

**Income Disparity among Chinese Cities:  
Evidence, Decomposition, and Future Prospects**

*Hiroshi Sakamoto, ICSEAD*

*and*

*Binjian YAN, College of Economics and Management,  
Nanjing Agricultural University*

Working Paper Series Vol. 2012-09  
October 2012

The views expressed in this publication are those of the author(s) and do not necessarily reflect those of the Institute.

No part of this article may be used reproduced in any manner whatsoever without written permission except in the case of brief quotations embodied in articles and reviews. For information, please write to the Centre.

**Income Disparity among Chinese Cities:  
Evidence, Decomposition, and Future Prospects**

Dr. Hiroshi SAKAMOTO<sup>♦</sup>

(Corresponding Author)

Research Associate Professor

The International Centre for the Study of East Asian Development (ICSEAD)

11-4 Otemachi, Kokurakita, Kitakyushu 803-0814, Japan

Tel: +81 93 583 6202; Fax: +81 93 583 4602

E-mail address: sakamoto@icsead.or.jp

and

Dr. Binjian YAN

Assistant Professor

College of Economics and Management, Nanjing Agricultural University

Weigang 1, Nanjing, Jiangsu Province, China

Tel: +86 139 1394 1624

E-mail address: byron251@163.com

October 2012

---

<sup>♦</sup> The author thanks participants attending the Western Regional Science Association 51st Annual Meeting (February 2012), especially Professor Koichi Mera, and the seminar at Nanjing Xiaozhuang University and Nanjing University of Science and Technology (March 2012) for their useful comments. The author is responsible for all remaining errors.

# **Income Disparity among Chinese Cities: Evidence, Decomposition, and Future Prospects**

## **Abstract**

Although income disparity in China is a longstanding and frequently studied problem, scholars only recently have begun to examine income disparity among China's smaller geographic regions, notably cities or prefectures. This study extends scholarly thread using data from the *China City Statistical Yearbook*. Income disparity among cities is analyzed using a statistical indicator, followed by a decomposition analysis that divides Chinese cities into eastern and western regions. Then a simulation analysis of the change in income disparity created by city growth is conducted using a simple urban growth model. Data show that during the period 1994–2008 urban income disparity expanded, as did provincial income disparity. Growing income disparity between eastern and western Chinese cities is an important factor in the expansion of disparity. Our simulation shows that income disparity is reduced by enhancing the mobility of labor and capital.

JEL classification: C61, O18, O41, O53, R11, R23

Keywords: Income disparity, City level, China

## 1. Introduction

China has sustained high economic growth since initiating reforms in the late 1970s, and urbanization advanced quickly alongside economic development. According to the *Urban Blue Book: China City Development Report No.3*,<sup>1</sup> China's urban population reached 620 million people in 2009, three times greater than the U.S. population and 25% larger than the combined population of the 27 nations in the European Union. In 2009, China's urbanization rate reached 46.6%, leading the world's scale of urbanization. China's urbanization is expected to advance, and its urban population is projected to exceed its rural population in the near future. Although urbanization is generally regarded as desirable, social problems accompany it and income disparity, both within and among cities, exists. This paper addresses income disparity among cities.

China's regional income disparity is a longstanding and frequently studied problem.<sup>2</sup> Studies mainly use provincial output data such as per capita gross domestic product or gross regional product (GRP), and they observe that inter-province disparities in China decreased after 1979. In a 1986 study of urban households, Knight and Song (1991) show that China's urban wage structure is extremely compressed. In contrast, provincial disparities have grown, with the coastal and inland regions showing rising disparities since the mid- or late 1980s. However, studies of income disparity among smaller geographic divisions, such as cities or prefectures, are comparatively recent primarily because available data are not substantial. Among the few studies, Xu and Li (2004) examined income disparity among cities and Sakamoto and Fan (2010) among prefectures.<sup>3</sup> Unfortunately, Xu and Li (2004) examined the period 1989–1999, and their findings are no longer valid. Analysis using the latest statistical data is required, and it is possible to find richer evidence by analyzing smaller geographic divisions than by analyzing provincial data, overcoming at least some problems of data constraints.

This study analyzes income disparity among cities using a statistical indicator. We then conduct a simulation analysis of the change in disparity by city growth using a simple urban growth model. Xu and Li (2004) showed decreasing declining trend in income disparity among cities using  $\beta$  and  $\sigma$  convergence methodologies. If we assume that cities perform similar functions irrespective of their size, income disparity among cities may be reduced. However, researchers generally consider that urban income disparity parallels a well-documented income disparity among China's provinces. If they are correct, urban

---

<sup>1</sup> This is written by the Institute for Urban and Environmental Studies Chinese Academy of Social Sciences and Social Sciences Academic Press (China).

