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The Trend of Regional Income Disparity in China

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ABSTRACT

This paper is devoted to comprehensively analyze regional income disparities in China from 1978 to 2014. Since China began its reform and opening up, inter-provincial disparities have experienced a process of narrowing first and then expanding. But this expansive trend of inter-provincial income disparities has slowed down and began to decrease somewhat around 2000, and the income disparity between the regions has kept a narrowing trend since 2004. Using provincial economic growth data, we analyze the changes of China's economic growth pattern since reform and opening up and investigate the main factors influencing regional economic growth and regional disparities.

Keywords: Income Disparity, Regional Economy, Regional Policy, Gini coefficient, China

FOREWORD

Eradication of poverty has become the major concern of the global society since the World Summit of Social Development in Copenhagen in 1995. It was ranked to be the first priority goal of the Millennium Development Goals of the United Nations in 2001. The causes of poverty are very complicated. It is described in the World Bank's World Development Report 1990 that "In many countries poverty has a significant regional dimension. In general, it is more common in areas with low average income, but the link is sometimes surprisingly weak." This is especially true in China. Rural poverty played a dominant share of China's poverty. Based on current Chinese standard of poverty line, it is 2800 yuan (at current price) in 2014, and China has around 70 million rural people in poverty based on this standard. China has set up the target to eradicate all rural poverty by the year 2020 in the recent "Recommendations for the 13th Five-Year Plan for Economic and Social Development by the Central Committee of the Communist Party of China (CCCPC)" promulgated on October 29, 2015. This paper will be presented from the perspective of analysis of regional income disparity in China. The study has been supported by China's Postdoctoral Science Foundation (Grant No.2015M581051).

1. INTRODUCTION

China is a large developing country with huge population and tremendous size of territory; the natural endowments and economic and social conditions of various regions differ greatly, making regional imbalance a basic national condition of China. Regional income disparity is one of the crucial issue faced by China in its medium and long term development, it is also a core problem to be solved with full effort to achieve coordinated regional development. Therefore, there is the necessity to study in depth the phenomenon of regional income disparity.

Many researchers have studied the trend of change of inequality in China's regions. Most studies discovered that China's regional disparity measured in terms of GDP per capita declined significantly from 1978-1990, which was the first stage of China's reform and opening (Jian, Sachs and Warner, 1996; Hu and Wang, 1996; Dayal-Gulati and Husain, 2000; Ki, Feng and Hou, 2004). Many of these studies recognized that in this initial stage, this was mainly due to the per capita output of rural areas which was lower than the national average, but that the rural reform in this stage had promoted greatly to the growth of agricultural production, and therefore the underdeveloped rural regions were benefiting much more from the reform. There is the emergence of a trend of continuous regional disparity of China since the 1990s (Wang and Fan, 2004; Kanbur and Zhang, 2005). This is mainly due to the increase of disparity between the coastal area and provinces (including autonomous regions) in the hinterland. Since the year 2000, although there is still growth of disparities among four regions[1], the rate of increase becomes relatively smooth and there is a decrease of regional disparity to certain extent after the year 2004 (Xu and Li, 2006). Liu (2009) finds that the performance of the Western Development Strategy accelerates the economic growth rate of the Western region by about 1.5 percentage point in average every year since the year 2000, and that it makes China's regional economy going from divergence to convergence.

Some studies also find that China's urban-rural disparities constitute to be the main part of the overall disparities (Kanbur and Zhang, 1999; Yang and Zhou, 1999). Using urban and rural household consumption data of 28 provinces and autonomous regions (exclusive of Beijing, Tianjin and Shanghai) between 1983 and 1995, Kanbur and Zhang (1999) find that urban-rural disparities accounted for 70% of the overall regional disparities. The enlargement of regional disparities in China is shown mainly by the rapid expansion of urban-rural income disparities since the 1990s (Yang and Zhou,1999; Sicular et al., 2007). Chen and Lin (2013) find that the urban-rural disparities and the lagging of urbanization are two major challenges currently faced by China.

Researchers generally believe that geographic, institutional and some other factors have played important roles in the changes of China's regional income disparities since China's reform and opening up. Wang and Fan (2004) discovered that foreign direct investment (FDI), governmental transfer payment and labor migration have affected the changing of China's regional disparities. Wang and Fan (2005) consider that the unequal education opportunity is one of the key factors leading to China's regional disparities. Peng and Liu (2010) show that the main reason for the rapid expansion of China's regional disparities between the Eastern, Central and Western regions is due to the implementation of the unbalanced regional development strategy since China's reform and opening up, and is also due to the difference in the natural conditions and geographical location. Huang (2013) emphasizes the role of institutional factors in the growth of regional economy. The economic development and institutional changes in coastal areas have entered into a virtuous cycle of interactive growth pattern, while the institutional variables in the Central and Western regions are still relatively low. Accordingly, the Eastern coastal areas have a higher level of economic development than the Central and Western regions (Huang, 2013).

This paper proceeds as follows: Section 2 introduces the methodology and indicators used in this paper. Section 3 describes the trend of inter-provincial income disparity in China from 1978 to 2014. Section 4 analyses the factors of inter-provincial income disparity. Conclusions and policy implication are derived in Section 5.

[1] It refers to the classification of China's regions into Eastern, Central, Western, and Northeastern.

2. RESEARCH METHODOLOGY

There are many indicators reflecting on regional income, and the following three indexes are adopted to measure China's regional disparities in this paper: GDP per capita, urban household disposable income per capita and rural household net income per capita. GDP per capita is the most frequently used indicator that reflects certain region's economic development level. Compared with other indexes, time series of GDP per capita are available systematically. Household income is the main determinant of household living standards and quality of life, which can directly reflect the welfare enjoyed by household. In China, household income is measured by urban household disposable income per capita and rural household net income per capita. The data on household income come from household survey teams of the National Bureau of Statistics.

Gini coefficient and Theil index are applied to research the trend and the stage of China's regional disparities from the 1978 to 2014.

(1) Gini coefficient

The Gini coefficient is widely used in the inequality literature. Following Shankar (2003), we compute the unweighted Gini coefficient as follows:

$$G_u = \left(\frac{1}{2\bar{y}_u}\right) \cdot \frac{1}{n(n-1)} \sum_i^n \sum_j^n \left| y_i - y_j \right|$$

y_i and y_j are the GRDPs per capita of region *i* and *j* respectively. *n* is the number of regions, and $\bar{y}_u$ is the unweighted mean of the per capita GRDPs. G_u varies from 0 for perfect equality to 1 for perfect inequality.

The unweighted Gini coefficient take every region in the same magnitude, i.e. each region is taken as one equal unit irrespective of the population it has. The Gini coefficient weighted by population, which weights each difference of per capita GRDPs by respective population proportions, is calculated as shown below:

$$G_u = \left(\frac{1}{2\bar{y}}\right) \cdot \sum_i^n \sum_j^n \left| y_i - y_j \right| \frac{P_i P_j}{P^2}$$

Where $\bar{y} = GDP/P$ is the national mean per capita GDP. P_i and P_j are the populations of regions *i* and *j* respectively. *P* is the national population, and *n* is the number of regions.

