

Empirical Study on Unbalanced Development of Regional Environmental Economy in China

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Abstract

First of all, this article makes an EKC analysis in the industrial effluent, industrial waste water and industrial sulfur dioxide in the three major economic zones in China. Then, by referring to the tool of index distribution quotient and comprehensively observing the industrial structure pattern of population, this article finds out that an obvious economic gradient zone feature exists in the three major economic zones. This not only provides thinking for exploration of specific tactics in gradually promoting gradient transfer of population industrial structure among the three major economic zones, but offers theoretical foundation to realize the relatively balanced “win-win” between economic layout and environment development.

Keywords: Economy growth, Environmental pollution, Environmental Kuznets Curve (EKC), Population industrial structure, Distribution quotient

1. Introduction

So far, environment has not been a production factor resource as termed by classical economists that not only didn't affect the progress of economic development, but also could be acquired infinitely free of charge (Note 1). The environmental quality deterioration that occurred within the global scope from the end of 80s and earlier 90s of the Twentieth Century made human being further realize existence of environmental pressure. Whether economic growth is a method to resolve the environmental issue or a factor that causes the environmental issue has encouraged economists to make an empirical research on relationship between the economy and the environment.

Considering existing literature, since the common index to measure economic growth is income level, relation between economy and environment is intensively manifested as the relation between income and the environment. In 1993, Panayotou borrowed the reverse U curve between per capita income and income inequality defined by Kuznets in 1955 and for the first time termed the reverse U relation between the environmental quality and per capita income as Environmental Kuznets Curve (EKC). As far as economy in such big powers as China, there exists great slip in study on EKC. As economy in big powers, one of the most obvious characteristics is that regional economic gradient exists objectively due to the vast territory of those countries. However, there has rarely been any specific analysis in the relationship between the environment and economic growth in gradient economic zones in China so far. With a view of that, this article is going to employ per capita gross domestic product and the indicator of discharge of industrial pollutant and make a comparative analysis in the EKC of the three major economic zones in China so as to quantitatively describe the economic and environmental development of the three major economic zones (Note 2).

2. Research methodology

Considering the availability of the data used in this article, this article chose the following three indicators as representatives to discuss the relationship between economic growth and environmental pollution: discharge (ten thousand tons) of industrial effluent, discharge (a hundred million cubic meters) of industrial waste gas and

discharge (ten thousand tons) of industrial sulfur dioxide in the three economic zones of eastern China, middle China and western China (Note 3) between 1991 and 2005. Since there are great differences between different indicators in terms of the unit, the logarithm value of each indicator was regarded as the research object and a regression analysis was made. The data selected in this article were panel data since panel data are more likely to reflect the relationship between environmental pollution and economic growth. However, it was likely that panel data might simultaneously have the two dimensional features of cross section and timing sequence, as a result of which processing data might directly affect efficiency of estimation of parameters. If we directly made a regression processing on data collected, then such phenomena as heteroscedasticity and sequence relevance might occur in the process of data analysis, which might reduce fitting degree of the model to a large extent and then lead to distortion of estimation of parameters. In order to eliminate influences of these factors on regression results, it was required to employ the weighting method and general difference method, etc., in the process of fitting equation to process the data, in which way the degree of fitting of the equation could be greatly enhanced and the rationality of estimation of parameters could be guaranteed. However, the data estimated were the LN value of the original data, but not fitted directly with the original data, so the result was not the actual quotient of influences of income on the environmental quality, but the LN value of the turning point. After taking the EXP of the value, we could get the actual estimated parameters and work out the accurate turning point.

3. Analysis of the simulation results

3.1 Discharge of industrial effluent and per capita gross domestic product

There exist respectively a relationship of reverse N, N and reverse U between the discharge of industrial effluent in eastern China, middle China and western China and per capita gross domestic product. From the regression results, a further analysis told us that the turning points of the curve of discharge of industrial effluent in eastern China and income were respectively 70.61533 Yuan/person and 36821.9 Yuan/person. That is to say, the degree of industrial effluent pollution in eastern China would rise with increase of per capita income when the per capita income exceeded 70.61533 Yuan/person and would decline with increase of per capita income when the per capita income surpassed 36821.9 Yuan/person. The turning point of the curve of middle area was 7630.179 Yuan/person. That is to say, the degree of pollution would decline with increase of per capita income when the per capita income surpassed 7630.179 Yuan/person. As for the western area, the two turning points were respectively 1847.462 Yuan/person and 4694.86 Yuan/person. Therefrom, we could find out the differences between the three areas and we made an in-depth exploration into the causes for the differences: the eastern area had entered a stage of rapid economic growth long before, but the economic growth within this period of time was based on high consumption of resources and energy, so the degree of water pollution was possibly the highest. The middle area was a region in which industrial sections were relatively intensive, so its turning point was quite likely to be higher than that of the western area. The complicated pattern of the curve in the western area was partly as a result of the defect of the model per se or was caused by certain error in the process of data collection.

