:

First is the necessity, restrictions, impact of making competition and cooperation among ports. Wang Xudong and Du Lingdng analyze the negative impact of

competition without order among regional ports group. It will affect not only one port but also it will affect the development of the whole regional ports group. To avoid the negative impact, regional ports will have to choose to cooperate and coordinate.

But at the same time, it still has some restrictions on cooperation. Once one port can get more profit or interest, the cooperation among ports will stop.

Zhao Chao and Zhang Hanqing realize the positive impact of the competition and cooperation strategy on reducing market risk, improving service quality, Enhance competitiveness, reducing cost and improving profit.

Second is the study about the content and model of strategy of competition and cooperation. He Jianyun and Ning Yueming creat the theory of the organization of cooperation among ports. Li Nan thinks during the competition among ports, it will create several kinds of strategy model of cooperation. Kong Lei and Xu Changxin think that the cooperation among regional ports group is the combination of different kinds of terminal, the adjust of the regional ports' structure and the integration of terminal resources.He Jinayun and Ning Yueming provide the content and range of the cooperation among ports

With all these research, we already realize the importance of making competition and cooperation strategy among regional port group.

However, problem and weakness still exit. First is that there is no deeper study on the organization model of competition and cooperation strategy. Second is that there is few quantitative analysis on study of competition and cooperation strategy. Third is that there is no results of empirical analysis. They did not provide the strategy and

solution in some particular area.

In a word, this dissertation describes the current development status of Shanghai Port and Ningbo Port, combs and summarizes the main competition and cooperation model in regional ports in the world, does the mode test by empirical analysis, and then compare and select the most appropriate model based on comprehensive benefits for the two ports. In the end of the article, we give policy recommendations to the two ports in order to achieve high quality development of two ports and realize the best benefits.

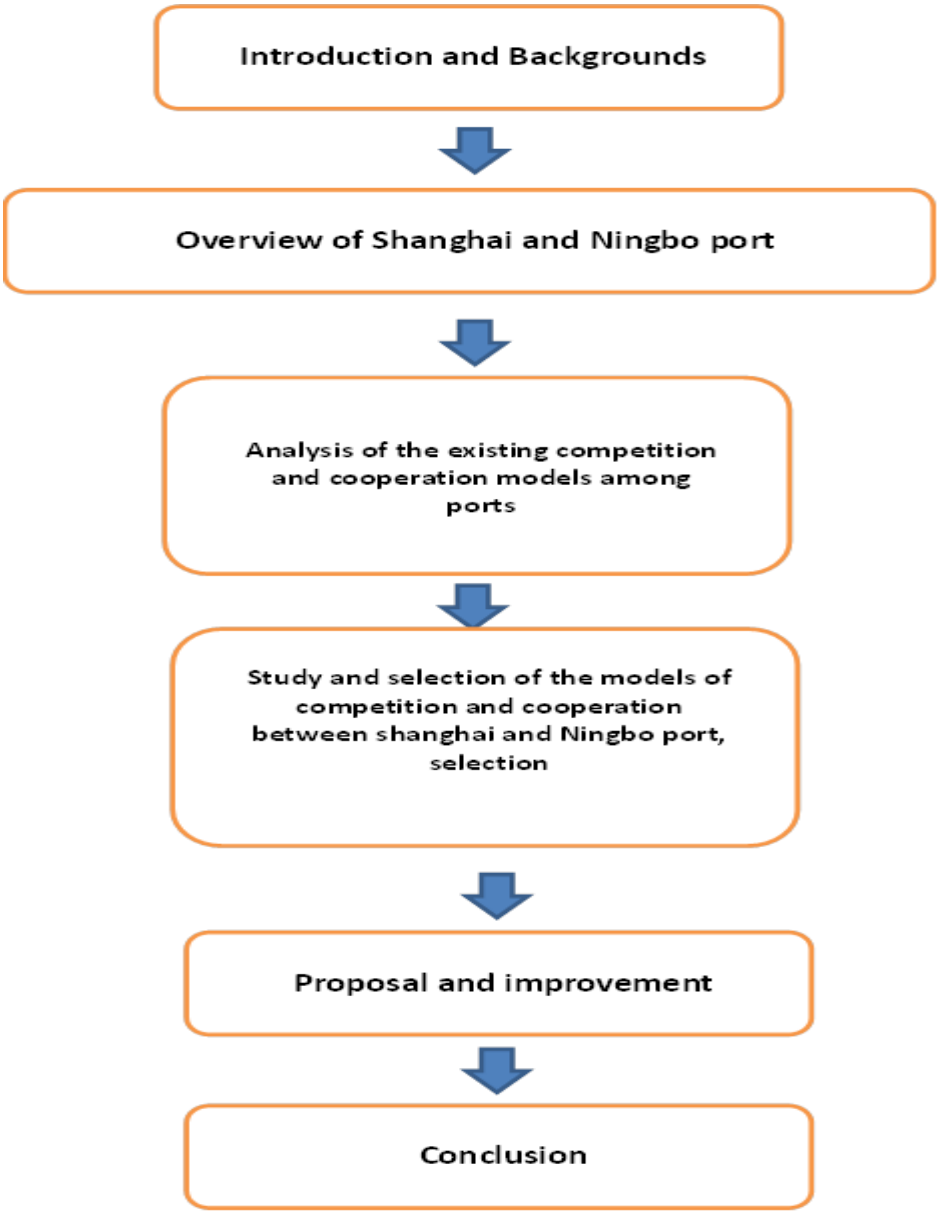
This dissertation tries to solve the existing problems and weakness of the existing study of competition and cooperation strategy model. However, it still has a long way to go.

1.3 Framework and Content of the Dissertation

First part of the dissertation, from the topic and background, we realize the problem and talk about the meaning of competition and cooperation between ports .And the content of the dissertation.

Second part of the dissertation, from the current situation and existing problems of the development of Shanghai and Ningbo port, we analyze the necessity of making competition and cooperation strategy between the two ports. We analyze several kinds of competition and cooperation models and analyze their features. Then we choose the corresponding mathematical model for each competition and cooperation model.

Third part of the dissertation, based on Shanghai and Ningbo port, after collecting date, we do the empirical analysis and test of each mathematical model. With the comprehensive benefit analysis, features of both ports, policy and real situation of each port, we compare and choose the best strategy model for Shanghai and Ningbo port.



Chapter Two: Overview of Port of Shanghai and Ningbo

2.1 Development of port of shanghai and Ningbo

2.1.1 Port of Shanghai

Port of Shanghai has an advantageous Geographical Location. It is situated at the middle of the Chinese coastline, where the Yangtze River, known as “the Golden Waterway”, flows into the sea. It is the leading port in the T-shaped waterway network composed by the Yangtze River and the coastline, and is also China’s largest comprehensive port and one of the country’s most important gateways for foreign trade.

It is faced towards the northern and southern coastal seas of China and the oceans of the world, and is linked with the Yangtze River and the inland waterways of Yangtze River Valley region such as Jiangsu, Zhejiang and Anhui provinces etc. Expressway and state-level highways lead the Port to the national highway network to all regions of the country.

Therefore, the Port enjoys an advantageous geographical location, favorable natural conditions, vast economically developed hinterlands, and complete inland distribution infrastructure and facilities.