(2) Theil index

Following Theil (1967), it is computed as follows:

$$Theil\_T = \sum_i \gamma_i \log \frac{\gamma_i}{p_i}$$

Where γ_i is the GDP share of region *i* and P_i is the population share of region *i*. For equal per capita GRDPs, i.e., with GRDPs proportional to regional populations, this index takes a value of 0. For a case where region *i* produces the entire GDP, Theil becomes $\log(P/P_i)$,where *P* is total population of the country, and P_i is the population of region *i*. Note here that as the population share of region *i* goes down, Theil rises if region *i* produces the entire GDP. Similar to the $Theil\_T$ index, we can compute

the $Theil\_L$ index, which use the population share as weight, i.e., $Theil\_L = \sum_i p_i \log \frac{p_i}{\gamma_i}$.

Suppose that the regions are grouped into mutually exclusive and collectively exhaustive groups and each group can be divided by several small sub-regions. The Theil index can be decomposed into within-group and between-group components as follows:

$$Theil\_L = \sum_{i=1}^{I} p_i \log \frac{p_i}{\gamma_i} + \sum_{i=1}^{I} p_i \sum_{j=1}^{n_i} p_{ij} \log \frac{p_{ij}}{\gamma_{ij}} = L_B + L_W$$

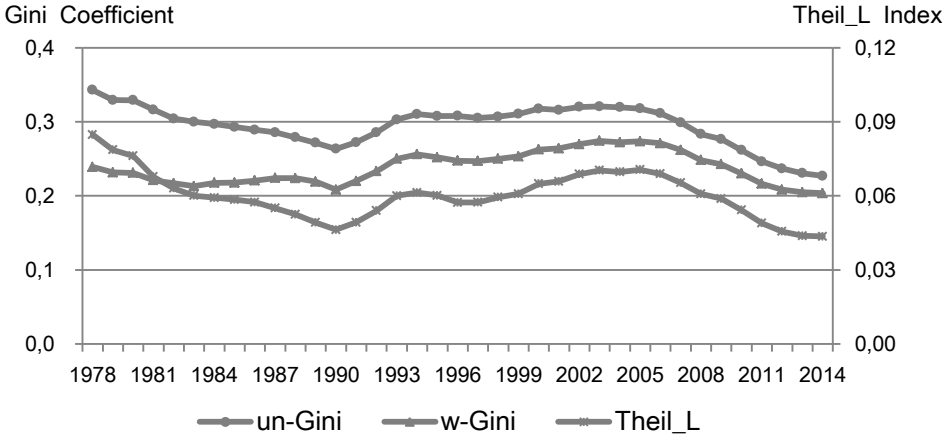
Where the meanings of P_i and y_i are the same as above, *I* is the number of groups, P_{ij} is population share of sub-region *j* in group *i*, y_i is GDP share of sub-region *j* in group *i,* L_B is the between-group component of the Theil index L and measures the extent of inequality due solely to differences in the group mean per capita GDP. L_W is the within-group component of the Theil index L and is defined by a weighted average of within-group Theil indices $L_i = \sum_{j=1}^{n_i} p_{ij} \log p_{ij} / \gamma_{ij}$ with the weights being the population shares of the groups P_{ij}.

3. THE TREND OF INTER-PROVINCIAL INCOME DISPARITY

3.1 Changes in inter-provincial income disparity measured by Gini coefficient and Theil index

According to the change of regional income disparity among provinces and autonomous regions of China based on GDP per capita at current price, the last 37 years from 1978 to 2014 are divided into four periods (Figure 1). The first period is 1978-1990, when there was reduction of regional income disparity among provinces and autonomous regions; the Gini coefficient unweighted by population had decreased from 0.343 in 1978 to 0.263 in 1990, and the Theil index had decreased from 0.085 to 0.046. The second period is the first half of 1990's. There was rapid increase of regional income disparity among provinces and autonomous regions in the first half of 1990s, the unweighted Gini coefficient had risen from 0.263 in 1990 to 0.308 in 1996, and the Theil index had decreased from 0.046 to 0.06. The third period is 1996-2004. There was still a slow increase of regional income disparity from the late 1990's to 2004. The fourth period is 2004-2014. After 2004, there was a relatively significant reduction of regional income disparity. The unweighted Gini coefficient decreased from 0.32 in 2004 to 0.23 in 2014, and the Theil index decreased from 0.07 to 0.04.

Figure 1. Change of Gini coefficient and Theil index 1978-2014 (based on per capita GDP at current prices)



Source: *Statistical Year Books* of each province and autonomous region in China.

3.2 Spatial decomposition of inter-provincial income disparity

China's central government divides 31 provinces into four regions in the "Eleventh Five-Year Plan (2006-2010)", which are the Eastern, Central, Western, and Northeastern regions (Figure 2). The Eastern Region includes Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan. The Central Region includes Shanxi, Henan, Hubei, Hunan, Anhui and Jiangxi. The Western Region includes Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang. The Northeastern Region includes Liaoning, Jilin, Heilongjiang. A four-region division is much reasonable within the current regional economic pattern, and intra-regional disparities are relatively trivial. More importantly, it helps the central government to develop corresponding regional development strategy and policies. Therefore, we analyze regional disparities based on four regions.

Figure 2. Four Regions (Western, North-Eastern, Central, Eastern) of China

In order to explore the spatial distribution of inter-provincial disparities in China, a group decomposition technique is applied in the following analysis. The Theil index of inter-provincial disparity with four regions can be decomposed into components of intra-region and inter-region. The result shows that the disparity among provinces and autonomous regions is caused firstly by the disparity among four regions, the second cause is the internal disparity of the Eastern Region (Figure 3).

Figure 3. Decomposition of inter-provincial disparity with four regions based on nominal GDP per capita at current price