3.2 Discharge of industrial waste gas and per capita gross domestic product

Considering the regression result of the relation between industrial waste gas discharge and per capita income, the curves of the three areas of eastern area, middle area and western area all exhibited a form of reverse U. The turning points of the curves in the three areas were respectively 2295.887 Yuan/person, 798.9852 Yuan/person and 1589.607 Yuan/person. It could be discovered that the curve of industrial waste gas discharge and income was different from the curve of industrial effluent discharge and income. The turning point of the former was not rising in proper order from the east to the west, but the turning point of the curve of the eastern area was the highest. The primary reason here was that development in the eastern area took a leading role and the use of fuel in the eastern area was more than that in the other two areas, which might result in the fact that the eastern area was more sensitive to pollution of industrial waste gas.

3.3 Discharge of industrial sulfur dioxide and per capita gross domestic product

The track of the three curves of the eastern area, the middle area and the western area was respectively a reverse N, U and N. The two turning points of the eastern area were respectively 1576.849 Yuan/person and 7784.42 Yuan/person, which indicated that the degree of pollution would rise with increase of per capita income when the per capita income surpassed 7784.42 Yuan/person. In the middle area, the turning point was 1352.468 Yuan/person. That is to say, when the per capita income in the middle area exceeded 1352.468 Yuan/person, the degree of pollution of industrial sulfur dioxide would change to rise from decline with changes of per capita income. By contrast, the two turning points of the western area were respectively 1545.775 Yuan/person and 4067.68 Yuan/person.

4. Empirical observation on population industrial structure

4.1 Analysis of regional gradient of employment specialization quotient

Borrowing the indicator Location Quotient (also termed as regional specialization quotient) that reflects non-uniformity of distribution of a certain category of population, we defined the employment specialization quotient as the following formula:

$$LQ_{ij} = \frac{L_{ij}/L_j}{L_i/L_t}$$

Where, LQ_{ij} stands for the employment specialization quotient of industrial sector of j of all cities in the i^{th} region; L_j stands for the number of population engaged in the industrial sector of j in the observed area (namely, all cities and regions in Jiangsu, Zhejiang and Shanghai in the Yangtze River delta, similarly hereinafter); L_{ij} stands for the number of population engaged in all cities in the i^{th} region; L_t stands for the total number of population engaged in all industrial sectors in the observed area; L_i stands for the total number of population engaged in all industrial sectors in all cities in the i^{th} region. It is thus clear that, employment specialization quotient refers to an analysis indicator expressed by a relative proportion to observe the distribution condition of the population engaged in different industrial sectors of different areas and cities at a certain period of time (relative to the entire area observed).

Starting out from the perspective of “specialization”, we observed the regional difference of changes of distribution of employment structure of Chinese labor force (see as Figure 1).

The eastern area had a relatively better natural environment and its economic development was relatively high, in which labor force of the secondary industry and the tertiary industry was relatively intensive in most provinces, with relatively obvious specialization, while the labor force of the primary industry was almost in a non-specialization state. The non-agricultural industrial structure was most prominent in the three municipalities of Beijing, Tianjin and Shanghai. Specialization of labor force in the tertiary industry in Beijing was the highest all over the country, and Shanghai was an area in which labor force of the secondary industry was the most intensive. Furthermore, non-specialization of labor force in the primary industry in Beijing and Shanghai was most obvious.

The western area had a relatively worse natural environment and its economic development was relatively low, in which labor force of the primary industry was relatively intensive in most provinces, with obvious specialization, while the labor force of the secondary industry and the tertiary industry, especially of the secondary industry was almost in a non-specialization state. It was indicated that, labor force of the primary industry in most provinces and regions in the western area was more intensive, and the proportion of labor force engaged in agricultural production was higher than that in other areas in the country.