Port of Shanghai has a vast Economic Hinterlands. It serves vast hinterland in the Yangtze River Delta and the entire Yangtze River valley. The Yangtze River Delta is

home to a cluster of cities which are the most economically vibrant area in China. The Jianghan Plain and Sichuan Basin are areas that are densely populated and have a developed agriculture and a strong industrial base. These areas will prove to be the powerhouse for the sustainable growth of the Port of Shanghai.

The annual import and export trade through Shanghai, in terms of value, accounts for a quarter of China's total foreign trade. The Port's container throughput in 2010 reached 29.069 million TEUs, ranking it the largest container port in the world.

Frequent Liner Services is another advantage of port of Shanghai. Container liner services from the Port of Shanghai cover all major ports around the world. More than 2,000 container ships depart from the Port every month, en route to North America, Europe, the Mediterranean, Persian Gulf, Red Sea, Black Sea, Africa, Australia, Southeast Asia, Northeast Asia, and other regions.

2.1.2 Port of Ningbo

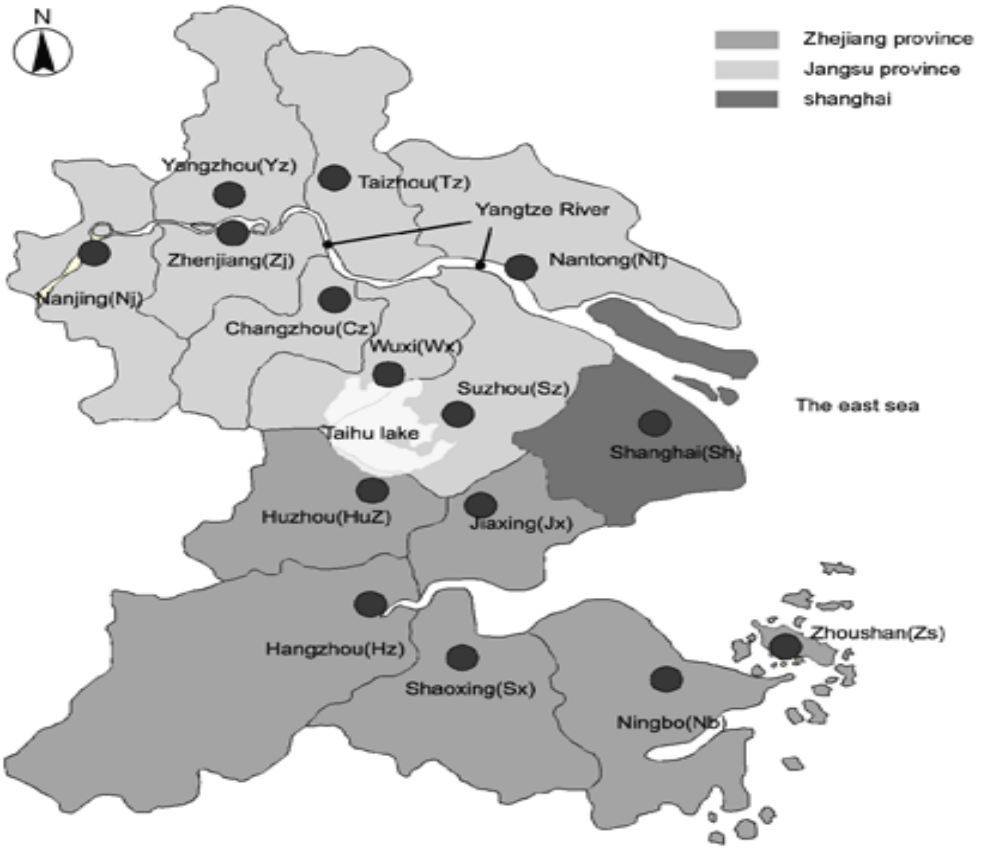
Port of Ningbo is one of the most important and busiest ports in mainland China. It is located on the rich coastal province of Zhejiang. The port is at the crossroad of the north-south shipping route and the important waterway of the Yangtze River. The port comprises several ports which are Beilun (seaport), Zhenhai (estuary port) and old Ningbo harbor (inland river port), Daxie and Chuanshan. It is one of a growing number of ports in China with a cargo throughput volume exceeding 100 million tons annually.

Ningbo Port is involved in economic trade with cargo shipment, raw materials and manufactured goods from as far as North and South America and Oceania. It has economic trade with over 560 ports from more than 90 countries and regions in the

world.

The Port of Ningbo has been merged with the Port of Zhoushan to form a combined cargo-handling center. The combined Ningbo-Zhoushan Port had a throughput of 627,000,000 tons of cargo in 2010, making it the second-largest port in the world (after Shanghai) in terms of cargo volume.

Port of Ningbo is a modern multi-purpose deep water port, consisting of inland, estuary and coastal harbors. There are a total of 191 berths including 39 deep water berths with 10,000 and more tonnage. The larger ones include the 250,000 tonnage crude oil terminal, the 200,000+ tonnage ore loading berth. There is also a purpose-built terminal for the 6th generation container vessel and the 50,000 tonnage berth dedicated for liquid chemical products.



2.2 Comparison of port of shanghai and Ningbo

2.2.1 Natural condition

Ningbo Port is well situated in the middle of China's coastline, at the T-shaped joining point of China's coastline and the Yangtze River. It's a famous deep-water port of mainland China. With deep water and smooth current, the port area of Ningbo is free from strong winds and waves. The entry channel is normally over 18.2 meters deep. Large ships of 250,000 up to 300,000 tonnages can come and leave at tide. With an exploitable deep-water coastline of over 120 km, Ningbo Port owns broad developing and construction prospects. On the north of Beilun Port Area, Zhoushan Islands serve as its natural defense, so there is no need to build breakwaters when constructing berths at Beilun Port Area. Less investment can produce better benefits. Ningbo-Zhoushan ports have obvious advantages in depth of water which was the most important factor in port nature factors. According to the index of International Shipping Center, the depth of water should be more than -14 meters. The average water depth is about -9 meters in Shanghai before the construction of Yangshan deep sea port, the container vessels are limited seriously by it. The deep water factor is one of the comparative advantages of Ningbo-Zhoushan port.

2.2.2 Price

Port charges in mainland China are based very closely on a standard rate specified by China's Ministry of Communications. It includes separate charges for stevedoring, piloting and tugs. Currently Shanghai and Ningbo both adopt a more flexible pricing

policy than sticking simply to the centrally set standard rates. Their approach is characterized by a differentiation between large and small customers, especially with respect to the stevedoring charge. Generally, large mainline operators receive a 10% discount compared with coastal liner operators.

The piloting tariffs are all based on a standard rate by Ministry of Communications. For distances less than 10 nautical miles, the rate is 0.5 RMB per net ton. For any distance above 10 nautical miles, the rate for the rest of the voyage is 0.005 RMB per net ton per nautical mile. Since the piloting distance for Ningbo is relatively shorter than for the terminals in Shanghai, especially STC, so the piloting charges payable in Ningbo are generally less than those prevailing in Shanghai.

According to the price on website, the tug tariffs for the ports of Shanghai are more expensive than Ningbo. However, the stevedoring charges are almost same in Shanghai and Ningbo.