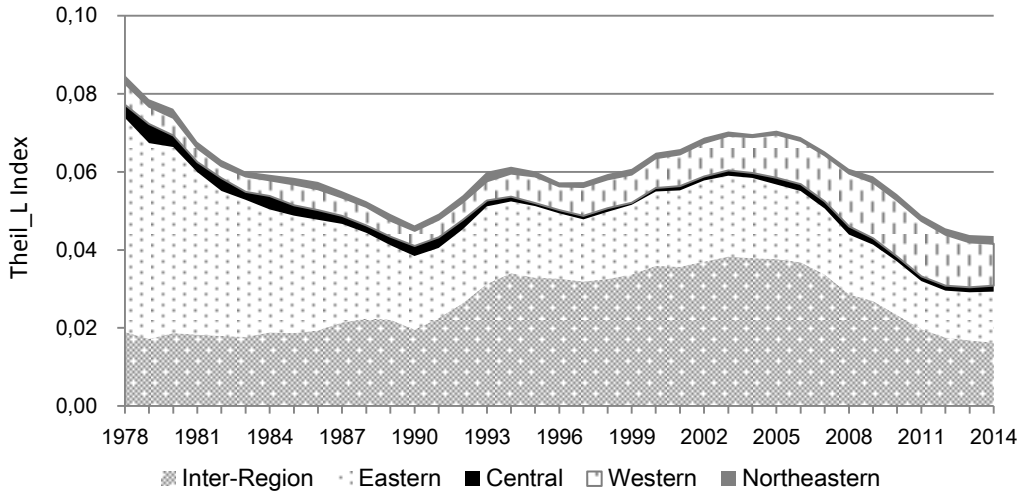


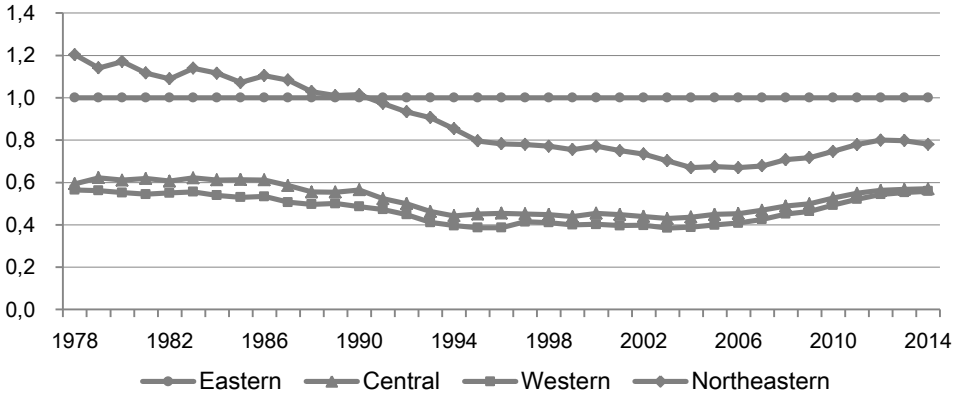
Table 1. The share of intra-region and inter-region disparities based on nominal GDP per capita

Year	Disparities within Eastern	Disparities within Central	Disparities within Western	Disparities within Northeastern	Disparities Among Four Regions
1978	64.7%	4.0%	6.3%	2.6%	22.4%
1990	40.7%	5.7%	8.3%	3.0%	42.3%
1996	29.1%	1.5%	10.6%	1.8%	57.0%
2004	29.5%	1.9%	13.2%	1.1%	54.4%
2014	29.9%	3.7%	24.6%	4.4%	37.4%

The decline of regional income disparity of China in the period from 1978 to 1990 is mainly due to the significant decline of internal disparity in the Eastern Region; the contribution of internal disparity of the Eastern Region has decreased from 64.7% in 1978 to 40.7% in 1990 (see Table 1).

In the first half of 1990s, the further expansion of disparities between the Eastern and other regions aggravated the regional inequality of the whole country. The GDP per capita of the Eastern Region has increased acceleratively in the early 1990's, and was obviously higher than that of the Central, Western, and Northeastern regions (Figure 4). The disparity among the four regions accounted for inter-provincial disparities was increased from 22.4% in 1978 to 57% in 1996 (see Table 1).

Figure 4. Comparison of GDP per capita in the four regions (Easter region =1), 1978-2014



After entering the 21st century, the expanding rate of regional disparities has slowed down. The share of disparities among the four regions accounted for inter-provincial disparity was decreased from 57% in 1996 to 54.4% in 2004.

Since 2004, the share of disparities among the four regions to overall disparity sharply decreased from 54.4% in 2004 to 37.4% in 2014. The disparities of GDP per capita between the Eastern Region and non-eastern regions were gradually reduced. The ratios of GDP per capita in the Central and Western Regions over the Eastern Region rose from 44% and 39% in 2004 to 57% and 56% in 2014 respectively. Also, there was a significant trend of increasing internal disparities in the Western Region. The share of Western Region's internal disparities to overall disparity increased from 13.2% in 2004 to 24.6% in 2014, which was much higher than that of other regions. For example, the GDP per capita of Inner Mongolia was 71046 yuan in 2014, which was one of the top ten of the country, while the GDP per capita of Tibet, Gansu, Yunnan and Guizhou were less than 30000 yuan at the lower side.

3.3 Decomposition of inter-provincial income disparity into rural-urban income gap

Beside the disparity among the four regions, the income gap between rural and urban areas is also the main component of the Chinese national overall income inequality. Kanbur and Zhang (1999) employed a data set that includes data of household consumption in 28 provinces of China from 1983 to 1995. They concluded that rural and urban disparity accounted for 70 percent in their analysis of the total regional gaps. Furthermore, since the late 1990's, the progress of Chinese urbanization becomes faster and faster. The urbanization rate was improved by 0.65 percentage point annually in average from 1978 to 1995 while the urbanization rate kept growing at a speed of 1.4 percentage point annually during the period of 1996 to 2005. In 2015, China's urbanization rate reached 56.1%. Additionally, regulations of China on population flow from rural to urban areas were significantly relaxed recently, resulting in a huge number of movement of rural labor force to urban areas. All these trends influence rural and urban gaps significantly.

We decomposed the Theil indexes of inter provincial income disparities into gaps between rural and urban areas, inter cities, and inter rural areas based on household income at current price. Each province is divided into urban and rural areas, giving 62 regions throughout the nation with 31 rural and urban places respectively. Theil indexes are decomposed based on this kind of classification. Figure 5 and Table 2 demonstrate the results based on household income per capita.

Figure 5. Decomposition of inter provincial disparity into urban and rural areas based on household income per capita

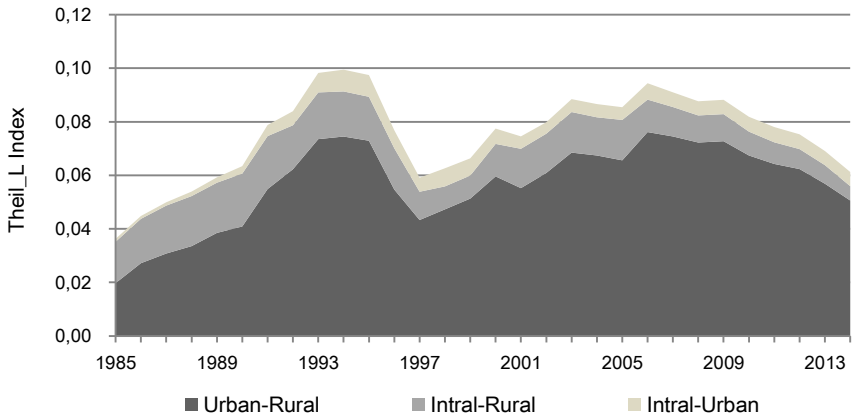


Table. 2 The share of disparities between urban and rural areas based on household income per capita

Year	Disparities within urban areas	Disparities within rural areas	Disparities between urban and rural areas
1985	3.1%	42.6%	54.3%
1990	4.4%	31.1%	64.5%
1996	8.7%	20.1%	71.2%
2004	5.7%	16.5%	77.8%
2014	8.7%	8.7%	82.6%

Anyhow, either from the absolute value or from an analysis of value of share of total disparity, the increase of disparity between the urban and rural area is very significant. Urban-rural disparities are the main source of regional disparities and have always represented a contribution of over 70% in regional disparities since 1992. The disparity in the level of income between the urban and rural areas has a share of total disparity of around 54.3% to 74.2% from 1985 to 1992. In this period, the whole country focused on the development of the city and industrial sector, with the result of faster industrial development than that of agriculture. The governmental investment in agriculture had gradually declined, and the rural economic system reform had not achieved appropriate progress in the short term. Therefore, the income gap between urban and rural households was gradually expanding in this period. Since 2006, the government has implemented a series of policies to support and benefit the agriculture sector, such as the reduction of agricultural tax, the implementation of a grain subsidy policy and so on, which caused the income gap between urban and rural areas to stabilize gradually. The Theil index of household income disparity between the urban and rural areas began to decline from 0.094 in 2006 to 0.061 in 2014, but its share of total regional disparity still exceeded 80%. The narrowing of income gap between the urban and rural areas in this stage played an important role on decreasing inter-provincial disparity.