The natural environment condition and the economic development level of the middle area was appropriately in between the eastern area and the western area, which was also reflected the specialization condition of employment structure of the labor force.

4.2 Characteristics of regional gradient of population industrial structure

Employment structure mentioned in this article refers to the sectoral structure of employment, namely, distribution of employed population in the three industries. Regional distribution and change of industrial structure of population is an important content of population distribution in economic activities, and is also the specific reflection of regional economic development level and structural characteristics. At the same time, it is an important influential factor that leads to regional distribution and change of population.

Figure 2 describes the changes situation of the output of the three industries (respectively represented with GDP1, GDP2 and GDP3) from 1978 to 2005 and the employment quantity (respectively represented with L1, L2 and L3). Therefrom, we can come to such a conclusion: with changes of the industrial structure, development of the secondary industry is relatively fast, the tertiary industry takes the second place and the primary industry is developed most slowly. In the meanwhile, with development of the employment structure, employment quantity of the secondary industry and the tertiary industry increases year by year. The employment quantity of the tertiary industry has surpassed the employment quantity of the secondary industry, and the employment quantity of the primary industry goes towards decline. However, as a matter of fact, since the gradient difference exists objectively in the industrial structure of the eastern area, middle area and the western area, obvious regional gradient feature also exists in the employment structure (see as in Figure 3). It gave us the following enlightenment: economic development has promoted escalation of the industrial structure and has stimulated

rationality of the employment structure. For instance, the proportion of employed population in the primary industry of the eastern area is far lower than that of western area; the proportion of employed population in the secondary industry and the tertiary industry of the eastern area is higher than that of the western area.

5. Conclusions and suggestions

5.1 Constructional pollution has become an important issue in the environmental pollution in China

The so-called constructional pollution means that the condition of pollution is related with a certain structure in the economic system which, as a matter of fact, refers to a proportional relation or a distribution relation. Certain proportional relation or distribution relation leads to certain pollution characteristics. That is to say, if the proportional relation or distribution relation is changed, then characteristics and condition of pollution will also be changed. Thus, the key to resolve constructional pollution is to alter the particular structure in the economic system. China is vast in territory and there are great differences in the productivity development level, economic technical level and social development foundation, so there exists objectively the economic technical gradient and population industrial structure gradient in the three major economic zones of the eastern area, middle area and western area. At present, China is at an important stage in which economic transformation, economic structure adjustment and conversion of economic growth means are promoted simultaneously. At this stage, the industrialization of China, especially the progress of rural industrialization is being rapidly promoted, population is increasing, but resources applicable to govern the ecological environment are limited, so challenges to the ecological environment will be more and more serious.

5.2 The gradient transfer theory which originated from Vernon's product life cycle theory is actually a kind of disequilibrium development theory

The research result of this study again demonstrates that the development of regional economy depends on the condition of the industrial structure. Since the gradient exists, the sequence of spatial transfer exists too. The difference of gradient that exists objectively enables areas with high gradient to seek for development by continuous innovation and spreading outwards, while areas with medium and low gradient seek for development by accepting the spread or searching for opportunities to take a leap in development and push forward by countergradient. In order to realize regional gradient advance and the purpose of the relatively balanced "win-win" between economic layout and environment development, author of this article believes that we ought to grasp the important opportunity of regional gradient of China as a big economic power and take the following countermeasures. Firstly, we should further intensify the vigor of financial transfer by the central government to underdeveloped areas of middle and western China, formulate and carry out all sorts of preferential policies and establish the mechanism of "interests compensation" implemented by the eastern developed area to the middle and western areas. Secondly, we should appropriately guide "backflow of rural migrant workers in cities" through the market adjustment means and strengthen the effect of spreading of gradient transfer. Thirdly, we ought to encourage backward areas to cultivate new science and technology and industries with strong effect of growth pole and avoid being trapped in the low gradient and in lagging behind. Fourthly, we ought to upgrade the hierarchy of gradient transfer, accelerate the process of gradient transfer and diminish the economic gap between the eastern area and the middle and western areas at the time of promoting industrial escalation of eastern development area.

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Notes

Note 1. Neglect of Neoclassical Economics on natural resources can be dated back to the initiator Marshall.