Stevedoring, piloting and tug charges are the three major port costs incurred in calling at a mainland Chinese port. Together, they account for about 90% of the total direct cost of a vessel's call at port. By broadly comparing the cost associated with the port calls of ships of similar size, it is self-evident that Ningbo possesses a definite price advantage.

2.2.3 Informatization level

Informationization level is also an important index of hub ports. The efficiency of port works could be increased by high informationization level. The informationization level depends on the implement condition of EDI. Shanghai port has paid much

attention to promote informationzation and advanced equipment. The service objects of EDI platform are wide, which include government, port authority, liner, ship agent, cargo agent, tally company and so on. Especially in recent years, Shanghai has accelerated the construction of port infrastructure. Comparatively speaking, although Ningbo-Zhoushan port has started the development of EDI system, the coverage rate is much lower than in Shanghai port because of the backward equipment and limitation of the further development of Ningbo-Zhoushan port.

2.2.4 Port service

The quality of port service in Shanghai is better than that of Ningbo-Zhoushan port. It is one of the most important factors of port competitiveness. The major reason why Hong Kong Port and Port of Singapore could be huge ports of transshipment is its high level port service and the relative low price. Compared with Ningbo-Zhoushan port, the port service in Shanghai port is much better in piloting service as well as VTS, port facilities and port safety work. It is obvious that major facilities in Shanghai port are about twice as much as in Ningbo-Zhoushan port. It supports Shanghai port providing high level service reducing average loading time of vessels.

2.2.5 Hinterland

The major comparative advantage of Shanghai port is its huge hinterland—Yangtze River Delta area. Collecting and distributing system in this area is developed and it has advantage in industry, science, nature resource, skilled labor and demand of consumption. As the center of the economic development of western China, it would generate a lot of container cargoes from this area. Shanghai port could absorb these cargoes through multi-modal transport system and make western of China the direct

economic hinterland of Shanghai port. The hinterland of Ningbo-Zhoushan port is much smaller than Shanghai port. The main hinterland of Ningbo-Zhoushan port is south-east of Zhejiang province. Cargoes generated from Hangzhou, Jiaxing, and Huzhou are mostly exported or imported through Shanghai port. Because of the underdevelopment of railway transport in Ningbo, road transport is the main way for cargo collecting and distributing. In addition, the liners and sea routes in Shanghai port are much more than in Ningbo-Zhoushan port, so under the same condition, the shipper in other area would choose Shanghai port.

Table2.1

Port	Natural Condition	level of informatization	Port Service	Price	Collecting and distributing system
Shanghai		better	better		better
Ningbo	better			better	

2.3 Analysis of existing problems between the two ports

2.3.1 Policies of coordinate development between the two ports can't be put into practice

The reasons which lead to this problem are that policies are made by several government department and they all have their own plan to construct these ports. The ministry of transportation made a strategy that set the key port at Shanghai municipality as a center and the coastal ports of Jiangsu and Zhejiang province as two wings. That means it will make port of Shanghai as the trunk line port and ports

of Jiangsu and Zhejiang as the feeder port. However, national development and reform commission made another strategy that they plan to develop “Three Systems”. “Three systems” consist of Shanghai port container system, Ningbo port bulk cargo transit system and Jiangsu port river-sea transit system. We can see that different government department have not reaches an agreement of the role and function of each port which is a crucial block that stop the coordinate development.

2.3.2 Overlapped function problem

Port of Shanghai and Ningbo has same function orientation and same service business. Both Shanghai port and Ningbo port want to be the international container hub in this region. They compete on cargo resources without rules which will bring more problems. Most ports in Yangtze River delta has plan to construct container ports and berths to attract more cargos which will destroy the balance of supply and demand. And the same function of these ports will lead to more intensive competition.

2.3.3 The increasing number of ports leads to the competition on price

As the ports are related to the local government’s interests, it directly influences the local government’s finance and achievement. Most local government has planning to build their own multifunctional ports. They calculate hinterland resource by their own way which will lead to double counting and it finally will clause the imbalance of supply and demand. To get more cargos, ports in this region will have to compete on practice and they will lower their rate. For example, a 20’ container will cost six hundred at Shanghai port while at other ports along Yangtze River it only cost three hundred or even two hundred.

2.3.4 Weak cooperation basis

Systems between port of Shanghai and Ningbo have never been connected, such as information system, logistic system and distribution systems. These two ports consider more about competition than cooperation and never have a strong sense of coordinate development. Both of them only focus on their own interest. They have not do survey and research to choose the scientific competitive and cooperative strategy which will benefit both sides. During the integration of the two ports, it still needs to break down these barriers.

2.4 Necessity of setting competitive and cooperative strategy between two ports

2.4.1Necessity of competition

(1) Competition promote the development of both ports

In recent years, competition between port of Shanghai and Ningbo did not reduce the throughput of each port. On the contrary, scale of container business of both ports became larger and larger. It indicates that proper competition between the two ports definitely can get a win-win situation. Shipping company will also benefit from healthy competition as they will get lower price while have the better service quality. Meanwhile, Competition will help promote the construction and improvement of the Yangtze River delta port system.

(2) Competition promote the cluster effect

Port of Ningbo and port of Shanghai are both in the Yangtze River delta and the competition between them is internal competition. Internal competition is one of the key factors to improve the cluster effect. Competition will help both side realize the advantages of themselves which will reduce the over compete and over construction of ports. In addition, the two ports have same labor market, transaction cost and supplier, competition will promote the quality of product and service of both ports which will finally improve the competitiveness of the Yangtze River delta port group.

2.4.2 Necessity of cooperation

(1) Necessity of the development of Yangtze River delta port group

As the development of the ports in Yangtze River delta, competition among these ports becomes more and more intensive. To keep the dominant position of both ports in this region, they have to promote the coordinate development strategy which will take the advantage of natural situation of Ningbo port and the scale of Shanghai port. Meanwhile, cooperation will improve the competitiveness of the Yangtze River delta port group which will be good for the sustainable development of the whole region.

(2) Necessity of the international competition

Port of Shanghai and Ningbo not only compete with domestic ports but also with other Asian ports such as port of Busan. With the development of the economy in Yangtze River delta, ports in Korea and Japan begin to focus on the increasing number of cargos and the huge market of this area. They improve their own ports to increase the competitiveness which will help gain more cargos recourse in Yangtze River delta. With the construction of Shanghai international shipping center, it also tries to be the hub port in northeast Asia. To achieve this target, Shanghai should improve its own competitiveness while it still need keep cargo recourse steadily.

Therefore, Shanghai should enhance the cooperation with other ports in Yangtze River delta especially the relationship with port of Ningbo who has the natural advantages. Strengthen cooperation relationship will affect the construction of shanghai international shipping center and the competitiveness of the whole Yangtze River delta.

(3) Necessity of construction of Shanghai international shipping center

Construction of Shanghai international shipping center is the best way to achieve the optimum benefit of Yangtze River port group. Port of Shanghai has great advantages in economy and geographic locations which will help it to be the hub port. It has advanced deep water harbor, effective distribution network, government policy support, large shipping business, effective shipping service and large number of international transit cargos which means it has both strong soft power and hard power in this industry. Hard power such as port facilities and throughput is the basis for the development of soft power while soft power is the most important factor of the construction of international shipping center. To be the international shipping center, Shanghai still need to strengthen its soft power such as port service, working efficiency, recourse integration and so on. All these requirements need the supporting from other ports in Yangtze River delta especially port of Ningbo.

