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试论国际大都市圈的乘数效应

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ZHEJIANG UNIVERSITY PRESS
浙江大學出版社

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责任编辑　王大根
出　　版　浙江大学出版社
（杭州天目山路148号　邮政编码310028）
（E-mail:zupress@mail.hz.zj.cn）
（网址:http://www.zjupress.com）
排　　版　杭州好友排版工作室
印　　刷　杭州杭新印务有限公司
开　　本　880mm×1230mm　1/32
印　　张　6.125
字　　数　155千
版 印 次　2006年2月第1版　2006年2月第1次印刷
书　　号　ISBN 7-89490-233-0/G·461
定　　价　15.00元

序

21世纪是都市圈的世纪，经济发展的主要动力将越来越源于都市圈，尤其是国际大都市圈。国际大都市圈在国家和世界经济发展中发挥着枢纽作用，是连接国际国内经济的重要结点和产生新思想、新技术的“孵化器”。有关国际大都市圈的概念及理论可追溯到1957年，法国城市地理学家简·戈德曼(J. Gottmann)在考察了美国东北海岸三个多世纪以来的城镇发展历程后，提出了一种崭新的城镇群体空间发展理念——“Megalopolis(大都市带)”。两年后，日本经济学家高野在研究大城市郊区化和卫星城镇问题时，从商业角度提出了“大城市圈”的概念。紧随其后，一些国家和地区也从不同角度对城市群及都市圈等现象进行了定义和划分。从各国学者的定义中可以看出，国际大都市圈内涵的核心就是作为经济发展载体的区域系统观和整体观。

以上海为中心、由15个城市形成的长江三角洲地区，被称为世界第六大城市群，最有可能成为我国境内的国际大都市圈。目前国内专家学者对长江三角洲地区构筑国际大都市圈已进行了一系列的研究和探讨。长三角城市群向国际大都市圈迈进的可能性是存在的；但由于多种因素的制约，长三角城市群目前离国际大都市的差距还相当大，尤其是一条条无形的行政区划线，阻隔了各城市之间经济、社会、文化的天然纽带：市场分割、结构雷同、重复建设，使城市之间经济发展的优势互补作用大打折扣。

《试论国际大都市圈的乘数效应》一书在充分论证国际大都市圈理论的基础上，运用系统动力学和区域经济的研究方法，从国际大都市圈产业的投入产出内部结构入手，建立起国际大都市圈乘数效应的系统动力学模型。通过对长江三角洲15个城市产业结构优化调整的经济效益分析，计算出长三角城市群构筑国际大都市圈所产生

的乘数效应。根据优势互补原则，优化产业的结构及布局，使调整后的整个都市圈的投入产出比大于调整前的投入产出比，以此来说明乘数效应在都市圈结构调整中所产生的作用。虽然在定义与内涵上本书的乘数效应和著名的凯恩斯乘数效应有较大区别，但作者借用凯恩斯投资乘数效应的概念，首次提出了国际大都市圈乘数效应的概念及其内涵，这对于探索衡量国际大都市圈乘数效应的定量分析方法还是很有意义的，可为有关方面的研究提供借鉴。此外，本书通过区域综合经济梯度分析所得出的都市圈内各城市的能级，通过建立偏离—份额模型和区位商分析模型对各城市优势产业进行选择，和国际大都市圈乘数效应的系统动力学模型融为一体，这一点也是难能可贵的。

本书观点鲜明、分析透彻、资料翔实、内容丰富，对有关政府部门和专家学者所进行的战略研究工作有重要参考价值。

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Abstract

Introduction

The formation and development of Megalopolis Sphere is the demonstration of worldwide urbanization after World War II, the inevitable result of the assemblage of population, capital, material, technology and information under the circumstances of modern transportation and communication, also the inevitable trend of urbanization development against the background of world economy globalization and regional economy incorporation. International Megalopolis Sphere plays the role of hinge in the development of national and world economy, is an important link between economy both at home and abroad, and an incubator, which results in new technology and conception, with powerful international radiant ability and field effect. Therefore, the key point confronted with China after the entry into WTO is to foster and form many Megalopolis Spheres that can lead to stable economic growth as quickly as possible to strengthen China's competition in the global market.