The inter-rural income disparity in the level of household income was higher than inter-urban income disparity, and its share of total regional disparity was decreased greatly from 42.6% in 1985 to 8.7% in 2014. On the contrary, there was an increase of regional income disparity to some extent among the urban areas from 3.1% in 1985 to 8.7% in 2014, but it had a relatively small share of total disparity (see Table 2).

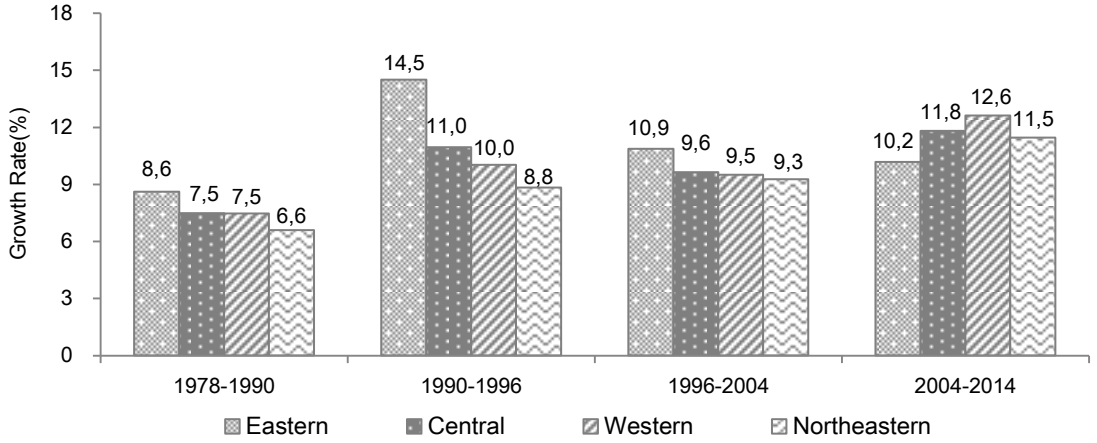
4. THE FACTOR ANALYSIS OF INTER-PROVINCIAL INCOME DISPARITY

The change of regional income disparity can be caused by the difference in the regional economic growth rate. In this section, using provincial economic growth data, we will analyze the changes in China's economic growth pattern since reform and opening up and investigate the main factors influencing regional economic growth and regional disparities.

4.1 Changes in patterns of regional growth and inter-provincial income disparity

According to the four periods of the change of regional income disparity based on the above calculation results of Gini coefficient and Theil index, this section will analyze the change in China's economic growth pattern from 1978 to 2014 and its impact on inter-provincial income disparity. In Figure 6, it can be seen that the growth rates of GDP per capita of China's four regions are significantly different during each period.

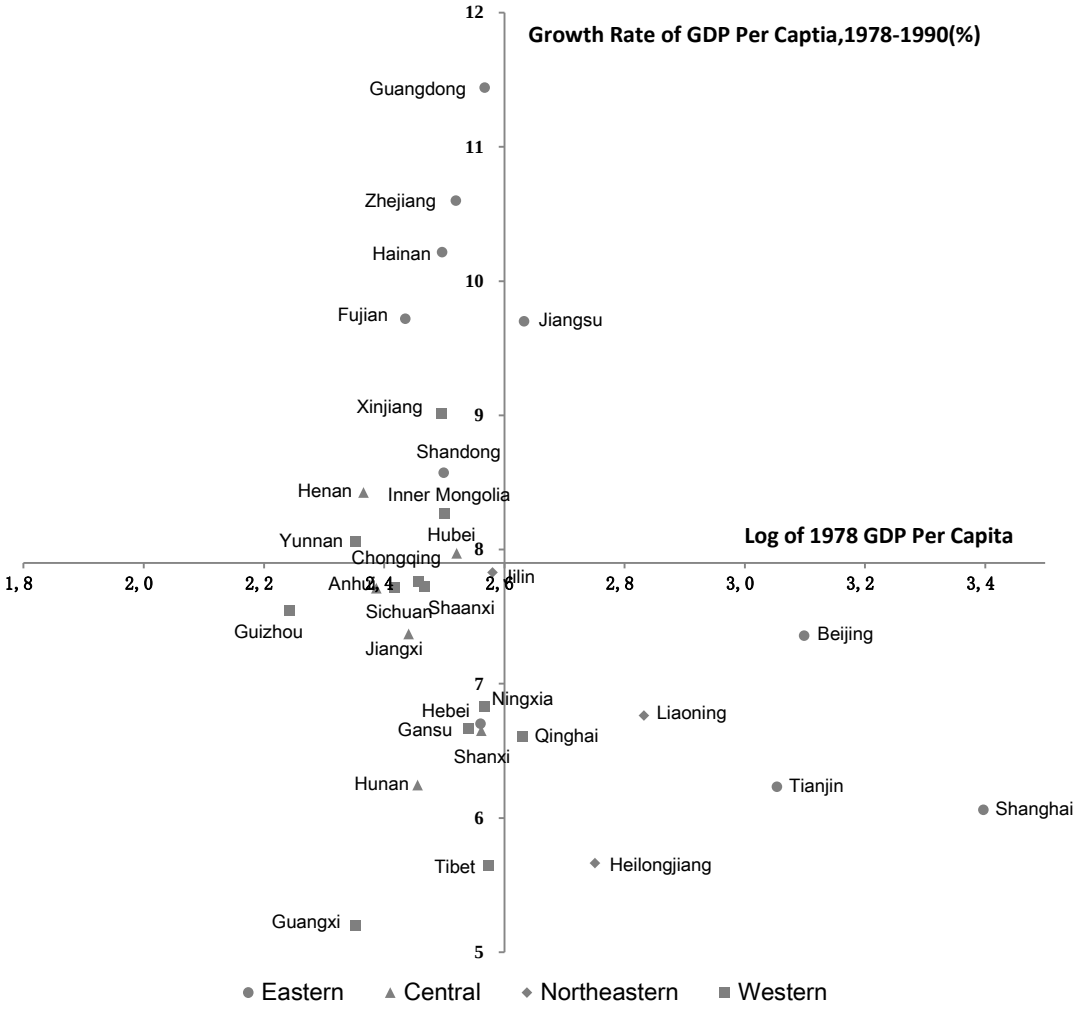
Figure 6. Growth rate of GDP per capita of China's four regions, 1978-2014