Chapter Three: Model of competitive and cooperative strategy

As the exiting problems and the necessity of setting competitive and cooperative strategy between the two ports, making a scientific and effective strategy is really

important.Throughout the strategies of competition and cooperation among ports all around the world, there are three typical models

3.1 Cartel model—Government leading the integration of ports

It is a model that government set a port authority to supervise different ports and implement unified plan. This model was well used in the integration of Tokyo bay port group. In empirical analysis, we will choose cartel model to analysis.

A cartel is a formal "agreement" among competing firms. It is a formal organization of producers and manufacturers that agree to fix prices, marketing, and production. Cartels usually occur in an oligopolistic industry, where the number of sellers is small (usually because barriers to entry, most notably startup costs, are high) and the products being traded are usually homogeneous. Cartel members may agree on such matters as price fixing, total industry output, market shares, allocation of customers, allocation of territories, bid rigging, establishment of common sales agencies, and the division of profits or combination of these. The aim of such collusion (also called the cartel agreement) is to increase individual members' profits by reducing competition.

As the government has a commanding lead position in implementing policies in cartel model, the government can decide the output distribution by policies to achieve the best interest. Considering all the above we choose cartel model to do the empirical analysis.

3.2 Stackelberg competition model—Setting ports association

In this model, we need to set ports and harbors association. And the association will use law or forms of council to control the development of the ports. Port of New York and New Jersey is one of the successful cases as this kind of model. We will choose stackelberg competition model to analysis this kind of competition and cooperation model.

The Stackelberg leadership model is a strategic game in economics in which the leader firm moves first and then the follower firms move sequentially. In game theory terms, the players of this game are a leader and a follower and they compete on quantity. The Stackelberg leader is sometimes referred to as the Market Leader. There are some further constraints upon the sustaining of a Stackelberg equilibrium. The leader must know exante that the follower observes his action. The follower must have no means of committing to a future non-Stackelberg follower action and the leader must know this. Indeed, if the 'follower' could commit to a Stackelberg leader action and the 'leader' knew this, the leader's best response would be to play a Stackelberg follower action. Firms may engage in Stackelberg competition if one has some sort of advantage enabling it to move first. More generally, the leader must have commitment power. Moving observably first is the most obvious means of commitment: once the leader has made its move, it cannot undo it - it is committed to that action. Moving first may be possible if the leader was the incumbent monopoly of the industry and the follower is a new entrant. Holding excess capacity is another means of commitment.

According to the real situation between port of Shanghai and Ningbo, we can

assume that one is the leader port and the ports and harbors association will coordinate the output quantity of the leader. Then the other port will decide its own output according to leader’s output and its own situation which to get the largest interests.

3.3 Cournot competition model—Free competition

Cournot competition is an economic model used to describe an industry structure in which companies compete on the amount of output they will produce, which they decide on independently of each other and at the same time. It has the following features:(1)There is more than one firm and all firms produce a homogeneous product, i.e. there is no product differentiation;(2)Firms do not cooperate, i.e. there is no collusion;(3)Firms have market power, i.e. each firm's output decision affects the good's price;(4)The number of firms is fixed;(5)Firms compete in quantities, and choose quantities simultaneously;(6)The firms are economically rational and act strategically, usually seeking to maximize profit given their competitors' decisions.

Between port of Shanghai and Ningbo, we assume that the two ports are equal. Both of them can’t decide and affect the price and output in this area. They all needed to consider each other’s policies and plan. In this situation, we think that we can use cournot competition to analysis this model.

Chapter four: Empirical analysis and test of models

4.1 Analysis and test

Date of port of Shanghai:

Years	Throughput（10000 ton）	Income（10000 CNY）	Cost of Production（10000 CNY）	Unit Price of Throughput（Yuan/Ton）
2012	73600	2838810.21	1927898.62	38.57079
2011	72032	2177885.72	1178116.03	30.23497501
2010	65197	1910545.26	1007431.27	29.30418976
2009	59205	1654534.47	928434.69	27.94585711
2008	50808	1814047.96	911651.21	35.70398284
2007	49227	1632839.78	855107.84	33.16959758
2006	47040	1248437.15	621427.97	26.5399054
2005	44317	1099040.72	539562.53	24.79952885
2004	37896	804119.95	366031.26	21.21912471
2003	31621	582661.22	284075.99	18.42640081
2002	26384	196081.22	115513.89	7.431823075

Table 4.1

Date of port of Ningbo:

Years	Throughput （10000 ton）	Income （ 10000 CNY）	Cost of Production （10000 CNY）	Unit Price of Throughput （Yuan/Ton）
2012	44500	780219.6	415850	17.53302472
2011	43330	698279.5	360745.8	16.11538195
2010	41200	600391.7	311681.4	14.57261408
2009	38400	488874.7	229175.4	12.73111198
2008	36200	457396.5	206455.5	12.63526243
2007	34578	419771.2	167895.8	12.13983458
2006	30904	368343.2	132764.7	11.918949

Table 4.2

As the table above, we use below letters stand for each date:

Q: Throughput of each port

P: Unit price of throughput

C: Cost of production

π: Income of each port

MC: Marginal cost

MR: Marginal Income

Now we use excel to get the result of relationship between functions in each models:

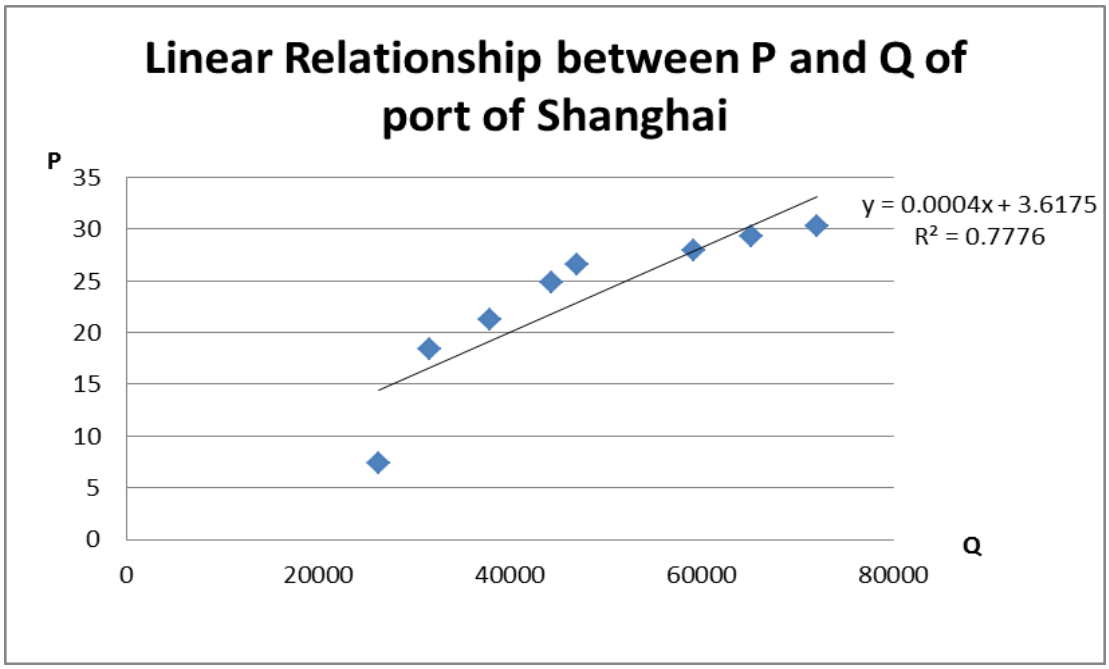


Figure 4.3

From the Figure 4.3, we can see $P_1=0.0004Q_1+3.6175$. And the correlation coefficient for the linear relationship between P and Q is 0.7776 which is acceptable.

