



Research on Homogeneous Structure of Manufacturing Industry from the Angle of the Division of Labor

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Abstract

After near thirty years development, the Yangtze River Delta region (includes Jiangsu, Shanghai, Zhejiang) has been one of the places with fastest economy development and strongest economy power in China. Meanwhile, the economic integration in Yangtze River Delta region, especially the industry integration was proposed twenty years ago. In this paper, from the labor division angle the author has analyzed the homogeneous phenomenon of manufacturing industry in Yangtze River Delta region based on amounts of basic researches. By means of demonstration analysis with computation measures, the author has advanced relevant policy suggestions.

Keywords: Yangtze River Delta region, Manufacturing industry, Homogeneous industry structure, Labor division

1. Introduction

Since China socialist market economy reform in 90s 20 century, with the economic globalization background, the Yangtze River Delta region has attracted amounts of domestic and foreign capitals due to its predominant position, nice developing foundation and favorite policies. All industries, mainly the secondary industry in this region, have stepped into the fast-speed development path. And its average GDP increasing rate is higher than the country average rate with 2 to 3 point. The Yangtze River Delta region has become an important economy driver in China with its increasing economic status inside and outside.

In the rapid economic developing process, conflicts and problems are in existence, especially the homogeneous phenomenon of industry structure (mainly manufacturing industry) among the two provinces and one city. The homogeneous industry structure means certain similarity and common inclination of regional industry structure in its dynamic development and evolvement process, chiefly the industry homogeneous structure in areas. The arrangement of industry structure in one country or region determines its economic strength, while the reason of industry structure determines its development speed and stability.

2. Documents review

Scholars, both inside and outside, have carried out analyzing researches on this issue from different point of views. From the government point of view, Huang Youhe (2000), Hu Rongtao, Zhang Xuying, Su Mingwu (2002), Xu Jianming (2003), Yao Xianguo and Xie Xiaobo (2004) have presented the causes of homogeneous industry structure in Yangtze River Delta region. Their researches have been based on the game analysis between the local government and the central government, between the local governments. From the industry cluster point of view, Ni Shugao (2004) has analyzed the present industry structure in Yangtze River Delta region. In his opinion, the different industry frameworks originated from the transfer of various systems are due to the negative influences of the local economy on the industry cluster. According to Hong Yinxing, Liu Zhibiao (2003) and Chen Jianjun's (2004) researches, the numerous similarities in the chief outer variables which determine economic behavior, such as resources, technologies and traditional cultures, in different minor areas of the Yangtze River Delta region determine that the behaviors of economy subjects have high similarities, which will lead to similar industry structures in different areas. The cutthroat competition existed in region economy is coming from system and market frame, but not the homogeneous industry structure issue. Zhang Lei and Zhang Minglong (2003) have performed quantitative measurement to the local relations in Yangtze River Delta region by means of Euclidean Distance and concluded that the competitive local relations have surpassed the compensated local relations in this region.

Liang Qi (2004) has calculated the present regional industry labor division index in China based on the Paul Krugman's

formula. With the regional labor division index $(S_{jk} = \sum_{i=1}^n \left| \frac{q_{ij}}{q_j} - \frac{q_{ik}}{q_k} \right|)$ he calculated the labor division differences in