<sup>2</sup> For instance, Tsui, 1991; Chen and Fleisher, 1996; Jian et al., 1996; Raiser, 1998; Khan et al., 1999; Fujita and Hu, 2001; Cai et al., 2002; Bhalla et al., 2003; Meng, 2004; Kanbur and Zhang, 2005; Demurger et al., 2006; Tsui, 2007; Sakamoto and Islam, 2008; Ramstetter et al., 2009; Fleisher et al., 2010; and Lau, 2010.

<sup>3</sup> However, Sakamoto and Fan (2010) focus only on counties of the Yangtze River Delta.

income disparity may also be expanding.<sup>4</sup>

## 2. Evidence of City Disparity

China's administrative boundaries are complicated. Three types of areas are referred to as a "city" (*shi*). *Designated cities*—for example, Beijing, Tianjin, Shanghai, and Chongqing—are treated same as provincial (government) level. *Area-level cities* include prefectures and prefecture-level cities. The final category, *xian ji shi*, includes cities that receive the same treatment as prefectures. This study analyzes designated cities and area-level cities.<sup>5</sup>

First, we discuss income disparity among Chinese cities drawing data from the *China City Statistical Yearbook*<sup>6</sup> for the period 1994–2008. Although the examined period may seem brief, Chinese cities changed substantially during that time. Areas previously not treated as cities became treated as such when they met the criteria for population or industrial structure.<sup>7</sup> Therefore, although the number of Chinese cities is rising, the number included in this study suffers from sample exclusion arising from the defect of data (Table 1).

Table 2 compares aggregated data from the *China City Statistical Yearbook* and data from the *China Statistical Yearbook*. Although Table 1 shows that the number of cities is increasing, population data reflect approximately 80%–90% of China's population throughout the period. This is because the rural population is contained in areas currently called *Cities*. On the other hand, GRP will exceed the figure reported in the *China Statistical Yearbook*, and most probably each city's GRP has been over estimated. When economic growth is an important evaluation matter for (the government officers of) the province or the city government, GRP is released superfluously in many cases. However, since this is appropriately adjusted with a state level, the way of the number of the *China Statistical Yearbook* becomes small. Even if examinations of Chinese income disparity use city data drawn from comparisons of these two sources, the entire country generally can be analyzed.

This study adopts two statistical methods to interpret evidence of urban income disparity in China. One is the popular Theil index of disparity (Theil, 1967).

---

<sup>4</sup> China's urban income disparities are also discussed outside China. Gluhik and Portnov (2004) proposed coordinate transformations to visualize the pattern of inter-urban income disparities and their dynamics in Israel during 1991 and 1999.

<sup>5</sup> In statistical analysis, a prefecture-level city is always treated using prefectural-level data.

<sup>6</sup> These data are compiled by Nippon Statistics Center (<http://www.nihon-toukei.co.jp/>).

<sup>7</sup> To qualify as a city in 1993, a municipal district had to contain a non-farm population of 250,000 or more and a GRP of 2,500 million Yuan or more. Its material production (agriculture and industry) had to be 2,500 million Yuan or more, of which industrial production should not be less than 80% and the share of tertiary industry should at least 35%. Its fiscal revenue had to be 200 million Yuan or more. A municipal-government prefecture contained a non-farm population of 200,000 or more. (Notice from the State Affairs Administration of China on May 17, 1993, [http://www.siping.gov.cn/spqy/falu/htm/daohang/xzf/mz/mz\\_data/18.txt](http://www.siping.gov.cn/spqy/falu/htm/daohang/xzf/mz/mz_data/18.txt)).

$$T_t = \sum_i \left( \frac{Y_{t,i}}{\sum_j Y_{t,j}} \right) \log \left( \frac{Y_{t,i} / \sum_j Y_{t,j}}{N_{t,i} / \sum_j N_{t,j}} \right) \quad (1)$$

where  $Y_{t,i}$  is the GRP of city  $i$  at time  $t$  and  $N_{t,i}$  is the population of city  $i$  at time  $t$ .<sup>8</sup>