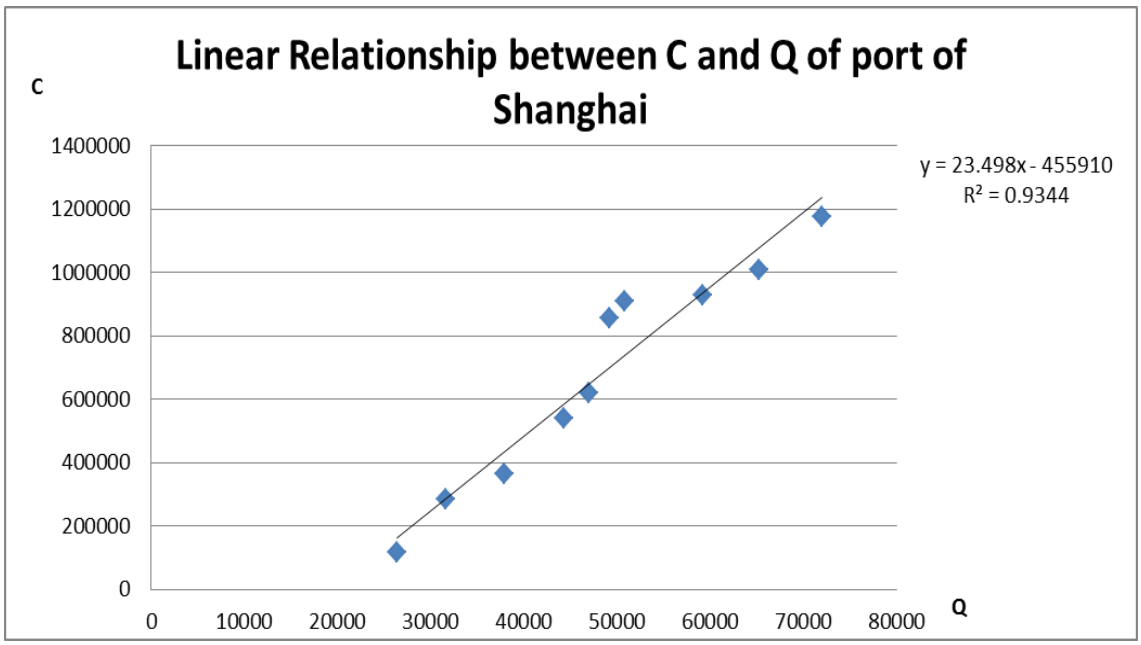


Figure 4.4

From the Figure 4.4, we can see $C_1=23.498Q_1-455910$. The correlation coefficient for

the linear relationship between C and Q is 0.9344 which means there is a high correlation between the two functions.

This function equation above is used to analysis Stackelberg competition model and Cournot competition model.

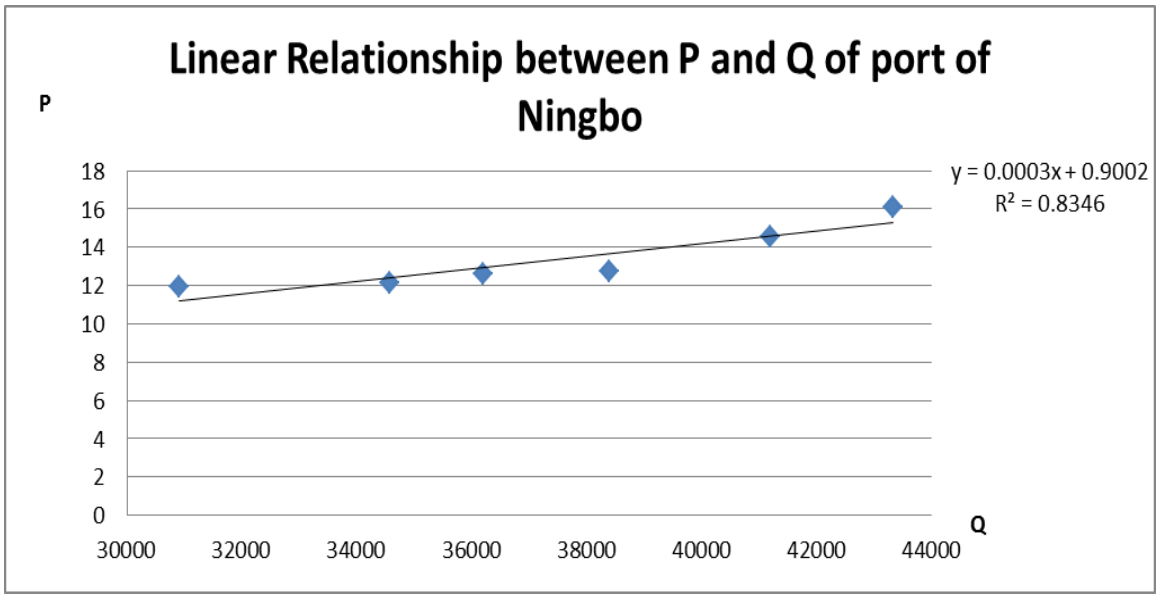


Figure 4.5

From the Figure 4.5, we can see that P2=0.0003Q2+0.9002. The correlation coefficient is R^2=0.8346 which is good.