various regions in China between 1997 to 2000. In her opinion, the regional specialization is deepening and with China socialist market economy reform process the market mechanism will exert a more powerful influence on resources allocation. Wang Hao and Feng Yao (2004) have proposed to build integrated property right market to regulate the property right business and to decrease costs, advancing the utilization efficiency of property right. The property right can serve as a tie to allocate resources reasonably and to speed up economic development and to drive the regional economic integration. They also insist to restrict the cutthroat competition in different regions. The economy structure adjustment, reasonable labor division and strong cooperation can help to realize the transfer from administrative economy to regional economy, and to advance the integration process in Yangtze River Delta region. Based on demonstration analysis of the relationship between industry development and region in Yangtze River Delta, Wang Yizhi, Wang Zhen, Gu Liying (2000) have presented the industry integration thought. That is to construct integrated factor market and commercial and trade circulation system to drive industry integration in Yangtze River Delta region. Meanwhile a series of policy innovation can help to build a more active policy system. In Zhang Haiyan and Chen Yufang's (2004) opinion, the evolvement of regional industry structure is influenced directly or indirectly by the flow of transnational capitals, the form of global market system, the net system of global production labor division, and the transnational flow of technology and labor, under the economy globalization. Based on the analysis of European economic integration and the present situation in Yangtze River Delta region, Zhou Zhenhua (2002) and Wang Xiaohui (2004) have proposed some measures to speed up regional economic integration.

Judging from the above researches, these scholars have investigated this issue and have presented relevant conclusions and policy suggestions chiefly from the government angle, from the industry competition angle and from the local relation angle, but seldom from the labor division angle. In this paper the author has mainly used the economy new classical school theory represented by Yang Xiaokai and Huang Youguang for reference. Beginning with labor division, the author has performed basic investigation on this issue and with the panel data model he has carried out demonstration analysis, filling up the research empty in this field.

3. Theory model and relevant analysis

The new classical school, represented by Yang Xiaokai and Huang Youguang, using the inframarginal analysis method, has made Adam Smith's labor division theory revival by combining with Coase's transaction-cost theory and has been modified to explain and analyze economic phenomenon. Its key point is that labor division is the result of exchange. Labor division and specialization can speed up knowledge accumulation and bring about profit increase. Otherwise, coordinate labor division requires costs (namely transaction costs) and the deepening of the labor division leads to the increase of transaction costs which is decided by the transaction mechanism efficiency. The advantages of labor division conflict with the increase of transaction costs what constitutes basic restriction of labor division evolvement. In this conflict, the deepening of labor division is determined by the relative balance between transaction costs and labor division profits, showing a self-evolving process.

Meanwhile, they discussed the inner relevancy of labor division, specialization and industry structure adjustment.

Along with constant improvement of transaction efficiency, labor division evolvement is appearing. Economy development, trade, industry structure adjustment and market structure change are different sides of this evolvement. With the decrease of transaction costs, labor division level and production efficiency have been improved constantly. The regional trade economy has been changed toward the specialized production economy based on inter-dependence. As a result, the whole region will gain benefits from specialization and the level of industry regional integration will be improved further. Labor division and specialization are the two sides of one coin. They connect with each other closely. Where there is labor division, there is corresponding specialization. Industry structure is the result of labor division and specialization. Labor division and its corresponding specialization can lead to two results. One is the variety of products. The other is the singularity of production (specialization). The two are defined relatively from the social scope and the enterprise angle. The variety of products and their proportion determined by production consumption and living consumption have formed industry structure. The singularity of enterprise production demands other enterprises' coordination and cooperation in material, parts and sale. As a result, this will form industry structure for certain period.

The constant evolvement and advancement of industry structure is also the result of labor division and specialization.

Industry structure adjustment is to coordinate and to deepen labor division and specialization. Labor division and specialization are natural evolving processes. Correspondingly, it is the constant evolving and optimizing process of regional industry structure which is based on obeying the labor division and specialization evolvement laws. Labor division and specialization are in favor of improving and advancing product quality, adjusting and upgrading consume structure what will serve as structure strategic adjustment foundation. Regional labor division-----specialization-----industry structure adjustment has been the inevitable process of regional economy development and the eternal driver of economy increase.

General equilibrium model of transaction efficiency and labor division evolvement

Assumption: the consumer--producer muster is M continuum. It means a large population in economy. Each

consumer---producer follows the utility function. $U = (x + kx^d)(y + ky^d)$.

