Analysis on the Regional Disparity in China and the Influential Factors

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Abstract

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. This paper is devoted to 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 main factors influencing regional economic growth and regional disparities.

Keywords: Income disparity, Regional economy, Regional policy, Theil index

1. Introduction

China is a large developing country with huge population and tremendous size of territory, the natural endowments, economic and social conditions of various regions differ greatly, therefore, regional imbalance becomes the 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.

Many literatures had studied the trend of change of inequality of 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 above studies recognized that this was mainly due to the per capita output of rural area in this initial stage was lower than the national average, and the rural reform in this stage had promoted greatly the growth of agricultural production, therefore, the underdeveloped rural region were benefited much more from the reform. There is emergence of trend of continuous regional disparity of China since 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 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 economic growth rate of Western region about 1.5 percentages in average every year since the year 2000, and it makes China's regional economy from divergence to convergence.

Researchers generally believe that geographic, institutional and some other factors have played important roles in changes of China's regional income disparities since China's reform and opening up. Wang and Fan (2004) discover that FDI, governmental transfer payment, 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.

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[1] Note: It refers the classification of China's region into Eastern, North-eastern, Central and Western region.

Peng and Liu (2010) show that the main reason for the rapid expansion of China's regional disparities between the Eastern, Central and Western is due to the implementation of the unbalanced regional development strategy since China's reform and opening up, and also due to the difference of 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.

2. Date and Methods

There are many indicators reflecting 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 of household income come from by household survey teams of National Bureau of Statistics.

Theil index are applied to research the trend and the stage of China's inter-provincial income disparity from the 1978 to 2014. Following Theil (1967), it is computed as follows:

$$Theil\_T = \sum_i \gamma_i \log \frac{\gamma_i}{p_i} \quad (1)$$

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, and gain the following formula (2):

$$Theil\_L = \sum_i p_i \log \frac{p_i}{\gamma_i} \quad (2)$$

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:

$$Theil\_L = \sum_{i=1}^{I} p_i \log \frac{p_i}{\gamma_i} + \sum_{i=1}^{I} p_i \sum_{j=1}^{n_i} p_{ij} \log \frac{p_{ij}}{\gamma_{ij}} = L_B + L_W \quad (3)$$

Where the meanings of pi 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 and Spatial decomposition of inter-provincial income disparity

Chinese central government divides 31 provinces into four regions in "Eleventh Five-Year Plan (2006-2010)", which are Eastern, Central, Western, and Northeastern regions (Figure 1).

Four-region division is much reasonable within 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.

In order to explore the spatial distribution of inter-provincial disparities in China, 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 Eastern Region (Figure 2).

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 of Eastern Region, and the contribution of internal disparity of Eastern Region has been decreased from 64.7% in 1978 to 40.7% in 1990 (Table 1).

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

After entering the 21st century, the expanding rate of regional disparities had been slowed down. The share of disparities among four regions accounted for inter-provincial was decreased from 57% in 1996 to 54.4% in 2004. Since 2004, the share of disparities among four regions to overall disparity sharply decreased from 54.4% in 2004 to 37.4% in 2014. The disparities of GDP per capita between Eastern Region and non-eastern regions gradually reduced. The ratios of GDP per capita in Central and Western Regions to 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 of Western Region. The share of Western'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, GDP per capita of Inner Mongolia was 71046 yuan in 2014, which was one of top ten of the country, while GDP per capita of Tibet, Gansu, Yunnan and Guizhou were less than 30000 yuan which was at the lower side.

4. The factor analysis of inter-provincial income disparity

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

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

According to the four period of the change of regional income disparity based on the calculation results of Theil index above, this section will analyze the changes of China's economic growth pattern from 1978 to 2014 and its impact on inter-provincial income disparity. In Figure 3, it can be seen that the growth rates of GDP per capita of China's four Regions are significantly different at each period.

The first period is 1978 to 1990. Fig.4 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 late 1970s in 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 Yangtze River Delta, the Pearl River Delta, Liaodong Peninsula etc. A coastal open area extending from the south to the north of China along the coast line was formed, which shared a serious of special preferential policies in finance, taxation, investment and so on. 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 Eastern Region was in the national leading level. From 1978 to 1990, the Eastern Region's capital construction investment accounted for 53.5% of the whole nation.