The first period is 1978 to 1990. Figure 7 is designed to show the growth pattern of China's regions in this stage. China had entered a new period of socio-economic development in the late 1970s with the implementation of reform and opening to the outside world under the leadership of Deng Xiaoping. The major issue of regional development at that time was to promote development through expansion of opening. Four special economic zones (SEZ) were set up in 1980 along the coastal area. Fourteen coastal cities were opened to the outside world in 1984, there were further opening of some coastal economic zones in the Yangtze River Delta, the Pearl River Delta, Liaodong Peninsula, etc. Pudong New Area in Shanghai had also been approved for development and opening up in 1990. A coastal open area extending from the south to the north of China along the coast line was formed, which shared a series of special preferential policies in finance, taxation, investment and so on. It is also based upon the concept of Deng Xiaoping, who claimed that the basic way to realize common prosperity was to let some regions and some people to become rich first; the national development strategy and the arrangement of productive forces began to target on efficiency rather than on the objectives of defense and reducing the disparity between regions. Since then, the Sixth Five-Year Plan (1981-1985) has implemented a non-balanced development strategy which has greatly promoted the development of coastal areas that had advantageous geographical superiority and a better economic foundation, so that the economic growth rate of the Eastern Region was in the national leading level. From 1978 to 1990, the Eastern Region's capital construction investment accounted for 53.5% of that of the whole nation.

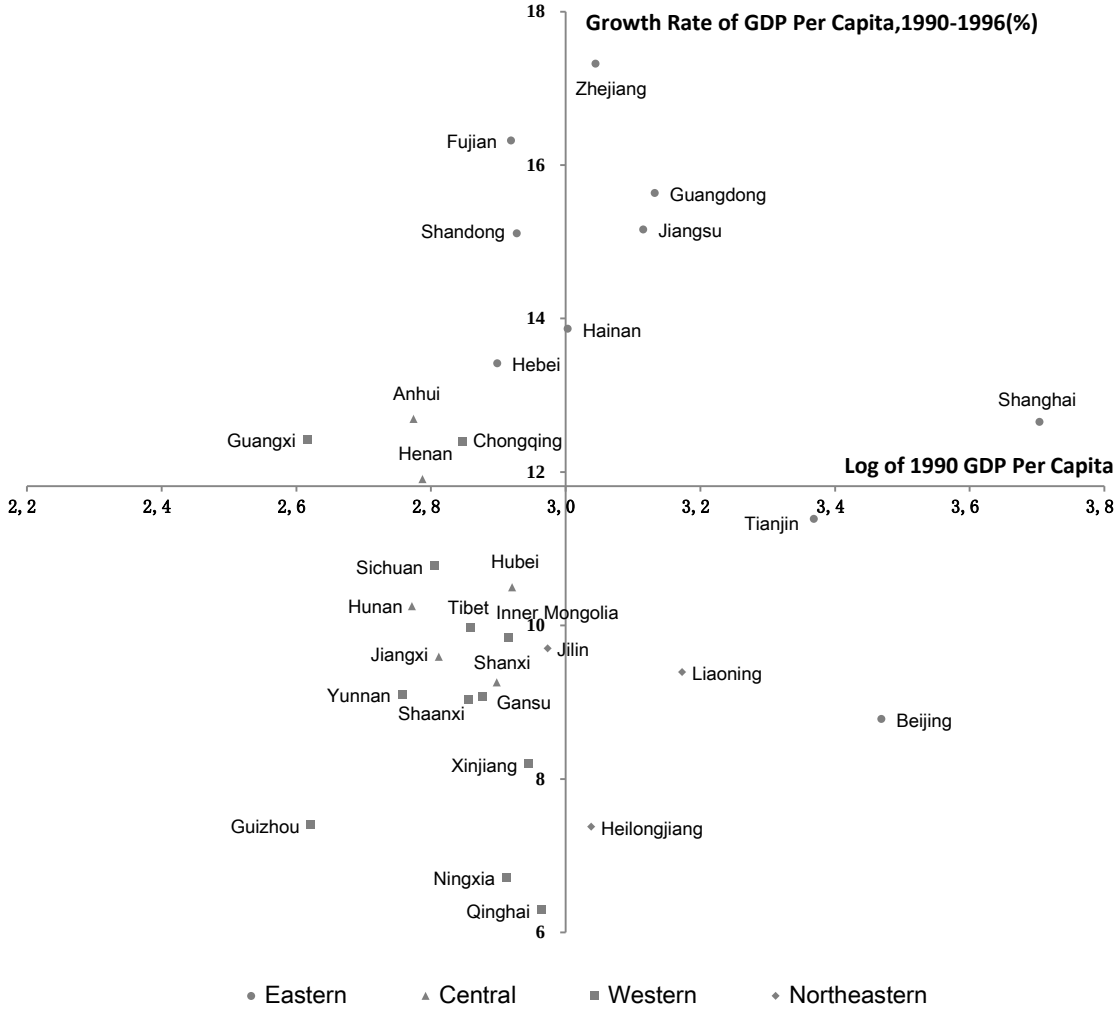
In this case, the average growth rate of economic development in the Eastern Region was higher than in other regions (Figure 6), especially for the coastal provinces such as Guangdong, Zhejiang, Jiangsu, Fujian etc.; the economic growth rate of those provinces was in the top five of China (Figure 7). In 1978, among ten provinces in the Eastern Region, there were only Beijing, Tianjin, and Shanghai Municipality with relatively higher GDP per capita. Shanghai had the highest GDP per capita of the Eastern Region which was up to 2498 Yuan, in contrast to Fujian province which had the lowest GDP per capita in this region — and only 1/9 of that of Shanghai. After the reform and opening up, the internal disparities were reduced in the Eastern Region. Analyzing comparatively, most of the Central and Western provinces and autonomous regions had growth rates lower than the national average. This resulted directly in widening disparities with the Eastern Region. It is shown clearly that a large part of provinces and autonomous regions of the Central and Western regions is located in the lower left part (with lower income and lower growth rate) of Figure 7.

Figure 7. Growth Pattern of China's Regions, 1978-1990



The second period is the first half of 1990s. China's reform and opening up had significant effect on propelling the economic growth of the Eastern Region that has higher GDP per capita and growth rate than other regions. The growth rate in the Eastern Region was 3-5 percentage points higher than that of other regions as shown in Figure 6. Figure 8 shows the growth pattern of China's regions in the period of 1990-1996. It can be seen in Figure 8 that the trend of Eastern provinces concentrating in the upper right part (with higher income and higher growth rate) compared with Figure 7. This indicates that the level of economic development as a whole in the Eastern Region had been improved and its internal disparities significantly reduced compared with the first stage, while many provinces and autonomous regions of the Western and Central regions remain located in the lower left part (with lower income and lower growth rate). This resulted in widening the regional disparities in China.