The Theil index can decompose samples and investigate the factor analysis of regional disparities. For example, China can be divided into the eastern region that is economically developed and the western region that lags economically, enabling an east–west disparity to be analyzed.<sup>9</sup> In this case, we redefine the index to adopt two stages from Eq. (1).<sup>10</sup>

$$T_t = \sum_k \sum_i \left( \frac{Y_{t,k,i}}{\sum_r \sum_j Y_{t,r,j}} \right) \log \left( \frac{Y_{t,k,i} / \sum_r \sum_j Y_{t,r,j}}{N_{t,k,i} / \sum_r \sum_j N_{t,r,j}} \right) \quad (2)$$

where  $k$  is region (east or west). Then the Theil index of each region is defined as

$$T_{t,k} = \sum_i \left( \frac{Y_{t,k,i}}{\sum_j Y_{t,k,j}} \right) \log \left( \frac{Y_{t,k,i} / \sum_j Y_{t,k,j}}{N_{t,k,i} / \sum_j N_{t,k,j}} \right) \quad (3)$$

In that case, the Theil index is decomposed as

$$T_t = \sum_k \left( \frac{\sum_j Y_{t,k,j}}{\sum_r \sum_j Y_{t,r,j}} \right) T_{t,k} + \sum_k \left( \frac{\sum_j Y_{t,k,j}}{\sum_r \sum_j Y_{t,r,j}} \right) \log \left( \frac{\sum_j Y_{t,k,j} / \sum_r \sum_j Y_{t,r,j}}{\sum_j N_{t,k,j} / \sum_r \sum_j N_{t,r,j}} \right) \quad (4)$$

The right-hand side of Eq. (4) indicates the Theil index between the two regions.

$$T_{t,inter} = \sum_k \left( \frac{\sum_j Y_{t,k,j}}{\sum_r \sum_j Y_{t,r,j}} \right) \log \left( \frac{\sum_j Y_{t,k,j} / \sum_r \sum_j Y_{t,r,j}}{\sum_j N_{t,k,j} / \sum_r \sum_j N_{t,r,j}} \right) \quad (5)$$

Therefore, overall disparity can be decomposed into intra-city disparities for each region and inter-regional disparities between the two regions:

<sup>8</sup> Since no reliable data for real growth rates exist, nominal GRP data are used.

<sup>9</sup> In our definition of the two regions, eastern cities belong to the following provinces (cities): Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. Western cities belong to China's other provinces (cities).

<sup>10</sup> Akita and Alisjahbana (2002) and Akita (2003) are representative of studies that use two-stage nested Theil decomposition to analyze regional disparity.

$$T_t = T_{t,east} + T_{t,west} + T_{t,inter} \quad (6)$$

Next, we investigate the change in disparity by approximating the density function. The Theil index provides only summarized information about the distribution of disparities. Density function estimation is more effective in examining the details of the distribution change (Quah, 1996, 1997; Sakamoto and Islam, 2008; Sakamoto and Fan, 2010).<sup>11</sup>

The procedure for approximating the distribution density is as follows. Let  $Y_{t,i}/N_{t,i}$  denote the per capita GRP of city  $i$  at time  $t$ . The denominator of the second equation is the cross-section average of  $Y_{t,i}/N_{t,i}$ . We first want to abstract from the shift in the mean of the distribution, as reflected in the secular movement. We therefore normalize data for different years by their respective cross-section means and take the log as the variable for analysis. We denote this variable as  $Z_{t,i}$  so that

$$Z_{t,i} = \log\left(\frac{Y_{t,i}/N_{t,i}}{\sum_j Y_{t,j}/\sum_j N_{t,j}}\right) = \log\left(\frac{Y_{t,i}/\sum_j Y_{t,j}}{N_{t,i}/\sum_j N_{t,j}}\right) \quad (7)$$

We begin by approximating the actual distribution of  $Z_{t,i}$  for the selected years using the Gaussian normal kernel (Silverman, 1986). The density function used for the approximation is

$$\tilde{f}(Z_t) = \frac{1}{h} \sum_i \frac{N_{t,i}/\sum_j N_{t,j}}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}\left(\frac{Z_t - Z_{t,i}}{h}\right)^2\right) \quad (8)$$

where  $Z_{t,i}$  is an observed value of the variable for city  $i$  at time  $t$ , and  $h$  is the window width (assumed to be 0.20 in this study<sup>12</sup>). The range of  $Z$  is assumed to be between  $-2.60$  and  $2.60$ . This function can also decompose samples into an eastern region and a western region, and can draw a density function.