In this case, the average growth rate of economic development in the Eastern Region was higher than in other regions, especially for the coastal provinces such as Guangdong, Zhejiang, Jiangsu, Fujian etc., economic growth rate of those provinces was in top 5 in China (Figure 4). 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 which was up to 2498 Yuan, in contrast to Fujian province which had the lowest GDP per capita in this region——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 provinces and autonomous regions is located in the left- lower part (with lower income and lower growth rate) of Figure 4.

The second period is the first half of 1990s. China's reform and opening up had significant effect on propelling economic growth of the Eastern Region that has higher GDP per capita and growth rate than other regions. The growth rate in Eastern Region was 3-5 percentage point higher than other regions that is shown is Figure 5. Figure 8 shows the growth pattern of China's region in the period of 1990-1996. It can be seen in Figure 5 that the trend of Eastern provinces concentrating in right-upper part (with higher income and higher growth rate) compared with Figure 4. This indicated that the level of economic development as whole in the Eastern Region had been improved and its internal disparities was significantly reduced compared with the first stage .While many provinces and autonomous regions of Western and Central Regions are located in left-lower part (with lower income and lower growth rate). This resulted the widening regional disparities in China.

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 coordinated regional development strategy by the Central government. In 1995, the government pointed out clearly that one of the important policies must be carried out in the next 15 years was adhering to coordinate development of regional economy and gradually narrowing the gap of development of regions. The Central government decided to implement the Western Development Strategy in 1999. Revitalization of Northeastern old industrial bases and Plan of Rise of Central China were successively implemented since 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. To narrow the regional difference and promote the regional coordinated development became the fundamental principle of establishing regional policies. The overall regional development strategy of four regions had been formed. These measures of regional policies had greatly supported rapid economic growth in Western Region, which can be shown in Figure 6, a part of provinces and autonomous regions are located in left-upper part of this figure with higher growth rate of GDP per capita. Although Eastern Region's GDP per capita and growth rate was 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 had been improved significantly, even some of them were higher than the average growth rate of Eastern Region.

The fourth period is from 2004 to 2014. Some new features are emerged in the Chinese economy in this period, one is accelerated 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 large decline of external demand caused by international financial crisis, the development of Chinese economy has focused more on the pull of domestic demand. The new pattern of regional economy formed in this period is caused by the superimposition of the implementation of overall regional development strategy of four blocks with the new features of economic structure. Comparison of the regional growth pattern from 2004 to 2014 with those of former 3 periods, the number of provinces and autonomous regions (most of them were in Western and Central Regions before) in left-lower part (with lower income and lower growth rate) was decreased, and the number of non-Eastern regions (such as Inner Mongolia, Liaoning) in right-upper part (with higher income and higher growth rate) was increased (Figure 7). The growth rates of Inner Mongolia, Shaanxi and Guizhou which had abundant resources of Western Region in the top level. That indicates the growth rate of non-Eastern Regions was higher in this period than those in former 3 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 and 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 3 shows that the growth rates of GDP per capita of Central, Western and Northeastern region from 2004 to 2014 are higher than that of Eastern Region.

With the relatively rapid growth of less developed regions and economic slowdown of Eastern region caused significant decreasing of regional disparities in China during 2004 to 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 regions has been narrowed. The disparities of economic growth rates among regions were affected by the changes of domestic economic environment, the region 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 regression analysis based on growth equation derived from new classical growth model (Barro & Sala-I-Martin, 1995). The basic equation employed here is:

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

$$(4)$$

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 eliminating 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 coefficient and u and ε are residual errors. We choose samples from 2004 to 2014, and the final regression equation is:

$$g_{i,t} = a + \beta_1 \ln(y_{i,t-1}) + \beta_2 Inv_{i,t-1} + \beta_3 Gov_{i,t-1} + \beta_4 Urb_{i,t-1} + \beta_5 Edu_{i,t-1} + \beta_6 Inf_{i,t-1} + u_i + \varepsilon_{it} \ (5)$$

where $g_{i,t}$ represents 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 development level of infrastructure of province i represented by road density in year t-1.