Note 2. In the earlier 80s of the Twentieth Century, in order to satisfy with the requirement of economic construction practice in China, scholars at home localized the theory of gradient process and classified regional spatial economical development level into the three major zones of eastern, middle and western areas.

Note 3. Eastern and middle areas include Beijing, Shanghai, Tianjin, Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, the Guangxi Zhuang Autonomous Region and Hainan. Middle area includes Shanxi, Inner Mongolia Autonomous Region, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan. Western area includes Sichuan, Guizhou, Yunnan, Tibet Autonomous Region, Shaanxi, Gansu, Qinghai, the Ningxia Hui Autonomous Region and the Xinjiang Uygur Autonomous Region. Collection of data about Chongqing was difficult, so Chongqing was not within the scope of consideration.

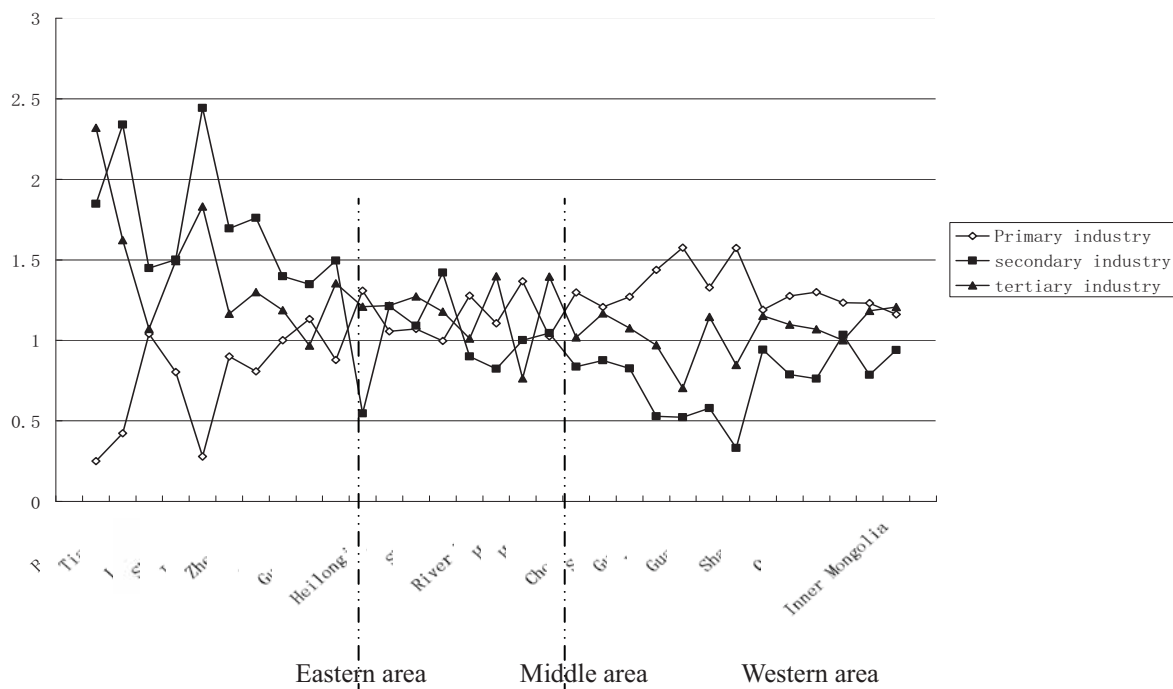


Figure 1a. Distribution mode of regional specialization quotient of employment structure of labor force in China (2000)