The Yangtze River Delta, Zhejiang River Delta and the area of Beijing, Tianjin, Hebei province around the Bohai Sea, are the most important areas in China with the highest economic growth and density of cities. Among them, the Yangtze River Delta is most likely to be the 6th largest International megalopolis Sphere. Composed of 15 cities from Shanghai, Jiangsu and Zhejiang, the Yangtze River Delta covers 99610 square kilometers, accounting for 1.05% in the country; has

the population of 74,480,000, accounting for 6.1%. However, its total output value makes up 20% of the nation. The 15 adjacent cities are closely related to each other with similar culture and integrated economy. But the different administrative demarcation in these cities hinders the natural economic, social, and cultural contact among them. Each doing things in its own way, market division and local protectionism handicap the free flow of economic resources and regional cooperation. So, the only choice at the present economic development stage is to determine the function of the Yangtze River Delta and form an International Megalopolis Sphere pattern with reasonable division of labor and mutual advantages supplement according to the basic theory of International Megalopolis Sphere, referring to the evolutionary process and function orientation of the famous International megalopolis Spheres at present.

Multiplier Theory, put forward by Kenneth, a famous economist, is an important tool to analyze economic functioning. It arises from the relations between different regions and departments in the national economy. Its developing process can be regarded as a limitless chain reaction. e.g. Investment in one economic department can increase not only its demand but also the income and investment in other departments. The earnings can be put into use of consumption of production and living, then changed into workers' income in other regions. This cycle goes on. The increased investment reinforces the multiple increase in income and consumption, thus stimulates production and increases employment. With the help of Kenneth's Multiplier Theory, we can further apply it to international metropolitan multiplier effect. Here it means: Through the reasonable orientation of all members (cities) in the Megalopolis Sphere on the basis of mutual advantages supplement, we can optimize the industrial structure and location, in-

crease the ratio of input to output. Based on the above conception, this paper puts forward systems dynamics model of International megalopolis Sphere's multiplier effect. Through the adjustment of industrial structure and comparison between different plans, with the purpose of optimizing systematic function by means of adjusting systematic structure, we can compare and analyze the concluded choices. It indicates that without the increase of capital, the total output value of the Megalopolis Sphere can increase by more than 100% because of the interrelation and interaction between different regions and industries on condition that the structure and location are optimized. Thus it proves that multiplier effect plays an important role in the structure adjustment of Megalopolis Sphere.

The Systems Dynamics Model of International Megalopolis Sphere's Multiplier Effect

Megalopolis Sphere economics system is a big, complicated one. Different industrial departments, production and consumption, supply and cost, restrict each other and interact as both cause and effect. The essence of multiplier effect is the chain reaction to the total demands stimulating effect. Through the technical link between input and output and other relevant mechanism in the economic system leading to demand, the multiple increase in national economy can be formed, which is the so called multiplier effect. This chapter, trying to apply systems dynamics, a dynamic mutational approach, from the internal structure of national economic development, through simulating dynamically the input and output chain of all industries in the International megalopolis Sphere, can conclude the multiplier relations between input and output in the International megalopolis Sphere, from which we can analyze the economic interest as a result of adjusting in-

dustrial structure.

The Systematic Functional Feedback of International Megalopolis Sphere's Multiplier Effect

The International megalopolis Sphere's multiplier effect system consists of population, industry and investment modules. By comparing and analyzing the multiple plans, adjusting and optimizing the industrial structure in the Megalopolis Sphere, with the premise of unchanged even decreased investment, we can increase the regional total output value and raise the ratio of input to output of the national economy in the whole Megalopolis Sphere, thus form the International megalopolis Sphere's multiplier effect.