Figure 8. Growth Pattern of China's Regions, 1990-1996

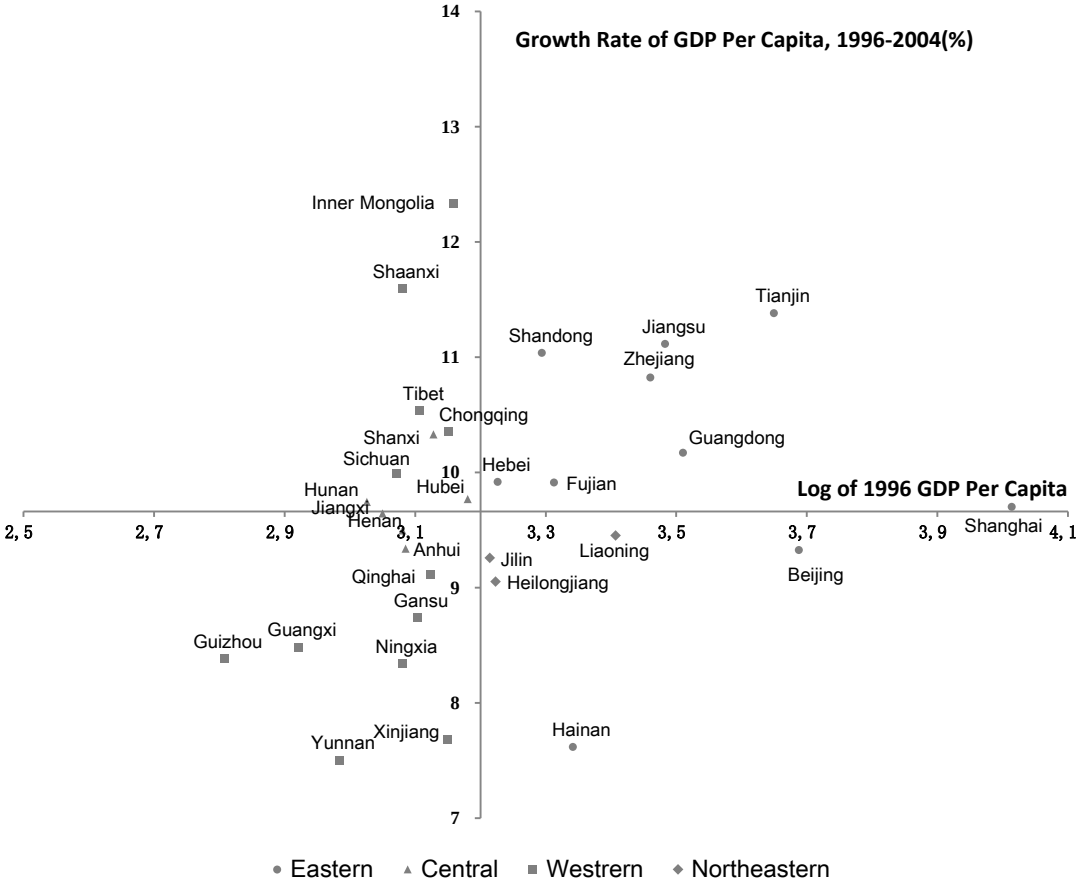


The third period is from 1996 to 2004. In this period, in order to prevent the widening trend of inter-provincial disparities, China's regional strategy had been switched from unbalanced regional strategy since reform and opening to a coordinated regional development strategy by the central government. In 1995, the government pointed out clearly that one of the important policies to be carried out in the next 15 years was adhering to a coordinated development of regional economy and gradually narrowing the gap of development of specific regions. The central government decided to implement the Western Development Strategy in 1999. As a result, the government drastically increased investment in the Western Region. The central government spent more than 360 billion Yuan for construction investment on the development of the Western Region from 2000 to 2003. In 2000, the government implemented "ten key projects" in the Western Region, including construction of traffic infrastructure, improvement of the ecological environment, exploitation of energy resources and so on. The revitalization of Northeastern old industrial bases and a Plan of Rise of Central China were successively implemented since the Western Development Strategy in the beginning of this century. The reform of the economic system of less developed regions had been accelerated, and the support of government to non-eastern regions had been increased. Narrowing the regional differences and promoting coordinated regional development became the fundamental principle for establishing regional policies. The overall regional development strategy of four blocks[2] had been formed. These measures of regional policies have greatly supported the rapid economic growth in the Western Region; as shown in Figure 9, a part of its provinces and autonomous regions are located in upper left part with higher growth rate of GDP per

[2] Refering to the four regions: Eastern, Central, Western and Northeastern.

capita. Although the Eastern Region's GDP per capita and growth rate were still at the upper level of the country, the rates of economic growth of some low-income Western provinces and autonomous regions such as Inner Mongolia, Shanxi, Shaanxi and Tibet, have been improved significantly; even some of them were higher than the average growth rate of the Eastern Region.