Figure 1 measures the Theil index in a period. Contribution to the disparity index is shown in Table 3. Except for some periods, the index rises. That is, income disparity tends to expand contrary to the findings of Xu and Li (2004). The earlier studies cited here mention this same rising tendency in provincial income disparity. When the contribution of disparity is seen, the disparity among eastern region cities is conspicuous during the measured period beginning in 1994, though the disparity

<sup>11</sup> Other applications of this approach are given by Hao and Zou (2008), He and Zhang (2007), and Xu and Wang (2008).

<sup>12</sup> Per Silverman's rule (Silverman, 1986), Gaussian kernel density is of the window width  $h_n = 0.9 \cdot Std \cdot Num^{-1/5}$ .  $Std$  is the standard deviation, and  $Num$  is the sample size.

seldom spread thereafter. Therefore, the increased disparity between cities in the eastern and western regions is attributable to the rising disparity among cities in the west. However, note that the number of samples in a measurement year differ in Table 1. Perhaps the income disparity among cities expanded because incomes in areas newly designated as cities was comparatively low. Particularly, the number of cities in the west rose from 126 to 200 (Table 1), and it is believed that income in these cities increased less than the previously defined city. To judge whether this supposition is correct, analysis by kernel density function is needed.

Figures 2–5 measure the income distribution in specific years using a kernel density function. Beginning from 1994, income distribution widens—i.e., income disparity expands. In high-income cities, which shows around 1.5 in the log of relative income ( $Z$  in Eq. (7)), the density rises comparatively less. In low-income cities, density rises in the comparatively wide range of  $-0.8$  to  $-1.8$ . Differences between the regions are due to the findings that eastern cities are comparatively wealthy, whereas western cities are comparatively poor. Moreover, the tendency is conspicuous. There is the possibility of a bimodal distribution in provincial income disparity observed by Sakamoto and Islam (2008) for eastern cities and by Zhou and Zou (2008) for prefecture-level cities in China.

### 3. Simple Simulation for Decreasing Disparity

The previous section made it clear that income disparity among cities in China's urban areas expanded. Although it is important for China's economic development that the country urbanizes, expanding income disparity among developed cities is a big problem, and a policy to reduce disparity is required. We conclude that it is important to improve mobility of production factors among cities. Our conclusion is confirmed by economic theory (Barro and Sala-i-Martin, 2004) and mirrored by earlier policy suggestions (Chen et al., 2010). This section uses a simple economic model to analyze how improving the mobility of labor and capital reduces income disparity in the simulation.

First, to model a city's income, we adopt a simple economic growth model with a Cobb–Douglas production function as follows:

$$Y_{t,i} = \gamma_{t,i} \cdot L_{t,i}^{\alpha_i} \cdot K_{t,i}^{(1-\alpha_i)} \quad (9)$$

where  $L$  and  $K$  are labor and capital, respectively,  $\alpha$  is a share parameter, and  $\gamma$  is a parameter for total factor productivity. According to profit maximization (or cost minimization) problem, first-order conditions of  $L$  and  $K$  are denoted as follows:

$$PK_{t,i} \cdot K_{t,i} = (1 - \alpha_i) \cdot PY_{t,i} \cdot Y_{t,i} \quad (10)$$



$$PL_{t,i} \cdot L_{t,i} = \alpha_i \cdot PY_{t,i} \cdot Y_{t,i} \quad (11)$$

where  $PL$  and  $PK$  are prices of labor and capital, respectively. We assume the price of  $Y$  ( $PY$ ) as a numeraire.

$$PY_{t,i} = 1 \quad (12)$$

Labor and capital are growing dynamically. Their dynamic equations are specified as

$$L_{t+1,i} = L_{t,i} \cdot (1 + NR) + ML_{t,i} \quad (13)$$

$$K_{t+1,i} = (1 - \delta) \cdot K_{t,i} + ir \cdot Y_{t,i} + MK_{t,i} \quad (14)$$

where  $NR$  is the exogenous labor growth rate,  $\delta$  is the exogenous depreciation rate, and  $ir$  is the exogenous investment rate. We assume these rates are 0.01, 0.05, and 0.40, respectively.<sup>13</sup>

$ML$  and  $MK$ —the highlights of this model—are the total of inter-city movement of labor and capital, respectively. Fukuchi's (2000) gravity model is adopted using each price difference between two cities.