Hereinto, x and y are respectively the self-support numbers of products x and y. x^d and y^d are respectively the numbers of two products purchased from the market. The 1-k is the iceberg transaction cost index. Or k is an outer transaction efficiency index, representing transaction condition. The k is related with base facilities, citizen level, transportation condition and general policy environment.

The production function and restriction of each consumer---producer is:

$$x + x^s = l_x^a \quad y + y^s = l_y^a \quad (a > 1) \quad l_x + l_y = 1$$

The x^s and y^s are respectively the sale numbers of two products. The l^i is the individual labor share in producing i, and it represents relevant specialization level. The budget restriction is:

$$p_x x^s + p_y y^s = p_x x^d + p_y y^d$$

P^i is the price of product i. And there is non-negative restriction.

Wen theorem: According to the optimal decision, a corporate does not sale more than one product type, and does not sale or buy same product type, and does not buy or produce same product type.

Therefore, three models should be taken into considerations.

Self-support model: defined by $x, y, l_x, l_y > 0, x^s = x^d = y^s = y^d = 0$. The number of all the self-support products is positive. And the number of all the trade products is zero. The decision-making issue is:

$$\text{Max}_{x, y, l_x, l_y} u = xy$$

$$\text{s.t. } x = l_x^a, \quad y = l_y^a, \quad l_x + l_y = 1$$

Add all the restrictions to the utility function and the target function has been changed into: $\text{Max}_{l_x} u = l_x^a (1 - l_x)^a$.

$$\text{Then, } \frac{du}{dl_x} = a l_x^{a-1} (1 - l_x)^a - a l_x^a (1 - l_x)^{a-1} = 0.$$

Here, $l_x = \frac{1}{2}$. So $u = 2^{-2a}$. It is the self-support real per capita income.

Specialization model (x/y): means producing x in specialization, sales x and buys y. Defined by $x, x^s, y^d, l_x > 0$,

$x^d = y^s = y = l_y = 0$. Then the decision-making issue is:

$$\text{Max}_{x, x^s, x^d} u = xky^d$$

s.t. $x + x^s = l_x^a$; $l_x = 1$ (The budget restriction is: $p_y y^d = p_x x^s$)

Add the restriction to utility function, delete l_x, x and y^d , then the result is:

$$\text{Max}_{x^s} u = (1 - x^s)k \frac{p_x x^s}{p_y}$$

Because $\frac{du}{dx^s} = 0$, the optimal decision is $x^s = \frac{1}{2}$. So $y^d = \frac{p_x x^s}{p_y} = \frac{p_x}{2p_y}$, $u_x = \frac{kp_x}{4p_y}$.

Specialization model (y/x): means producing y in specialization, sales y and buys x. According to the corner point

solution method in solving model (x/y), it is easy to get the equilibrium solution of model (y/x): $y^s = \frac{1}{2}$; $x^d = \frac{p_y}{2p_x}$;

$$u_y = \frac{kp_y}{4p_x}$$

That is:

Model	Corner point demand	Corner point supply	Self-support number	Specialization level	Indirect utility function
Self-support model	0	0	$x = y = \frac{1}{2}$	$l_x = l_y = \frac{1}{2}$	$u = 2^{-2a}$
Specialization model (x/y)	$y^d = \frac{p_x}{2p_y}$	$x^s = \frac{1}{2}$	$x = \frac{1}{2}$	$l_x = 1, l_y = 0$	$u_x = \frac{kp_x}{4p_y}$
Specialization model (y/x)	$x^d = \frac{p_y}{2p_x}$	$y^s = \frac{1}{2}$	$y = \frac{1}{2}$	$l_x = 0, l_y = 1$	$u_y = \frac{kp_y}{4p_x}$