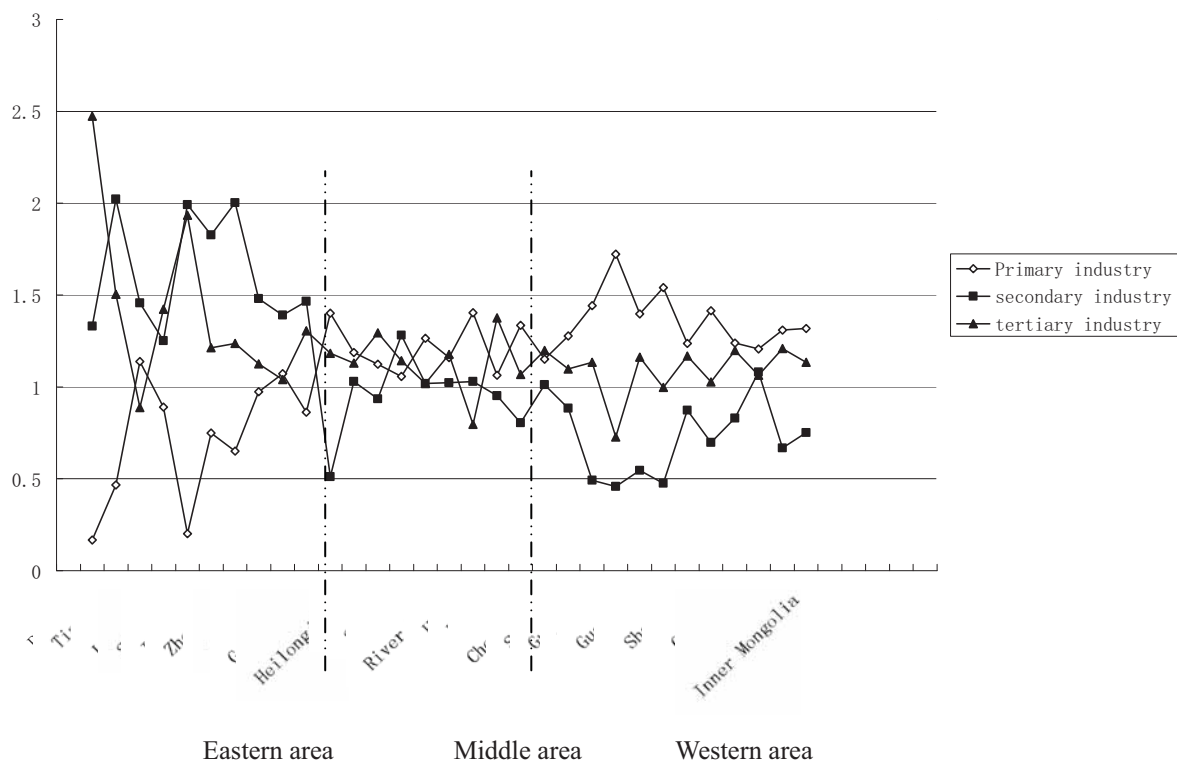


Figure 1b. Distribution mode of regional specialization quotient of employment structure of labor force in China (2004)

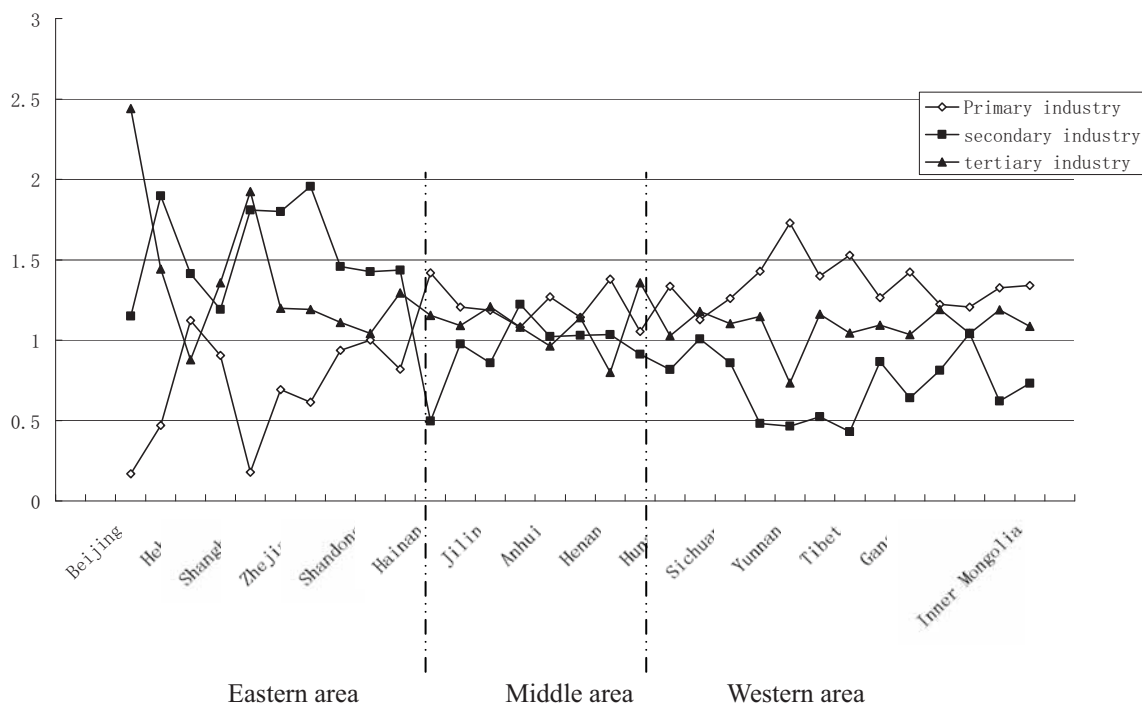


Figure 1c. Distribution mode of regional specialization quotient of employment structure of labor force in China (2005)