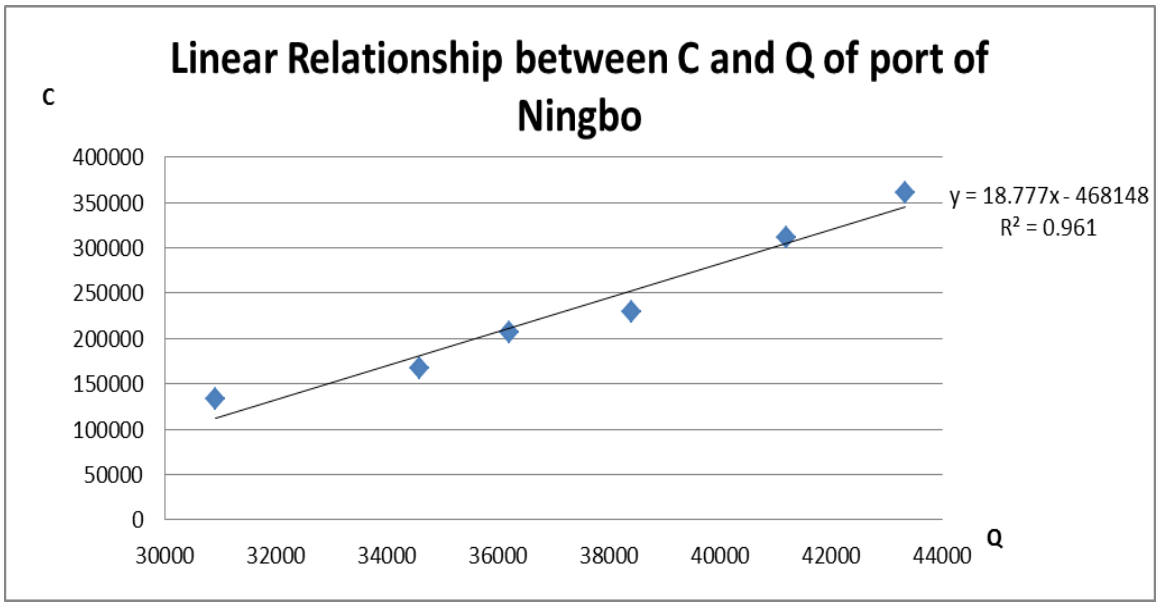


Figure 4.6

From the Figure 4.6, we can see that $C_2=18.777Q_2-468148$. The correlation coefficient is $R^2=0.961$ which is perfect.

This function equation above is used to analysis Stackelberg competition model and Cournot competition model.

As the cost function in Cartel model is quadratic function, we use quadratic fitting method to fit cost and output of each port.

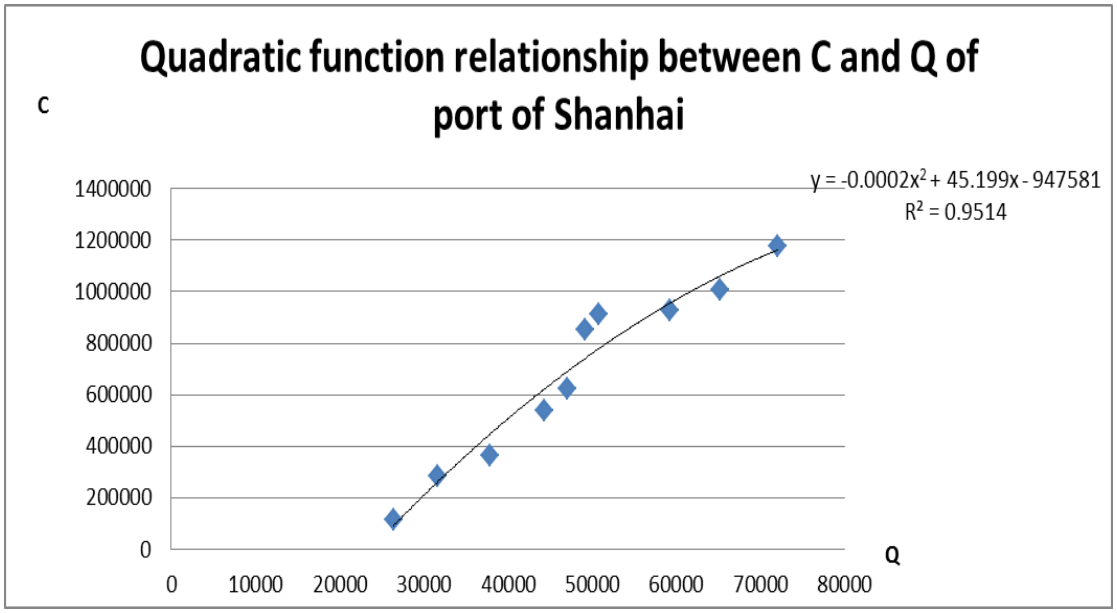


Figure 4.7

From the Figure 4.7, we can see $C_1=0.0002Q_1^2+45.199Q_1-947581$. The correlation coefficient is $R^2=0.9514$. The fitting result is good.

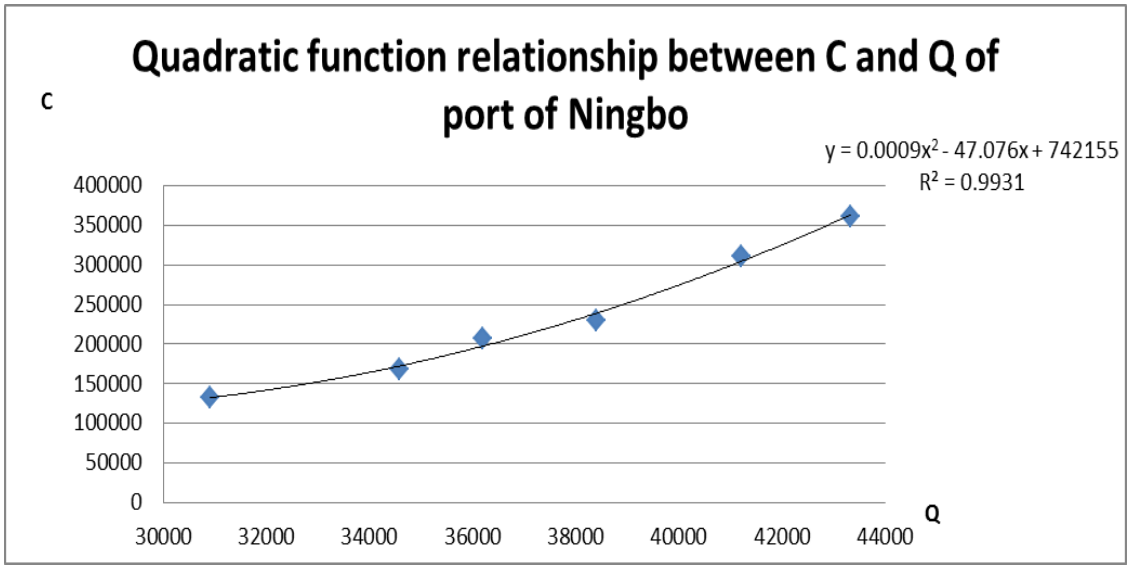


Figure 4.8

From the Figure 4.8, we can see $C_2=0.0009Q_2^2-47.076Q_2+742155$. The correlation coefficient is $R^2=0.9931$. The fitting result is great.

We will compare the income and output to choose the beast model.

First, according to the functional equation from Figure 4.1 and Figure 4.3, we will calculate the demand curve of the market which both the two ports facing. They face the same market, so $P_1=P_2$.

$P_1=0.0004Q_1=3.6175$

$P_2=0.0003Q_2+0.9002$

$P_1=P_2$

$Q=Q_1+Q_2$

So, the demand curve of Q and P is P=0.00017Q+0.6694. This functional equation is suit for all the three models.

1. Government leading the integration of ports (cartel model)

$C_1=0.0002Q_1^2+45.199Q_1-947581$, $MC_1=-0.0004Q_1+45.199$

$C_2=0.0009Q_2^2-47.076Q_2+742155$, $MC_2=0.0081Q_2-47.076$

According to cartel model, the equilibrium solution is $MC=MC_1=MC_2=MR$. As the functional equation of MC_1 and MC_2 and the same method above, we can get that $MC=71.563-0.0005Q$.