See Figure 2-1:

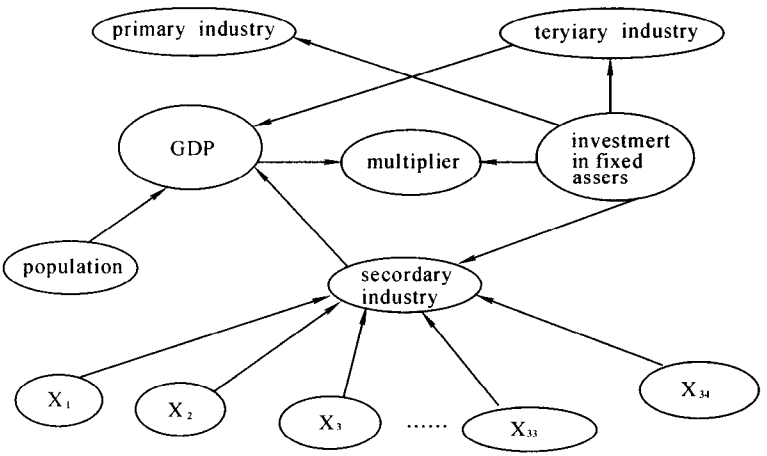

Figure 2-1

The Main Feedback Formulas of the Model

Based on the above figure, we can set up its model of the Yangtze River Delta. The research period is from 2000 to 2020, with the data of 2000 as its initiative. With the characteristics of magnitude and complexity, this model has 600 accumulating variable, 600 velocity variable and 1350 assistant variable. The initiative data is as much as 1000. The main formulas are as follows:

1) Population module

The same year's city(I) population (POP(I)) = last year's city (I) population + naturally growing population(POPR(I)) + mechanically growing population(POPD(I))City(I) naturally growing population(POPR(I)) = city(I) population (POP(I)) * natural growth rate (POPC(I))

City(I) mechanically growing population(POPD(I)) = city(I) population (POP(I)) * mechanical growth rate(POPD(I))

The Yangtze River Delta's population = Σcity(I) population (POP(I)) (I=1,2,…,15)

2) The primary industry module

The same year's city(I) primary industry added value(PI (I)) = last year's city(I) primary industry added value(PI (I)) * [1 + the growth rate of the primary industry(PIR(I))]

Each city's growth rate of the primary industry depends on its development trend of farming, forestry, animal husbandry and fishery.

The Yangtze River Delta's added value of the primary industry (PI) = Σcity(I) added value of the primary industry (PI(I)) (I=1,2, …,15)

3) The second industry module

①Industry

City(I) added industrial value is made up of added value of all

trades:

City(I) added industrial value (IND(I)) = ΣXi (i = 1,2,3,…, 34)

Added value of all trades (Xi) = total output value of all trades * growth rateThe same year's total output value = last year's total output value * (1 + growth rate)

According to the principle of giving priority to the development of superior trade, the development speed can be adjusted.

②Construction industry

The same year's city (I) added value of construction industry (CON(I)) = last year's city(I) added value of construction industry (CON(I)) * [1 + growth rate of added value of construction industry (CONR(I))]

The growth rate of added value of construction industry (CONR (I)) depends on each city's development pattern.

③The added value of the second industry

City(I) added value of the second industry (SI(I)) = city(I) added value of industry (IND(I)) + city(I) added value of construction industry(CON(I))

The Yangtze River Delta's added value of the second industry (SI) = Σcity (I) added value of the second industry (SI (I)) (I = 1,2 …,15)

4) The tertiary industry module

The same year's city(I) added value of the tertiary industry (TI (I)) = last year's city(I) added value of the tertiary industry (TI(I)) * [1 + growth rate of the tertiary industry (TIR(I))]

The growth of the tertiary industry depends on each city's development these years and its functional orientation of the Megalopolis Sphere.

The Yangtze River Delta's added value of the tertiary industry (PI) = Σcity (I) added value of the tertiary industry (TI (I)) (I = 1, 2⋯,15)

5) Regional total output value module

City(I) GDP (GDP(I)) = city(I) added value of the primary industry (PI(I)) + city(I) added value of the second industry (SI(I)) + city(I) added value of the tertiary industry (TI(I))

The Yangtze River Delta's GDP = ΣCity (I) GDP (GDP (I)) (I = 1,2⋯,15)

6) Investment of fixed assets module

The same year's city(I) investment of fixed assets (IFA(I)) = last year's city(I) investment of fixed assets (IFA(I)) * [1 + growth rate of the investmcnt of fixed assets(IFAR(I))]

Growth rate of the investment of fixed assets (IFAR (I)) is closely related with the growth rate of the primary, second and tertiary industry, which can be indicated by:

Growth rate of the investment of fixed assets (IFAR (I)) = the growth rate of the primary industry (PIR (I)) * αj + the growth rate of the second industry (SIR (I)) * βj + the growth rate of the tertiary industry (TIR (I)) * γj among them, parameterαj, βj, γj are different in different cities and can be found from previous data.