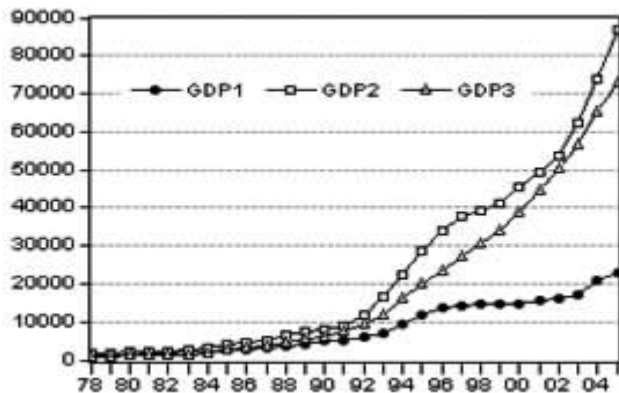


Figure 2a. Developmental trend
of the industrial structure

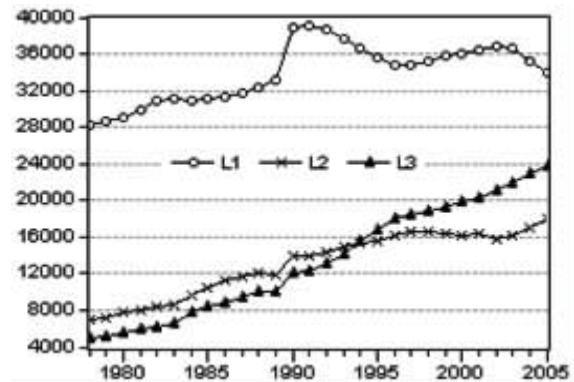


Figure 2b. Developmental trend
of the employment structure

Source of data: Sun Jian & Zhou Bing, 2008: "SEM Study on Correlation between Industrial Structure and Employment Structure", "Statistics and Decision", No. 11.