In accordance with the functional equation $P=0.00017Q+0.6694$, we get that $MR=0.00034Q+0.6694$.

As $MC=MR$, $Q=84397.143$, $Q_1=39587.5$,$Q_2=44809.643$, $P=15.017$

So, we can calculate that the revenue $\pi1=P*Q_1-C_1=66185.106$,$\pi2=232496.468$

2. Setting ports association (stackelberg competition model)

There are two conditions in stackelberg competition model:

(1) Port of Shanghai as leader and Ningbo as follower

In this condition the association will first set the output of Shanghai.

The cost functional equation of Shanghai is $C_1=23.498Q_1-455910$. The cost functional equation of Ningbo is $C_2=18.777Q_2-468148$

The revenue functional equation of Ningbo is $\pi2=P*Q_2-C_2=(0.00017Q=0.6649)*Q_1-18.777Q_2=468148$

After derivation of the revenue, we can get the condition of extremum is that $Q_2=53257.647-0.5Q_1$. This is also the reaction function of Shanghai to Ningbo. As the revenue functional equation of Shanghai is $\pi1=P*Q_1-C_1$, we can get that $\pi1=0.000085Q_1^2-13.7748Q_1+455910$.

When $\pi1$ is minimum, we can calculate that $Q_1=81028.235$, $\pi1=-102212.482$, $Q_2=12743.53$,$P=16.61$,$\pi2=440532.77$.

(2) Port of Ningbo as leader and Shanghai as follower

According to the method we used in condition one, we can get the reaction function of Shanghai to Ningbo is $Q_1=67142.941-0.5Q_2$.

The revenue functional equation of Ningbo is $\pi 2=0.000085Q_2^2-6.6933Q_1=468148$.

So, $Q_2=39372.353$, $Q_1=47456.765$, $P=15.43$, $\pi 2=336368.734$，$\pi 1=73028.82$

3. Free competition (cournot competition model)

The difference between cournot competition model and stackelberg competition model is that the two port have the same position and they are equal which means there is no leader or follower.

Because they are equal, the output of each port are made at same time which means they have to consider reaction function of each other.

According to the reaction function which we get in stackelberg competition model $Q_1=67142.941-0.5Q_2$, $Q_2=53257.647-0.5Q_1$, we can get $Q_1=54018.824$ and $Q_2=26248.235$

Then we can calculate that $P=14.315$, $\pi 1=-0.40155.665$，$\pi 2=351023.126$.

4.2 Comprehensive benefit analysis

From the calculation about economic evaluation, cournot model and the first condition of stackelberg competition model are ruled out as the revenue is negative. The total revenue and output of the second condition of stackelberg competition model is better than the result of cartel model. Therefore, if we just consider the economic evaluation, we will choose stackelberg competition model as the competitive and cooperative strategy between port of Shanghai and Ningbo which means we should setting ports association. However, to get a more comprehensive result, we need to consider more factors.

Here is the comprehensive benefit analysis:

(1)Through the coordination of ports association, both ports can take advantages of each other to increase efficiency which also will consolidate their role in northeast Asia even in world. Port of Ningbo has a better natural condition and its deepwater port is better than Yangshan deep water port. Ningbo has the better natural condition to follow the trend of shipping maximization than Shanghai. As all the advantages, Ningbo is a perfect back-up for Shanghai. The ports association will do an important role through the misplaced development between the two ports. Ningbo

(2)Through the coordination of ports association, the two ports in certain degree have their own right to manage ports. They have their own superiorities which are complementary with each other. Cooperation will realize the best use of each port. It will provide a strong foundation for the construction of Shanghai international shipping center. Port of Shanghai has an excellent shipping market and environment. It attracts lots of shipping companies and industries about shipping because of its history of shipping industry, the abundant shipping culture and the prefect foundation of shipping industry. With the mature of shipping industry, Shanghai already has been the best shipping service and shipping information center in China. Port of Ningbo also has a long history of shipping industry.

(3) Through the integration by ports association, it will promote the transition of economic development of Yangtze River delta. Ports and shipping industry as the key node of the regional economic development, it also relies on the development of economic hinterland.

(4)The model of setting ports association can avoid the disadvantages of the other two models. The model of integration by government will bring problems such as lag of policies, long time cycle of investment and low efficiency. The disadvantages of

free competition will cause consequence such as disorganization, blindness during development and competition, repetitive construction and etc. However, setting ports association is an efficient way to promote the development of regional port group.

4.3 Comparison and selection of the strategy model

According to the analysis above, we consider the factors of operation, economic, society and policy and we finally choose the model of setting ports association. During the process , we should take the advantage of this model and avoid the disadvantage. Meanwhile, we should insist the development of shanghai international shipping center and promote the construction of Ningbo regional hub ports. Both of the two program should carry on at the same time.

Chapter Five: Improvement and proposal of the strategy model

5.1. Model improvement

According to the model which we choose to set up ports association and make it to be the way of solving the cooperation of Yangtze river delta port group, the dissertation puts forward a model that we should make the enterprise occupy the main position, improve the ports association’s position and let the government keep in the background.

5.1.1 Keep the government in the background: the government should withdraw from the management of the ports.

The law of port has established the system that the ports are directly managed by the local government and the business operation of enterprise is separated from the government administration. The management authority and responsibility of the transportation and port department are explicitly stipulated in the law. It indicates the government has the authority in functions as overall planning, policy setting, information guidance, organization and coordination, providing service, inspection and supervision. The port enterprises are independent and fair in market. However, competition among ports is becoming more and more intense after the management authority of these ports belonging to local government. And the essence of the competition is the competition among the port cities and reflects the pursuit of interests of each port cities. The local government pursues the maximization of local profits because of the administrative structure and assessment mechanism of the local government officials. Since all these factors, the government occupies the main position in the development of the port, and it will finally block the development of the whole Yangtze River delta port group. At the same time, the port enterprises which controlled by the stated-owned capital is still the main force in the port market, and most managers of these enterprises are still appointed by the local government. It will affect the position of port in market and the maximization of benefit from ports of the region.

The local government should transform the role of development-oriented government into a service-oriented government, the government should strictly limit their own behavior and focus on the development of port cooperation terms and supervision, creating a good institutional environment for the development of port, providing

stable and perfect service for the public. The government should act the role of coordination instead of management. It should guarantee the independency of the port and build a circumstance of fair, normative and comfortable for the port enterprises.

5.1.2 Promote the development of the port association

The association is established by those enterprises who pursue the common interests. The association is a independent non-government organization, it can protect the profit of its own industry, establish self-discipline mechanism and prevent the vicious competition. At present, we have already set up the China port association and some associations of local area. The main functions of the association are industry service, development coordination, and industry self-discipline. However, the regional port association which based on the port group is still not established. The local port association such as the Shanghai port association, Zhejiang port association and Jiangsu port association are ineffective for cross-regional port service, coordination and industry self-discipline. On the contrary, the regional port association will solve these problems and is efficient in promoting the cooperation among ports.