$$ML_{t,i} = \sum_j \left[ \varepsilon_{i,j} \cdot \frac{L_{t,i} \cdot L_{t,j}}{\sum_j L_{t,j}} \cdot \log \left( \frac{PL_{t,i}}{PL_{t,j}} \right) \right] \quad (15)$$

$$MK_{t,i} = \sum_j \left[ \varepsilon_{i,j} \cdot \frac{K_{t,i} \cdot K_{t,j}}{\sum_j K_{t,j}} \cdot \log \left( \frac{PK_{t,i}}{PK_{t,j}} \right) \right] \quad (16)$$

If the price of labor (capital) in one city is higher than in another, labor (capital) relocates to the former city and exits the latter. The labor (capital) market reorganizes on the basis of this movement.  $\varepsilon$  is set up as a reorganization speed and the simulation by difference of this speed is considered.

Parameters of the production function ( $\alpha$  and  $\gamma$ ) are calibrated from the dataset.<sup>14</sup> However, the productivity parameter grows at the same rate.

---

<sup>13</sup> Although it is possible to change these various values, there is no essential difference in the result.

<sup>14</sup> The calibration process for a standard computable general equilibrium model is adopted.

$$\gamma_{t+1,i} = \gamma_{t,i} \cdot 1.01 \quad (17)$$

Data were estimated and the model was constructed as follows. First, data for population and GRP are taken from the previous section. We use the total population as the size of the labor force. Capital stock used provisionally what was divided by 0.1 (0.05 is the average investment rate and 0.05 is the depreciation rate) from the record of investment in fixed assets.<sup>15</sup> Labor's share of GRP is calculated from the share of employee compensation in GRP decomposed by value-added components for each province from the *China Statistical Yearbook*, (2008, p.53).<sup>16</sup> The resulting figure then was applied to each city in the applicable province. Distribution of capital applied what subtracted labor share from 1 to GRP of each city. Since GRP was divided into the labor portion and the capital portion, what divided the labor portion by the number of population serves as a labor price, and what divided the capital portion by capital stock serves as a capital price.

Figure 6 shows how the Theil index changed on the basis of the simulation results. The simulation is making  $\varepsilon$  in the movement function of labor and capital shown in Eq. (15) and (16), respectively, gradually increase simultaneously (from 0.00 to 0.05 by 0.01). The figure shows the dynamics of the simulation after 10 iterations. First, when no movement is evident ( $\varepsilon = 0.00$ ), we conclude that income disparity among cities expands by city growth; that is, by a difference in prices of labor or capital between cities. On the other hand, it is found that expansion of disparity eases by raising  $\varepsilon$ . Moreover, on a case-by-case basis, it can be made to reduce slightly from the disparity at the time of the base year in 2007.<sup>17</sup>

Next, Figures 7 and 8 show the east–west disparity when  $\varepsilon$  is 0.00 and 0.05, respectively. Table 4 shows the contribution to disparity in each case. The contribution of the east is rising and simulation, if any, falls on the level of 10% in the west. Moreover, the contribution of the east–west disparity rises slightly. This tendency is clearer for higher values of  $\varepsilon$ . Although improving the population's mobility can ease overall disparities among cities, it results in disparities being reduced in western cities and increased in eastern cities.

Figures 9–14 measure the income distribution structure between cities after the simulation using a kernel density function. These figures show the dynamics of the distribution structure after the 10 iterations. The figure shows that income distribution reverts to the mean following some change in  $\varepsilon$ . It is clear that the density of comparatively higher-income eastern cities (more than 1.5 in the log of relative income  $Z$ ) and the comparatively lower-income western cities (less than  $-1.5$ ) are falling notably. The densities of the

---

<sup>15</sup> This method of estimating capital stock applies in Islam et al. (2006, pp.146–149).

However, numbers such as a depreciation rate are based on assumptions.

<sup>16</sup> The 2009 version of the *China Statistical Yearbook* does not report this decomposition for 2008 but does so for 2007. Therefore, we set 2007 as the base year.

<sup>17</sup> However, if  $\varepsilon$  is made into a higher value, the problem that the number of movements increases extremely and the solution to a computer is no longer obtained will arise.

comparatively poor eastern cities and comparatively wealthier western cities rise (all are at levels between  $-0.6$  and  $-0.2$ ). This factor contributes to changes in contribution observed in Table 4. These findings show that mobility of labor and capital is a means for reducing income disparity among cities.