Figure 9. Growth Pattern of China's Regions, 1996-2004



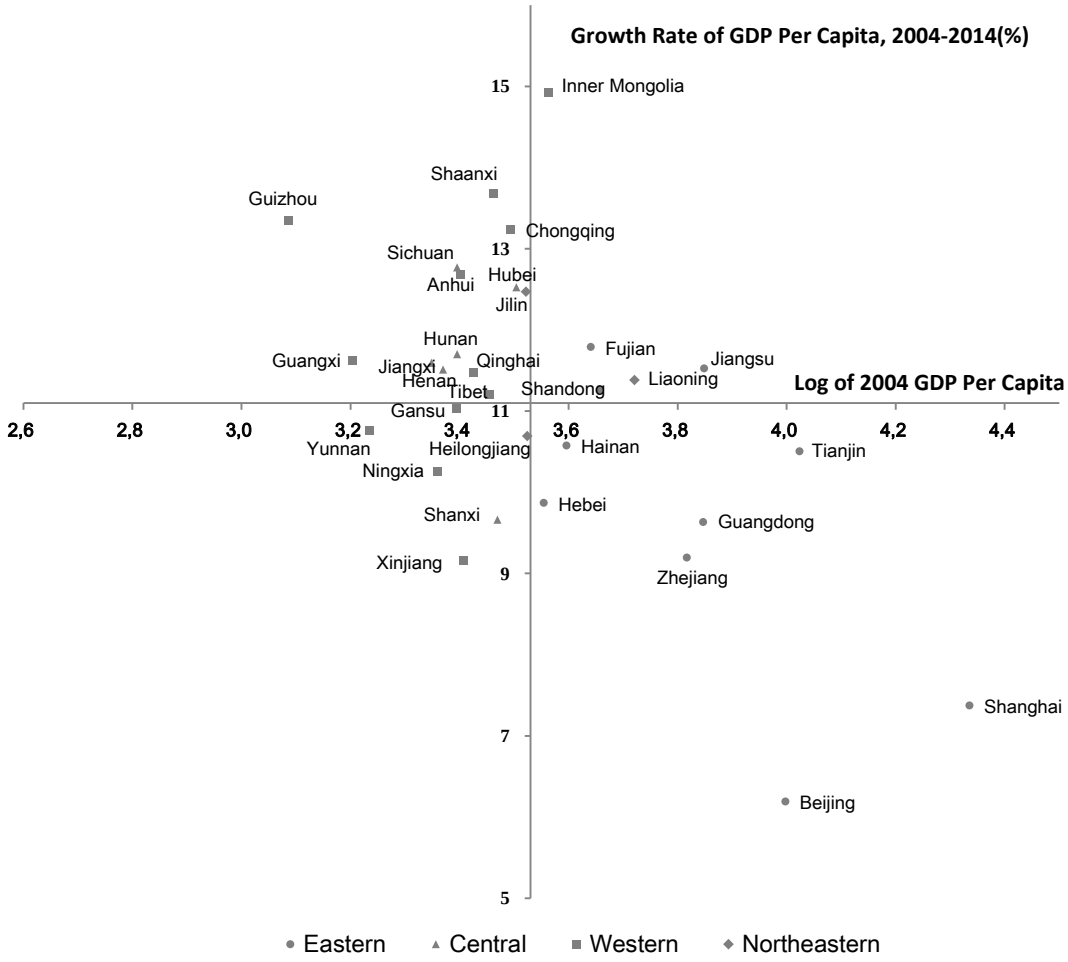
The fourth period is from 2004 to 2014. Some new features have emerged in the Chinese economy in this period; one is the accerelated development of heavy and chemical industries, the second is the rapid rise of cost of factors of production such as labor force, land and ecological environment, the third is a large decline of external demand caused by the international financial crisis. The development of the Chinese economy has focused more on pulling the domestic demand. The new pattern of regional economy formed in this period is caused by the superimposition of the implementation of the overall regional development strategy of four blocks with the new features of economic structure. Comparing the regional growth pattern from 2004 to 2014 with those of the former three periods, the number of provinces and autonomous regions (most of them were in Western and Central regions before) in lower left part (with lower income and lower growth rate) has decreased, and the number of non-eastern regions (such as Inner Mongolia, Liaoning) in upper right part (with higher income and higher growth rate) has increased (Figure 10). The growth rates of Inner Mongolia, Shaanxi and Guizhou which have abundant resources in the Western Region are in the top level. It indicates that the growth rate of non-eastern regions was higher in this period than those in the former three periods.

On the contrary, the Eastern Region experienced a slowing growth rate after 2004. With the rising cost of labor force and the decline of export demand caused by international financial crisis, the labor-intensive industries in Eastern areas which had high degree of external dependence entered into the bottlenecks of development that gradually shifted toward Central and Western areas. Also, more and more non-eastern regions can directly participate in the international production and labor division in the

background of constant deepening of the reform and opening-up. The proportion of Guangdong's exports in the national total amount decreased from 40% in 2000 to 30% in 2007. Figure 6 shows that the growth rates of GDP per capita of Central, Western and Northeastern region from 2004 to 2014 are higher than that of the Eastern Region.

The relatively rapid growth of less developed regions and the economic slowdown of the Eastern region caused a significant decrease of regional disparities in China during 2004 to 2014.

Figure 10. Growth Pattern of China's Regions 2004-2014



4.2 Changes in patterns of regional growth and inter-provincial income disparity

The above analysis shows that, since China began its reform and opening up, inter-provincial disparities have experienced a process of narrowing first and then expanding; and since 2004 the income disparity between the four regions has been narrowed. The disparities of economic growth rates among regions were affected by the changes in the domestic economic environment, the regional policies and other factors. In order to further our understanding of changes in regional disparities, we will conduct a quantitative analysis of determinants of regional economic growth. Combined with the foregoing analysis and researches of other scholars, we choose to examine the effects of factors including fixed asset investment rate, average education level, infrastructure level, urbanization rate and share of regional government expenditure in GDP on economic growth.

The basic estimation method of regional economic growth is a regression analysis based on growth

equation derived from a new classical growth model (Barro & Sala-I-Martin, 1995). The basic equation employed here is:

$$(\frac{1}{T})\cdot\ln(\frac{y_{i,t-1+T}}{y_{i,t-1}}) = \alpha - \ln(y_{i,t-1})\cdot[\frac{(1-e^{-\beta_1 T})}{T}] + \beta\cdot X + u_i + \varepsilon_{it}$$

where *T* stands for the length of time intervals. This paper selects the annual growth rate of per capita GDP as the dependent variable, so here *T*=1. We set a lag in the dependent variable after accounting for lagged effects of some institutional factors and labor capital on regional economic growth and on eliminating the effects of business cycle fluctuations. $y_{i,t}$ represents provincial per capita GDP in year *t* (calculated in terms of constant prices at 1978), *X* stands for factors influencing regional economic growth, β is a coefficient and u and ε are residual errors. We choose samples from 2004 to 2014, and the final regression equation is:

$$g_{i,t} = a + \beta_1\ln(y_{i,t-1}) + \beta_2 Inv_{i,t-1} + \beta_3 Gov_{i,t-1} + \beta_4 Urb_{i,t-1} + \beta_5 Edu_{i,t-1} + \beta_6 Inf_{i,t-1} + u_i + \varepsilon_{it}$$

where $g_{i,t}$ represents the average growth rate of per capita GDP of province *i* during the time interval beginning with year *t*, $Inv_{i,t}$ stands for fixed asset investment rate of province *i* in year t-1, $Gov_{i,t}$ is the share of regional government expenditure in GDP, $Urb_{i,t}$ is the urbanization rate, $Edu_{i,t}$ stands for average education level of province *i* represented by the share of people with education level of college or above in population above six years old, $Inf_{i,t}$ represents the development level of infrastructure of province *i* represented by the road density in year *t*-1.

Table 3. Regression results of China's regional economic growth（2004-2014）

	Coef.	Std. Err.	p>|t|
$\ln(y_0)$	-2.4708	0.1845	0.0000
Inv	3.5848	1.0503	0.0010
Gov	1.6569	1.8734	0.3770
Urb	10.4721	4.2398	0.0140
Edu	36.9341	7.3230	0.0000
Inf	1.9329	0.5922	0.0010
_cons	4.8085	1.4019	0.0010
sigma_u	2.2398		
sigma_e	1.9700		
Rho	0.5638		
Number of Obs	341		
R-Sq	within=0.376		

The results presented in Table 3 can shed light on the effects of the above factors on regional economic growth and thus have important policy implications for reducing regional disparities.

（1）In addition to $Gov_{i,t}$, other factors have a significant role in promoting regional economic growth. There exists significant conditional convergence among regions in China in the period 2004-2014. That is, after controlling other factors, the economic growth rate of more developed regions is slower, which is confirmed by the negative coefficient of $\ln(y_0)$. This result is consistent with the above conclusion regarding the dynamic pattern of regional economic growth.

（2）The improvement of education level can significantly promote regional economic growth. In modern economic growth, the role of human capital has been gradually increasing. The essence of human capital is to improve the quality of the population and to increase years of schooling.