The results presented in Table 2 can shed light on the effects of 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, economic growth rate of more developed regions is slower, which is confirmed by the negative coefficient of $\ln(y_0)$. This result is consisted 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 had been gradually increasing. The essence of human capital is to improve the quality of the population and 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 had led to great success. The 6th census indicates that western region had been benefited from the western development strategy and various preferential policies In Western region, the total population have college education and above was 2.7 times in 2010 compared with that in 2000, the general college students in the school Per 100,000 population was 4.18 times in 2010 compared with that in 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 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 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 had 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 inter-province migration and urbanization process of local population has been in continuous progress, which facilitated the decline of regional disparity in terms of development level and income.

5. Conclusions and policy implication

(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.

(2) Disparities among the four regions of China, especially disparities between Eastern region and other regions, are mainly causes for inter-provincial disparities. From 1978 to 2004, disparity among four regions 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 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 Eastern Region had made a great contribution to the decline of overall regional disparities of China. The Western region had experienced rapid growth since implement of Western development strategy in 1999, while a significant trend of increasing internal disparities had 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 and take the corresponding measures.

(3) 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.

(4) 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 regional economy faces the structural reform of the supply side put forward by the Central Government, which will effectively promote the transformation of regional economic structure, especially in the areas had hardly stressed; implementation of national development strategy such as One Belt and One Road Initiative, Yangtze River Economic Belt, 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; new regional planning and regional policy will boost the economic development in some areas. On the other hand, 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 is has being weaken, in contrast, the new dynamic mechanism has been not clear. The mode of "high investment & high consumption of resources" had boosted the economic growth of regions endowed abundant resources in the past period with rapid development of heavy and chemical industries. However, with the transformation of the global and domestic economy, the regions had been heavily dependent on resource and heavy chemical industry such as Shanxi, Hebei and Northeaster region are confronting increasing pressure of economic structure transformation, the future transformation road is still in a lot of uncertainty. In Eastern region, with the rising domestic labor costs and decline of global demand, the economic development mode mainly relied on the export of labor-intensive industries is now also facing industrial restructuring and upgrading, and the challenges to rise positon from low-end to high-end in 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 in the future for a long term in China.

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Table1 The share of disparities intra-region and inter-region 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%

Table 2　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		

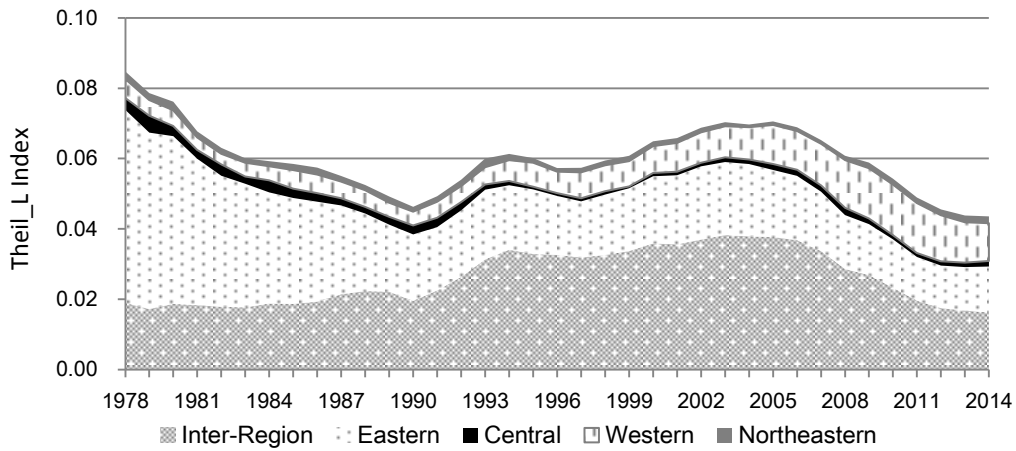**Figure1 Four Regions (Western, North-Eastern, Central, Eastern) of China**