If choosing specialization model (x/y), iff $u_x \geq u_A$ and $u_x \geq u_y$, then $\frac{p_x}{p_y} \geq \frac{2^{2-2a}}{k}$ and $\frac{p_x}{p_y} \geq 1$. If choosing

specialization model (y/x), iff $u_y \geq u_A$ and $u_y \geq u_x$, then $\frac{p_x}{p_y} \leq 2^{-2+2a} k$ and $\frac{p_x}{p_y} \leq 1$. If ensuring both, merely

$$k > k_0 \equiv 2^{2-2a} \text{ and } \frac{p_x}{p_y} = 1.$$

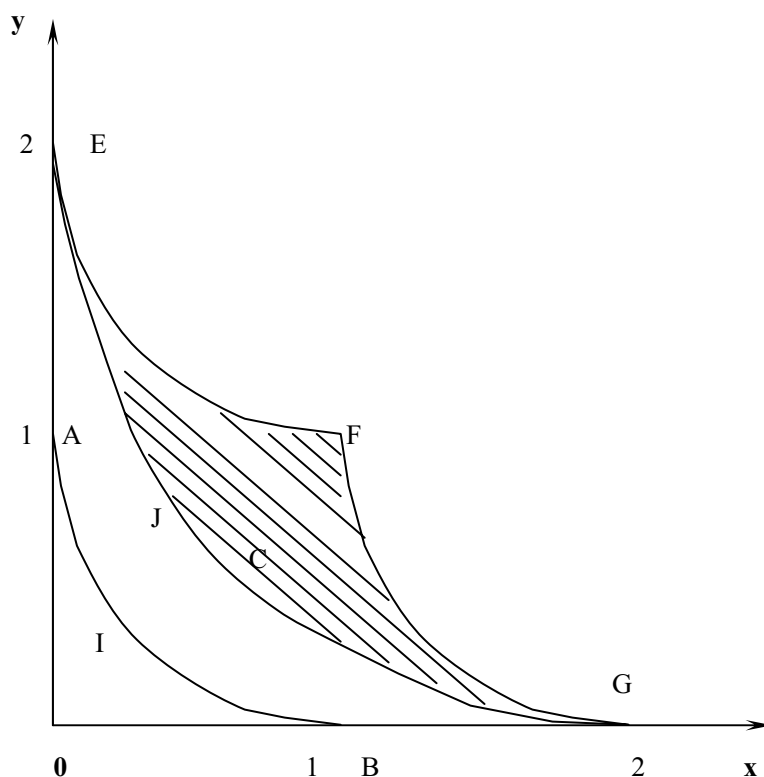
If choosing self-support model, iff

$$u_x < u_A \text{ and } u_x < u_A, \text{ and } \frac{P_x}{P_y} \in \left[2^{-2+2a} k, \frac{2^{2-2a}}{k} \right], \text{ then } k < k_0 \equiv 2^{2-2a}.$$

Then we can get the following conclusion. If there are reasonable labor division and specializing production between two regions, with rational industry structure and low homogeneous trend, there is a critical value scaled by transaction efficiency, namely $k = 2^{2-2a}$. That is, the labor division's precondition between two regions is $k > 2^{2-2a}$. Profits

from labor division in two regions are higher $(1-k)$ than transaction costs. Contrarily, the optimal decision is to perform transaction and labor division within respective region, but not between regions. Then, the homogeneous phenomenon in industry structure is inevitable between two regions.

In the next figure the shadow EFGCJ represents labor division profits. It shows that if the transaction costs are smaller than this shadow, the specializing division will appear. Otherwise, the optimal choice is to self-support.



If the transaction costs are increasing and finally surpass critical value, the labor division and cooperation will be changed from formerly within respective region to presently between two regions. Correspondingly, the industry structure in two regions is becoming more reasonable, and the industry homogeneous trend is becoming lower.

In this equilibrium model, the transaction efficiency is determined by two factors. (1) Hard conditions: nature and geography, transport technology and tools, traffic and living facilities, information conditions. (2) Soft conditions: legal tradition and property right, credit and social capital, education and personnel resources, policy and common service level, social stability, competitive bank system, openness level and trade system. Communicating technology and electronic business could greatly decrease transaction costs and promote general transaction efficiency. Government and relevant policy, laws and measures could decrease transaction costs, being important factors that influence transaction efficiency. Education level, literature degree, personnel resources training also could decrease transaction costs and increase transaction efficiency.