The Yangtze River Delta's investment of fixed assets (IFAR) = Pcity (I) investment of fixed assets (IFAR (I)) (I = 1,2,⋯,15)

7) Multiplier module

$$\text{Metropolitan multiplies (MULT)} = \frac{(GDP/IFAR)\ 2;3}{(GDP/IFAR)\ 1}$$

Predicted Effect of the Model

Based on the systems dynamics model of the Yangtze River Delta International megalopolis Sphere's multiplier effect, we can get the

predicted numbers of different targets, such as GDP of the primary, second and tertiary industry, investment of fixed assets, in the 15 cities in the Yangtze River Delta from 2000 to 2020.

By simulating the present trend, optimizing the industrial structure and predicting the ideal pattern, we can have three plans, i.e. plan of maintaining the status quo, plan of optimizing structure, ideal plan. They can be concretely explained as follows:

Predicting population and added value of the primary industry

Athough population is related to adjustment of the industrial structure, it has little profound on the population of a city, especially the total population of the Yangtze River Delta. Therefore, when predicting the total population, we omit the influential factor of adjustment of industrial structure and use the same predicted population. Similarly, because the primary industry accounts for relatively small in the total output value (only 6.6% at present), and with little room to adjust, it will keep going down in GDP. So, we take the second and tertiary industry into account when considering the adjustment of internal structure.

1) The predicted population

The natural growth of population in the Yangtze River Delta is low, it is even negative number in Shanghai, Nanjing, Suzhou and Wuxi. The natural growth rate of other cities is below 3 ‰, while it is about 1‰ for the whole area. In the next five years, it will remain negative increase. The mechanical growth rate now is 7‰ to 9 ‰, with further increase in future. According to the predicting effect of the model, the total number of the population in the Yangtze River Delta will increase from 84,583,600 in 2000 to 106,253,600 in 2020, with the growth rate of 11.5‰ per year. In 2000, it accounted for 6.5% of the nation, but will increase to 6.8% in 2010 and 7.16%

in 2020.

2) The predicted effect of added value of the primary industry

By predicting and analyzing the development trend of the internal structure in the primary industry, we can get the growth rate of the primary industry in the cities of the Yangtze River Delta from 2000 to 2020, from which we can predict the development of the primary industry in the 15 cities. The added value of the primary industry in the Yangtze River Delta will increase from 103.725 billion RMB in 2000 to 269.187 billion RMB, with the growth rate of 4.8% per year.

The three plans to optimize the economic structure in the Yangtze River Delta

1) The first plan (to maintain the status quo)

With the premise of each city developing in terms of its present pattern without considering the functional conformity of the Megalopolis Sphere, we need not change any paramcter, so the growth rate of all industries(the primary, second, and tertiary) and 35 trades of the industry can be found from the previous data and their development trend.

Here is the conclusion: the GDP of the Yangtze River Delta will amount to 15730.8 billion RMB, 10 times as much as that of 2000 (1559.631 billion RMB), with the growth rate of 12.2% per year; per capita GDP will be 148,000 RMB, equal to 18,000 $, 8 times the amount of 2000(18,440 RMB). The total investment of fixed assets will amount to 5753.056 billion RMB, 12.1 timcs as much as that of 2000(473.624 billon RMB), with the growth rate of 13.5% per year. The proportion of the primary, second and tertiary industry will change from 6.7:51.2:42.1 to 1.7:54.1:44.2 respectively.

2) The second plan (to optimize the structure)

From this plan we find out the superior industry in each city of the Yangtze River Delta. All the trades of industry in Shanghai have no distinct increasing and competing advantages, so it will pay attention to the tertiary industry, some backbone trades of the second industry, such as, car, electronic information equipment, power station complete sets of equipment, refined oil chemical, iron and steel, electrical appliance. Nanjing, Hangzhou, as capital cities, will give priority to the tertiary industry, while Zhoushan, as the only island city with abundant tourism resources, also play more emphasis on the tertiary industry. The other cities will make the best use of their advantages to develop the second industry, meanwhile, they will offer more support to their superior trades.