Figure2 Decomposition of inter-provincial disparity with four regions based on nominal GDP per capita at current price
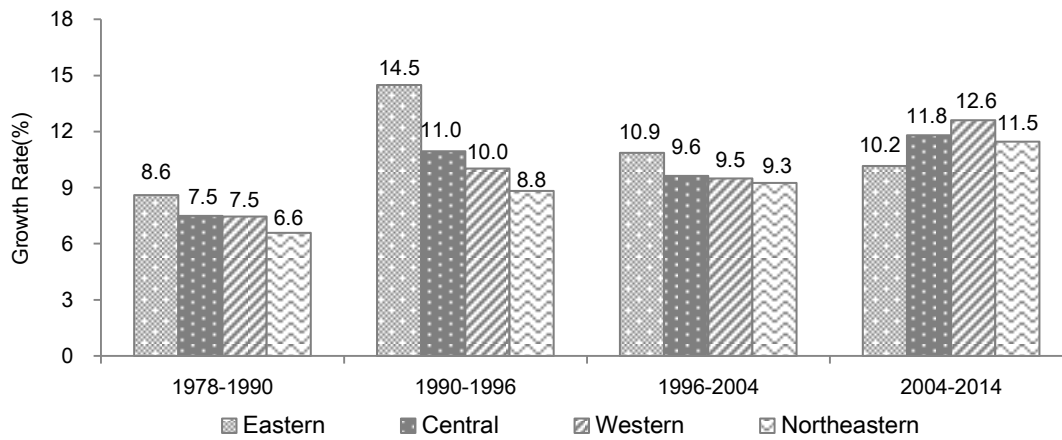

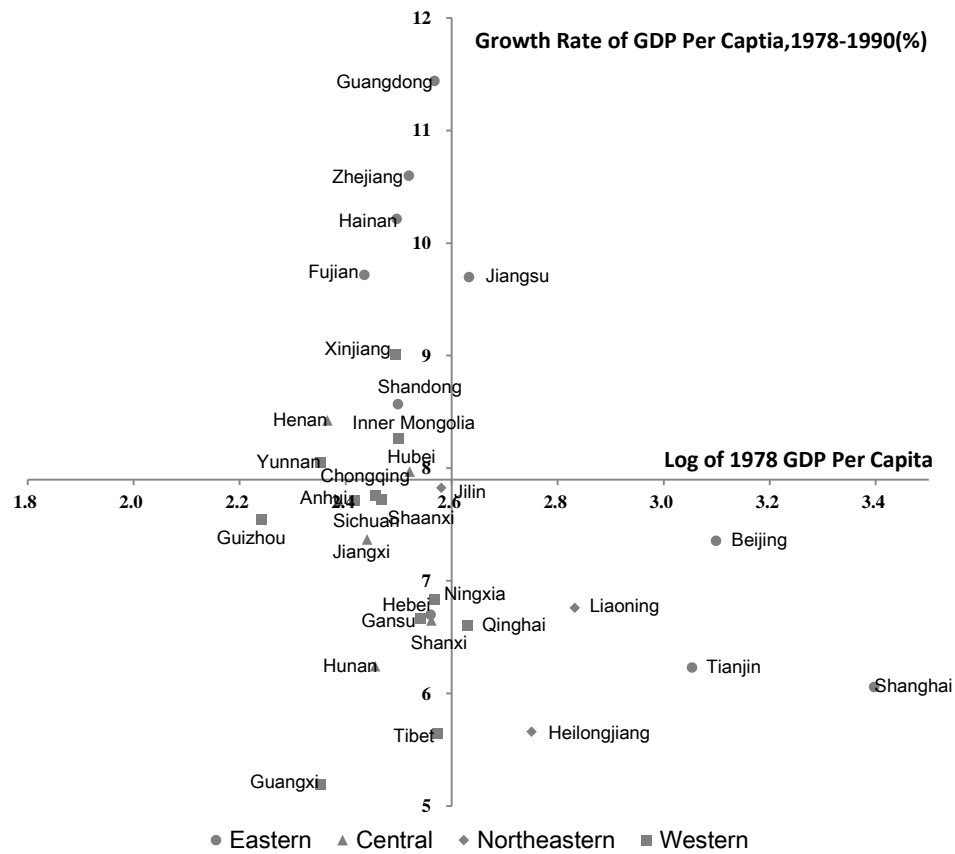**Figure3 Growth rate of GDP per capita of China's four regions 1978-2014**