This analysis frame, the critical value for transaction efficiency, $k=2^{2-2a}$, is unknown which can not be calculated properly. But the marketization changing index system includes quantitative analysis on the deciding factors of the transaction efficiency. Therefore, taking the marketization changing index as reference criterion to value transaction efficiency is reasonable. Scholars and specialists may take various methods and index to calculate or predict, but the results merely have relative meaning. It is not the results themselves that matter, but the changing trend which is reflected by the results sequence.

In this paper, the author adopted mainly the marketization quantitative index, aiming to reflect the general marketization process trend and to take it as reference index to value the transaction efficiency change. Using marketization index to value transaction efficiency change trend can broaden the model's application and explanation strength. Meanwhile it can provide theory basis for constructing a quantitative model.

2.1 Data

This paper is mainly based on the measure system by Xu Minghua (1999). It also uses some thoughts by Chen Zongsheng (1999), Fan Gang and Wang Xiaolu (2000), especially by Hong Yinxing and Liu Zhibiao (2001) for reference. They have set a series of reasonable measure index which can reflect characteristics of Yangtze River Delta region when they have tried to measure this region's marketization level. The index in this paper is just as following.

(1) Ownership pattern: proportion of non-state-owned economy to gross output value of industry, proportion of non-state-owned economy to social fixed assets investment, proportion of employment in non-state-owned economy to whole economy. (2) Government function transfer and government efficiency increase: proportion of the margin between tax, turned profits of state-owned enterprise and government allowance to finance income, proportion of infrastructure and enterprise reengineer expenditure in finance to policy allowance, proportion of non-state budget capital to infrastructure expenditure, proportion of government financial income to GDP, ratio of GDP to government expenditure, proportion of government expenditure to total consume, proportion of government or social party workers to total workers. (3) Commodity market growth: proportion of export value to gross output value of industry, proportion of consumable commodity retail sales to gross output value of industry and agriculture, wholesale and retail spot number per 10,000 capita. (4) Factor market growth: proportion of non-state financial education outlay to total education outlay, proportion of contract worker number to total worker number, number of job-hunting agency per 10,000 capita, proportion of finance and insurance to tertiary-industry, proportion of tertiary-industry transportation to total transportation, proportion of non-state-owned enterprise loans to short-term loans in finance agency, proportion of floating population in tertiary-industry to total floating population, proportion of stock market value to GDP, proportion of listing company number to total industry and agriculture company number, proportion of real estate industry to tertiary-industry. (5) Open-door to the outside world: foreign trade dependence degree, foreign capital utility per capita. (6) Human: private company number per 10,000 capita in city and county, number of private company investor per 10,000 capita in country and city, family Engel coefficient of country resident, family Engel coefficient of citizen.

Data of above index are chiefly abstracted from "Statistics Compilation of Fifty-year In China", "China Statistics Annual", "Shanghai Statistics Annual", "Zhejiang Statistics Annual", "China Finances Annual", "China Banking Annual", "China Market Statistics Annual", "China Labor Statistics Annual", "China Industrial Economy Annual". The time span is from 1990 to 2005.

According to the universal industry structure homogeneous coefficient $S(X, Y) = \frac{\sum_{i=1}^n X_i Y_i}{\sqrt{\sum_{i=1}^n X_i^2 \sum_{i=1}^n Y_i^2}}$ ("i" refers to the

industry sector of No.i. "n" refers to the number of industry sector. X_i and Y_i refer to the proportion of the No. i industry sector value to gross output value of manufacturing respectively in certain region and in whole country.), the industry homogeneous coefficient in Yangtze River Delta region can be obtained by calculation. The marketization degree can be

valued by composite index method ($K = \frac{1}{\sum_{i=1}^n w_i} (\frac{a_1}{a_0} w_1 + \frac{b_1}{b_0} w_2 + \dots + \frac{n_1}{n_0} w_n)$). The final value could be used to

reflect the marketization trend in Yangtze River Delta region and could be used for reference of weighing transaction

efficiency change. Using marketization index for valuing transaction efficiency changes could broaden the model's application and explanation. Meanwhile it serves as theory base for next quantitative model and regression analysis.