In recent years, in order to solve the problem of unbalanced allocation of educational resources, the government has increased transfer payments to improve education of less developed regions especially

rural area, which has led to great success. The 6th national population census indicates that the Western region had benefited from the western development strategy and various preferential policies. In the Western region, the total population with college education and above was 2.7 times in 2010 compared with that of 2000, and the general college students attending school per 100,000 population was 4.18 times in 2010 compared with that of 2000. Improvement of human capital has an important role for promoting economic growth in less developed regions; moreover, it provides a powerful driving force to improve regional competitiveness and narrow regional disparities in future.

（3）Fixed assets investment rate is an important factor driving regional economic growth in China. The relatively high fixed assets investment rate with great variations in China can exercise an important influence on regional economic growth. Regional fixed assets investment rate in China is not completely endogenously determined. Local governments can affect investment decisions of enterprises to some extent and national policies can also influence the regional distribution of investment (including FDI). In addition, we also choose investment rate in the beginning year rather than current investment rate as the explanatory variable to overcome the problem of endogeneity.

（4）There is a significantly positive correlation between development level of infrastructure and regional economic growth. We employ the index of highway density to measure the development level of infrastructure and find that the coefficient is positive. The impact of infrastructure level on regional economic growth is relatively large. In recent years, China's transport infrastructure construction has developed in great effort, high-speed traffic network construction in order to improve the transport speed and optimization of network system to enhance the efficiency and function have been playing an important role in promoting the economic development of less developed areas such as western regions, and improving efficiency of territory development, and reducing regional disparity.

（5）Urbanization level exerts a significantly positive impact on regional economic growth. Since 2000, our country's urbanization has accelerated, and the inter-province migration and urbanization process of local population have been in continuous progress, which facilitated the decline of regional disparity in terms of development level and income.

5. CONCLUSIONS AND POLICY IMPLICATION

Regional income disparities in China have caught widespread attention recently; there are many studies to this theme with different perspectives. This paper is devoted to analyze comprehensively the regional income disparities of China with various measurement indexes. The findings of this paper show that regional income disparities in China have the following main features:

(1) Since China began its reform and opening up, inter-provincial disparities have experienced a process of narrowing first and then expanding, and since 2004 the trend of the income disparity between the regions has been narrowed. It can be divided into four periods as follows:

The first period is the early period of China’s reform from 1978 to1990. In this period, the Eastern Region became the pilot area of China's reform and opening up. The non-balanced development strategy promoted the development of coastal areas greatly, and the economic growth rate of the Eastern Region was in the leading national level. There had been a sharp decline of internal disparities within the Eastern Region, which has contributed to the decline of the overall regional disparities of China.

The second period is the first half of 1990s. The economic growth rate in the more developed Eastern Region was still higher than that of the national average, resulting in further expansion of disparities between the Eastern and other regions, and aggravating the regional inequality of the whole country.

The third period is from 1996 to 2004, China’s regional strategy had been switched from an unbalanced regional strategy since reform and opening to a coordinated regional development strategy by the

central government. This period features a higher economic growth rate of less developed regions than before, and the state of expansion of inter-province disparity was relaxed.

The fourth period is after 2004 in which the rapid economic development of non-eastern regions and the slowdown of economic growth of the Eastern Region have caused a trend of large reduction of China's overall regional disparity. The new pattern of regional economy formed in this period is caused by the superimposition of the implementation of the overall regional development strategy of four blocks with the new features of economic structure.

(2) Disparities among the four regions of China, especially disparities between the Eastern and other regions, are mainly caused by inter-provincial disparities. From 1978 to 2004, the disparity among four regions that accounted for inter-provincial disparities rose continuously to more than 50%. It has declined since 2004, but it is still a major part of the inter-provincial gap. The internal disparity of the Eastern Region also has an important impact on inter-provincial disparities, and the contribution rate of the Eastern Region to inter-provincial disparity has been maintained at about 29% since 1996. From 1978 to 1990, the sharp decline of internal disparities in the Eastern Region had made a great contribution to the overall decline of regional disparities of China. The Western Region has experienced rapid growth since implementation of the Western development strategy in 1999, while a significant trend of increasing internal disparities has been showing. The share of Western's internal disparities to overall disparity significantly increased from 6.3% in 2004 to 24.6% in 2014. This matter needs to attract the attention of the government to take corresponding measures.

(3) Urban-rural income disparities are the main source of regional disparities. The increase of disparity between urban and rural area is very significant from 1985 to 1995. Since 2006, urban-rural disparities have always represented a contribution of over 80% in regional disparities. The inter-rural income disparity in the level of household income was higher than inter-urban income disparity, and its share of total regional disparity kept over 30% from 1985-1990. Since 1985, the inter-rural income disparity has decreased greatly, while there was increase of regional income disparity to some extent among the urban areas. The narrowing of urban-rural income disparities and inter-rural income disparities played an important role on decreasing inter-provincial disparities in China.

(4) According to the results of the regression analysis, the government expenditure, the level of infrastructure, urbanization and education have significant impacts on promoting regional economic growth and improving regional disparities. In the future, the government should adopt appropriate policy measures, including directing investment to the less developed regions, improving the level of infrastructure, raising the quality of the population to enhance economic growth capacity, accelerating the pace of urbanization and improving people's living standard by urbanization, etc.

(5) As far as the future is concerned, there is still a lot of uncertainty about the trend of regional disparity. On the one hand, the development of regional economy faces many favorable conditions. For instance, the development of the regional economy faces the structural reform of the supply side put forward by the central covernment, which will effectively promote the transformation of regional economic structure, especially in the areas hardly stressed; the implementation of national development strategies, such as One Belt and One Road Initiative, Yangtze River Economic Belt, an the integrated development of Beijing-Tianjin-Hebei, will continue to create better conditions and provide a better policy support for regional development; the improvement of transport infrastructure and communication network facilities will promote economic development of important node cities and regions, and induce concentration of production factors, improve the efficiency of economic operation; and new regional planning and regional policy will boost the economic development in some areas. On the other hand, in contrast the new dynamic mechanism has been not clear, affected by the weakening global market, the slumping global energy prices, decline of domestic investment rate and increasing pollution control efforts. The mechanism in past driving rapid catching-up of less developed areas has being weaken. The mode of "high investment and high consumption of resources" had boosted the economic growth of regions endowed with abundant resources in the past period with rapid development of heavy and chemical industries. However, with the transformation of the global and domestic economy, regions have been heavily dependent on the resource and heavy chemical industry

such as Shanxi, Hebei and theNortheaster region which are confronting increasing pressure of economic structure transformation, and the future road transformation is still in a lot of uncertainty. In the Eastern Region, with the rising domestic labor costs and the decline of global demand, the economic development model which relies mainly on the export of labor-intensive industries is now also facing industrial restructuring and upgrading, and the challenges to rise from a positon og low-end to high-end in the global value chain. In summary, it is difficult to say that the future of China's regional disparity will keep a downward trend; reducing the regional development gap is still the important task of the future in the long term in China.

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