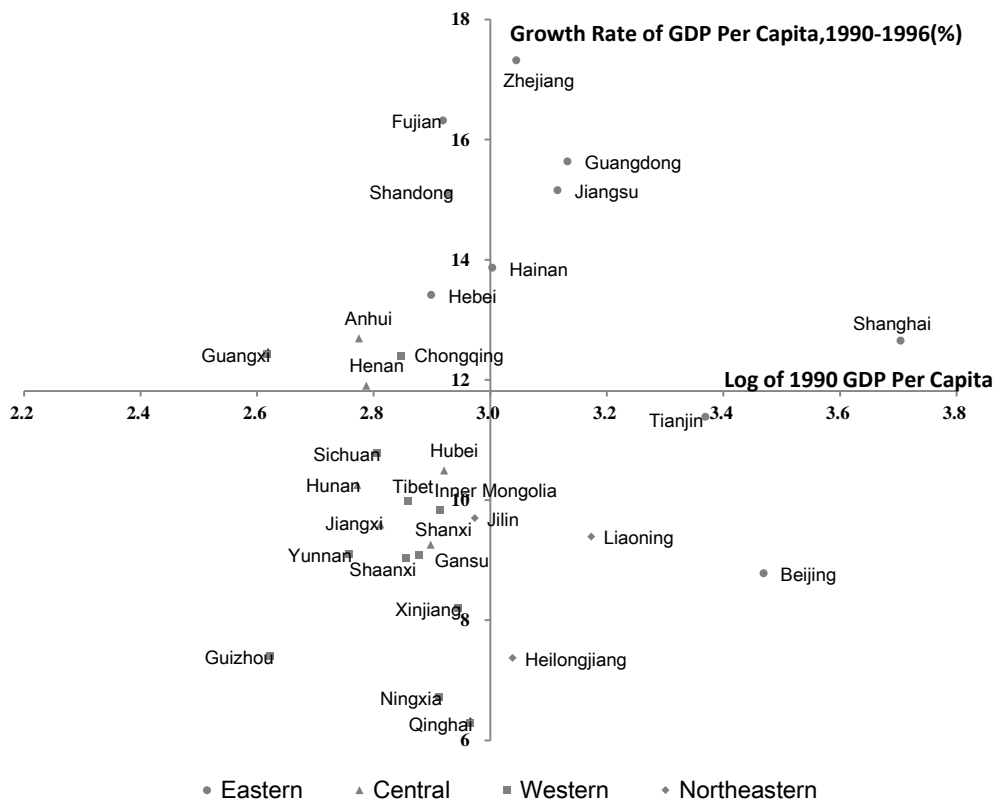**Figure 4 Growth Pattern of China's Regions 1978-1990**