2.2 Regression analysis and results

Based on the data of marketization index and industry homogeneous index $S(X, Y)$, make regression analysis on them and the result is:

$$Wstr = 0.9496 - 0.0126 Wmar + [AR(1) = 0.5337]$$

(7.8132) (-2.6253) (2.3366)

$R^2 = 0.8623$ $DW = 2.1128$

Apparently, along with the marketization process in Yangtze River Delta region (namely the transaction efficiency increase, the deepening of region division), the industry structure homogeneous phenomenon is showing a weaker trend and the regional industry structure is more reasonable. Based on the Panel Data model and analysis on six factors index we can conclude that the influences of them on industry structure homogeneous phenomenon in the process of marketization.

Take industry homogeneous coefficient X as dependent variable, six factors in marketization, that is X_1 (ownership pattern), X_2 (government function transfer and government efficiency increase), X_3 (commodity market growth), X_4 (factor market growth), X_5 (open-door to the outside world), X_6 (human), as independent variables, we can build the following model.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + u_{it}$$

Program in SAS and check by Hausman, the function result is as following.

Variables	R-squared	Adjusted R-squared	F-statistic	Durbin-Watson stat
Values	0.9692	0.8665	173.8697	2.0484

	C	X1	X2	X3	X4	X5	X 6
JS	1.0043	-0.4326** (-2.5341)	-0.0657* (-12.6362)	0.0746* (3.1953)	-0.0198* (-5.7317)	-0.0095* (-4.9051)	0.0121* (7.5661)
SH	0.7563	-0.0424* (-3.3658)	-0.0231*** (-1.9294)	0.0715** (2.4418)	-0.0450*** (-1.9785)	-0.0016* (-3.1966)	0.0025*** (1.8895)
ZJ	0.7982	-0.3639** (0.0410)	-0.1662* (-3.6493)	0.0401* (8.7473)	-0.0129* (-11.9283)	-0.0119* (-11.928)	0.0034* (4.1651)

3. Conclusion

From the analysis results of panel data model, we can conclude that, among the six marketization factors, X_1 , X_2 , X_4 and X_5 are in negative correlation with the homogeneous trend of manufacturing industry structure in Yangtze

River Delta region, whereas X_3 and X_6 are in positive correlation with it.

The ownership reform has driven the development of non-state economy. Along with the market economy system reform, the government function has been changed constantly and its efficiency has been greatly improved. Clear property right ensures enterprises independent right in investment and in decision-making, which contribute to constructing a modern enterprise system. In a sense, it has destroyed the construction repetition phenomenon resulted in too much government interference. The growth of factors market and the development of open door to the outside world have broaden the enterprises' invest resources. The enterprises can take part in global cooperation and attract high quality capital to weak the homogeneous trend of industry structure in Yangtze River Delta region.

As one of the most developed region in China, the Yangtze River Delta region has attracted amounts of foreign investors with its thriving commodity market and frequent transaction. The competition in market is extremely severe. Accompanied with the competition, the chief manager of enterprise will make micro-decision which accords with the aim of pursuing maximum profits as a "reasonable man". Furthermore, the resources and environment are similar in the two provinces and one city. It is easy to cause construction repetition in market which will result in higher homogeneous degree of industry structure in regions. Generally speaking, along with the market reform in Yangtze River Delta region, the transaction efficiency is increasing continuously what greatly pushes the labor division and cooperation between regions and effectively decreases the regional homogeneous trend of industry structure.

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