Here is the conclusion: the GDP of the Yangtze River Delta will amount to 16415.27 billion RMB, 10.5 times as much as that of 2000 (1559.631 billion RMB), with the growth rate of 12.5% per year; per capita GDP will be 154,000 RMB, equal to 18,600 $, 8.38 times the amount of 2000(18,440 RMB). The total investment of fixed assets will amount to 5574.620 billion RMB, 11.77times as much as that of 2000(473.624 billon RMB), with the growth rate of 13% per year. The proportion of the primary, second and tertiary industry will change from 6.7:51.2:42.1 to 1.6: 55.9:42.5 respectively.

3) The third plan(the ideal plan)

Based on the second plan, according to the requirement to build the Yangtze River Delta International megalopolis Sphere, each city's orientation in this circle will determine its development pattern, which is called ideal by the author. Here is the predicted effect:

The GDP of the Yangtze River Delta will amount to 16611.46

billion RMB, 10.65 times as much as that of 2000(1559.631 billion RMB), with the growth rate of 12.6% per year; per capita GDP will be 155,300 RMB, equal to 18,700 $, 8.42 times the amount of 2000(18,440 RMB). The total investment of fixed assets will amount to 5341.97 billion RMB, 11.28times as much as that of 2000 (473.624 billon RMB), with the growth rate of 12.7% per year. The proportion of the primary, second and tertiary industry will change from 6.7:51.2:42.1 to 1.6:56.2:42.2 respectively. Analysis of the Yangtze River Delta Megalopolis Sphere's multiplier effect

The Yangtze River Delta international megalopolis sphere's multiplier effect

According to the definition: Metropolitan multiplier

$$(\mathrm{MULT}) = \frac{(\mathrm{GDP/IFAR})2;3}{(\mathrm{GDP/IFAR})1}$$

Considering each city's orientation and industrial pattern in the Yangtze River Delta from the view of the whole International megalopolis Sphere, we can get the multiplier 1.08 when comparing the second plan to the first, while 1.14 when comparing the third plan to the first.

That means if choosing the second plan, the total input(the total investment of fixed assets) can be saved 178.436 billion RMB in 2020, while the output(the total regional output value) will increase 684.47 RMB. If the third plan is put into effect, the total input(the total investment of fixed assets) can be saved 411.086 billion RMB in 2020, while the output(the total regional output value) will increase 880.68 RMB. So, if the industrial structures in the 15 cities are adjusted and optimized on the principle of conception of International megalopolis Sphere, we can attain as much output as we can with as little of input. The better the structures are optimized, the more ratio

of output to input.

The status of the Yangtze River Delta in China in 2020

With the fast economic and social development, especially after the real International megalopolis Sphere is formed, the Yangtze River Delta, with mutual advantages supplement and reasonable industrial pattern, will play a more and more important role in the country. According to the predicted effect, the proportion of GDP in the 15 cities in the Yangtze River will increase from 17.7% in 2000 to 36% in 2020. Per capita GDP will increase from 18,400 RMB in 2000 to 150,000 RMB, about 5 times the average of the country. See Figure 3-1.

		2020		
		The first plan	The second plan	The third plan
Proportion of GDP in the country (%)	17.7	35	36.4	36.8
Proportion of population in the country (%)	6.68	7.16	7.16	7.16
Per capita (country, ten thousand RMB)	0.7	2.8	3	3.1
Per capita (the Yangtze River Delta, ten thousand RMB)	1.84	14.8	15.45	15.53

The comparison of city structure development in the cities of the Yangtze River Delta in 2020 (on the basis of the ideal plan)

① In terms of the economic gross, the GDP of Shanghai amounts to 4307.06 billon RMB, accounting for 25% of the total amount in The Yangtze River Delta. The cities whose GDP are over 1000 Billion RMB are Suzhou, Hangzhou, Ningbo, Wuxi, and Nanjing. Except Huzhou and Zhoushan, the GDP of other cities are more than 500 bil-