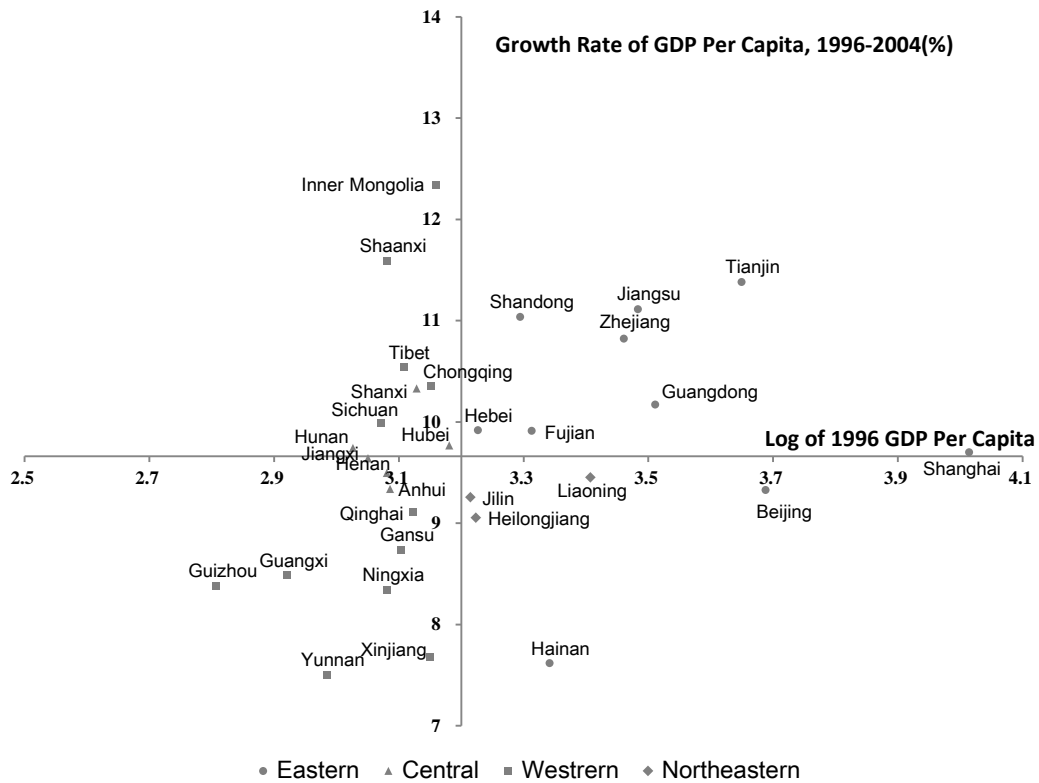**Figure 5 Growth Pattern of China's Regions 1990-1996**
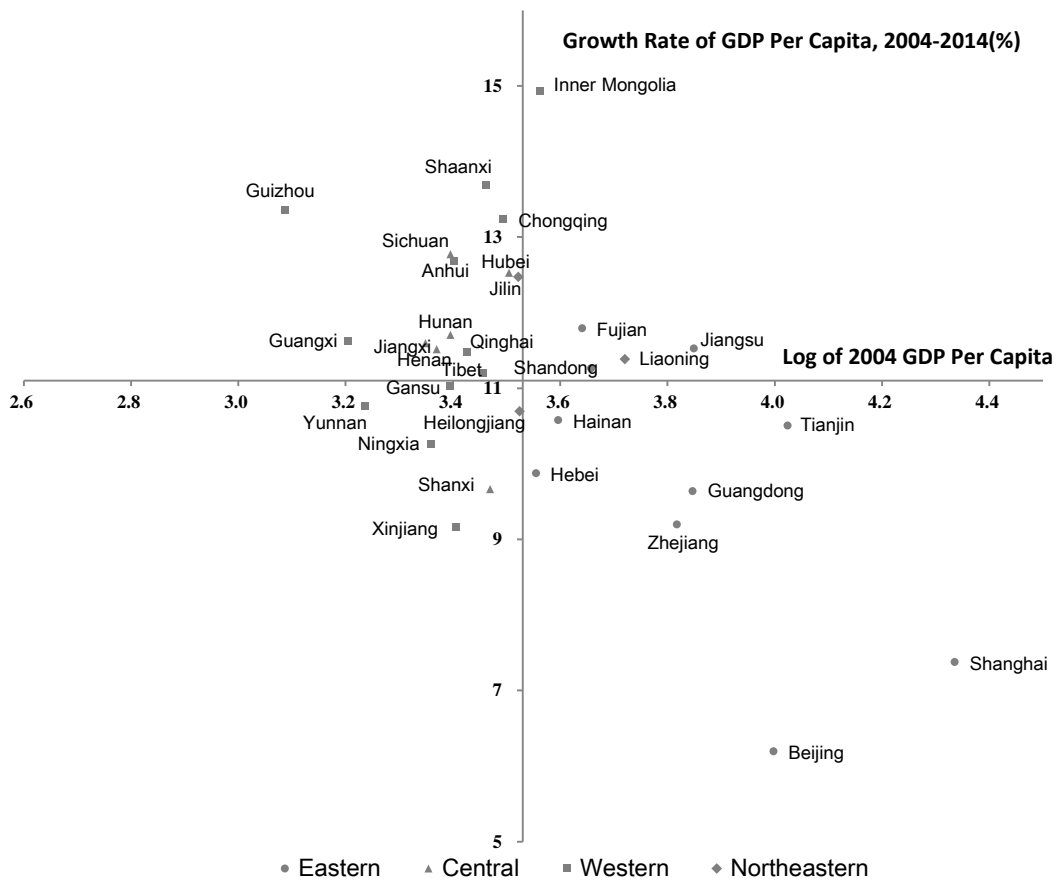
Figure 6 Growth Pattern of China's Regions 1996-2004

Figure 7 Growth Pattern of China's Regions 2004-2014