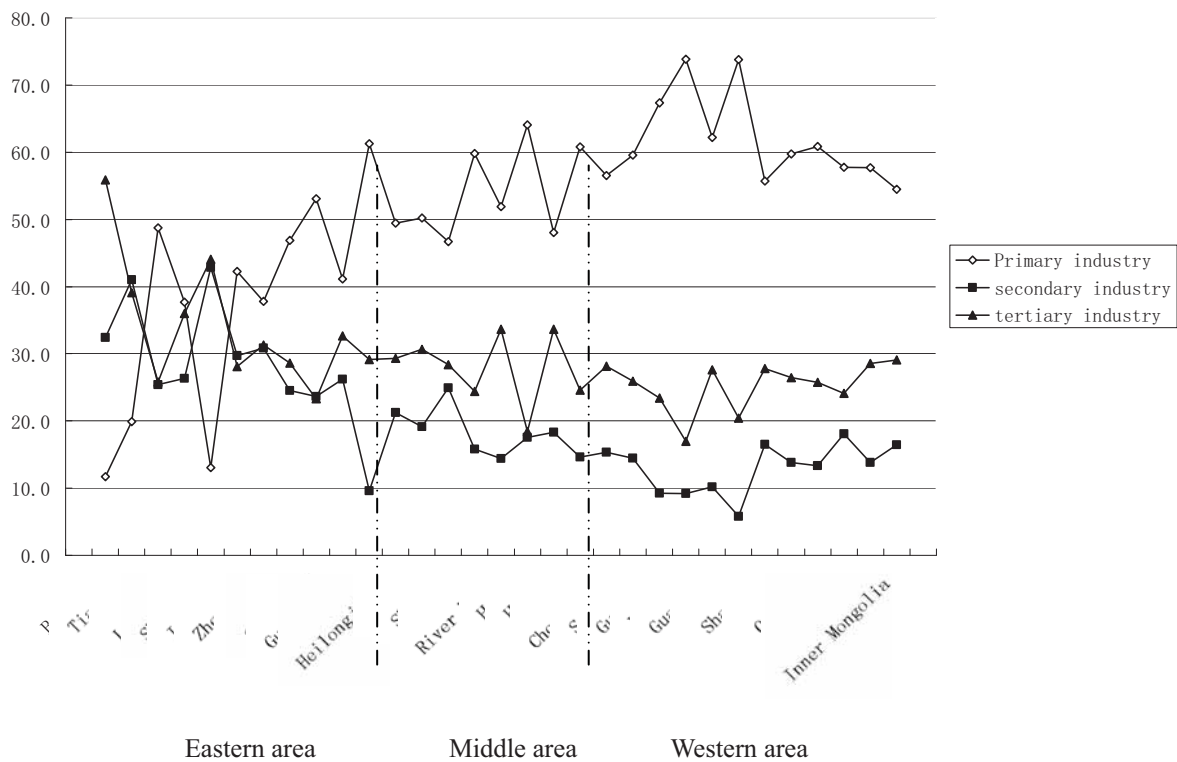


Figure 3a. Comparison of employment structure in all areas in China in 2000

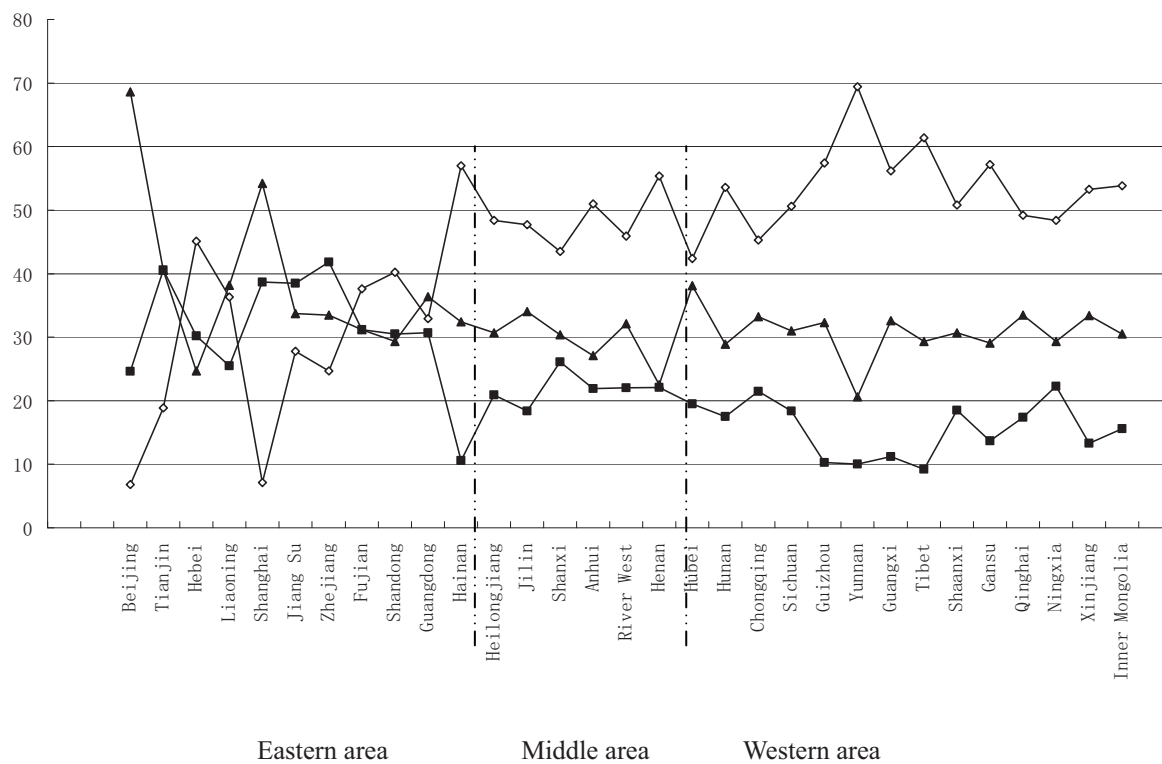


Figure 3b. Comparison of employment structure in all areas in China in 2005