We should establish the association of Yangtze river delta port group by making use of other ports' successful experience, we also should set up professional team about port planning and construction, port market regulation, port security and environment protection, port information and training, etc. Base on the association, the integration of traffic freight, tax standard, customs procedures, market management, administrative enforcement and policy system will be carried on. Meanwhile, we should build a more efficient mechanism of program development, assessment,

rewards and punishment, and information sharing.

The association of Yangtze River delta port group should be independent in the aspect of personnel, funds and operation. It should not be the agency of government. Its fundamental purpose is providing service for the members and its funds are mainly provided by members. To keep the independent of association, the association generally should not be subsidized by the government. Meanwhile, the daily operation of association should also be independent from the government. The port association is its members' spokesperson not a department of government.

5.1.3 Enterprises should be the mainstay of the market

Enterprises are the mainstay of the market competition, resource allocation and port cooperation. The integration of regional ports can only be achieved by the cooperation of port enterprises. There are three kinds of port enterprises: the port group corporation of each port, stated-owned enterprises, foreign dock investors and terminal operator which belong to the shipping company.

We should take maximum advantages of market and interest. We should encourage the enterprises to develop cross-regional investment and cooperation, merge or organize union of enterprises. At the same time, we should attract more capital which is not in Yangtze River delta to invest in the construction and operation of ports.

We will emphasize that the ideas of keeping the government in the background, setting ports association and letting enterprise be the mainstay of market is aim at the operation of the regional port group market. The government will still be responsible for the management and plan of port resources and the supervision of

port operation. The government has to take the authority in carrying on the port plan ratified by the country. The main function of the government should be limited in regulating and controlling the port resources while the function of ports association is coordination and autonomy. The enterprises ought to jump out of the restriction of administrative division and carry on free competition.

5.2 Policy recommendation

As the problems during the integration between port of Shanghai and Ningbo and problems during the actual operation during setting port association, here are some policy recommendations:

5.2.1 Government controls overall plan while strengthen the influence and execution of the association.

Ningbo port and Shanghai port are all located in the Yangtze River delta. The development of each port is affected by the administrative division and the difference structure. The central government and the local government should make overall arrangement on the investment scale and layout plan of the two ports. The government should carry on integration of port resource and create better industry environment to expand the space of industry development and promote the coordinated development of the two ports which will help achieve a win-win situation. We should cut down the excessive investment by local government and let the ports arrange their own investment scale under the effect of market economy.

5.2.2 Speed up infrastructure construction and strengthen the cooperation on

finance

In Yangtze River delta area, it is short of large-scale and professional deepwater wharf. Ports such as Ningbo-Zhoushan port and shanghai port can not adapt the request of ship maximization. So, the ports should focus on the construction of large and professional berth in future. First, it should promote the construction of the collecting and distributing system, the regional transportation system of the Yangtze River delta and the integration of infrastructure construction. Second, the ports should grasp the chance of the construction of Shanghai international finance center and Ningbo international finance service center to broaden financing channels and mutual investment which will help solve the finance problem. Meanwhile, it will reduce operation risk, avoid blind investment and redundant construction.

5.2.3 Define the develop orientation of each port and carry on misplace development

We should construct the combination harbor which means the system of shanghai container hub port and Ningbo transshipment port. The shanghai port should take the advantages of its abundant resources and comprehensive service capabilities, provide high value-added service for the clients. It should speed up the construction of Yangshan container terminal and improve the logistics system in port. The Ningbo-Zhoushan port is the superior area of constructing the coastal raw material industrial base whose resources are mainly from abroad. The natural condition of channel completely meet the transportation requirements of ore, crude, coal and any other cargo. It is the perfect site of undertaking the project of bulk commodities such as crude, ore and coal. So, it could act the role of energy transshipment port to service for its hinterland. Misplace development can avoid the improper competition

among regional ports. At the same time, in will promote shanghai port to concentrate on constructing the international container hub port and speed up the construction of Shanghai international shipping center, also, in favor of the construction of Ningbo-Zhoushan professional energy transshipment port.

5.2.4 Speed up the informatization construction and promote the linkage development of port logistics

At present, both port of shanghai and Ningbo make port logistics to be the main factor in increasing their comprehensive competitiveness. To achieve this target, they should build the unified platform for logistics and promote the development of logistics industry by make full use of information. They can establish the system of transfer and exchange information which is adapted to their own features. They should develop and perfect the shipping information system and the shipping trade system, build the common management platform, expand the information network and speed the construction of EDI platform and logistics information technology through which to be the logistics control center of the Yangtze River delta. It will provide superior intermediary service and information service for the transportation.

5.2.5 Speed up the development and cooperation of shipping service industry and promote the construction of soft environment of shipping

Both two ports should learn from the foreign ports such as Singapore port, London port and Rotterdam port in their experience of constructing international shipping center. They should strength the cooperation on constructing soft environment during the construction of shanghai international shipping center. And they also should cooperate in the aspect of shipping service enterprises, shipping research institute,

shipping consultancy, shipping human resources and shipping education. In order to improve the soft power of shanghai international shipping center, the ports should expand the service of shipping, logistics and port, speed up the building of shipping market, provide value-added service for the client, promote the comprehensive competitiveness and create a better policy circumstance for development. Every shipping related department should urge the two ports make full use of the shipping element to develop the soft environment, for example, Shanghai Shipping Exchange could announce the qualification assessment report of the shipping enterprises, and this can improve the credibility of the shipping enterprises to increase the shipping service level. All of this is a essential condition for the construction of soft environment. And the follows are some important factors to improve soft environment of the two ports:(1) improve the international degree of the domestic shipping enterprise, increase technology level and high value-added modern shipping service, speed the construction of the international finance center (2)strengthen the cooperation of college and scientific institute in the aspect of shipping research and the cultivation of shipping human resources.

We should legislate laws and regulations about the operation of port, the service of ship, the finance service and the tax service, and we should supervise the policy effectively, provide good tax environment, construct regional shipping exchange center and shipping information center, cultivate the industry chain of the management of ship, the shipping consultancy, financing insurance, maritime arbitration and notarization. We should narrow the gap between themselves and the international level, make the shipping finance and the system of maritime law be geared to international standards, establish relevant industry guidance and criterion, perfect the service system matched with the shipping high-end industry.

Conclusion

The dissertation analysis the development and economic hinterland of port of Shanghai and Ningbo .we conclude the problems that existing between the ports and analysis the reasons why these problems keep blocking the development of ports.
With this background, according to the successful case of competition and cooperation among regional ports group, we conclude three typical models: port integration by the government, setting port association, free competition. Considering the current situation of the two ports, we choose three mathematical model to analysis and test the corresponding competition and cooperation model. Through the comprehensive benefit analysis and with the economic evaluation, we choose the model of setting ports association as it bring higher revenue and output. Meanwhile, we give the improvement suggestion in policies to get the better solution.

Due to the limited time, resource, date and my limited capability, this dissertation only do empirical test on the part of model of competition and cooperation between port of Shanghai and Ningbo. We did not use quantitative analysis to calculate port competitiveness. We did not use other scientific method to do the quantitative analysis when we carry on the comprehensive benefit analysis. Both of them will affect the model of competition and cooperation between the two ports. Further study will help improve the model and be more effective in reducing competition among ports to improve their entirety competitiveness. To provide the scientific basis for model of competition and cooperation among ports, we still have a lot work to do.

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