#### 4. Conclusion

This study has analyzed income disparity among Chinese cities using data from the *China City Statistical Yearbook* for the period 1994–2008. The analysis revealed that income disparity among Chinese cities expanded during the period. Further, the expanding disparity between China's eastern and western regions seems attributable to income increases in western cities. Our simulation identified that boosting the mobility of labor and capital is a means for narrowing the general income disparity, and it indicated that east–west disparities could be relieved by improving the mobility of the general population. Overall, Chinese income disparity will probably persist for the immediate future. It is important for future research to continue analyzing urban income inequality in China by gathering more urban household survey data.

#### References

- Akita, Takahiro. 2003. "Decomposing regional income inequality in Indonesia and Indonesia using two-stage nested Theil decomposition method," *Annals of Regional Science*, 37, pp. 57–77.
- Akita, Takahiro and Alisjahbana, A. S. 2002. "Regional income inequality in Indonesia and the initial impact of the economic crisis," *Bulletin of Indonesian Economic Studies*, 38(2), pp.201–222.
- Barro, R. J. and Sala-i-Martin, X. 2004. *Economic Growth* (Second edition), MIT Press, Cambridge.
- Bhalla, A., Yao, S.J., and Zhang, Z.Y. 2003 "Regional Economic Performance in China," *Economics of Transition*, 11(1), pp. 25–39.
- Cai, Fang., Wang, Dewen., and Du, Yang. 2002. "Regional disparity and economic growth in China: The impact of labor market distortions," *China Economic Review*, 13, pp. 197–212.
- Chen, J. and Fleisher, B. 1996. "Regional income inequality and economic growth in China," *Journal of Comparative Economics*, 22, pp. 141–164.
- Chen, Z., Wan, G., and Lu, M., 2010. "Hangye Jian Bu Pingdeng: Riyi Zhongyao de Chengzhen Shouru Chaju Chengyin (Inter-industry income inequality: An increasingly important cause of income disparity in urban)," *Social Sciences in China*, 2010(3), pp.65–76 (in Chinese).
- Demurger, S., Fournier, M., and Li, S., 2006. "Urban income inequality in China revisited

- (1998–2002),” *Economics Letters*, 93(3), pp.354–359.
- Fleisher, B., Li, H., and Zhao, M. 2010. “Human capital, economic growth, and regional inequality in China,” *Journal of Development Economics*, 92, pp. 215–231.
- Fujita, M. and Hu, D. 2001. “Regional disparity in China 1985–1994: The effects of globalization and economic liberalization,” *The Annals of Regional Science*, 35, pp. 3–37.
- Fukuchi, Takao. 2000. “Long-run development of a multi-regional economy,” *Papers in Regional Science*, 79, pp. 1–31.
- Gluhih, R. and Portnov, B., 2004. “Visualization of the spatial patterns of inter-urban income disparities using coordinate transformations,” *International Journal of Geographical Information Science*, 18(3), pp.281–297.
- Hao, Zhou and Zou, Wei. 2008. “Zhongguo Chengshi Jumin Shouru de Fenbu Dongtai Yanjiu: 1995–2004 (Distribution dynamics of urban residential income in China: 1995–2004),” *Finance and Trade Economics*, 2008(10), pp. 16–22 (in Chinese).
- He, Jiang and Zhang, Xinzhi. 2007. “Zhongguo Shengqu Shouru Fenbu Yanjin de Kongjian Shijian Fenxi (Spatial-temporal analysis of China’s regional income distribution dynamics),” *Southern Economy*, 2007(1), pp. 64–77 (in Chinese).
- Islam, Nazrul., Dai, Erbiao., and Sakamoto, Hiroshi. 2006. “Role of TFP in China’s growth,” *Asian Economic Journal*, 20(2), pp. 127–159.
- Jian, T., Sachs, J., and Warner, A. 1996. “Trends in regional inequality in China,” *China Economic Review*, 7, pp. 1–21.
- Khan, A., Griffin, K., and Riskin, C., 1999. “Income distribution in urban China during the period of economic reform and globalization,” *American Economic Review*, 89(2), pp.296–300.
- Kanbur, R. and Zhang, X. 2005. “Fifty years of regional inequality in China: A journey through central planning, reform, and openness,” *Review of Development Economics*, 9, pp. 87–106.
- Knight, J., and Song, N., 1991. “The determinants of urban income inequality in China,” *Oxford Bulletin of Economics and Statistics*, 53(2), pp.123–154.
- Lau, Chi Keung Marco. 2010. “New evidence about regional income divergence in China,” *China Economic Review*, 21(2), pp. 293–309.
- Meng, X., 2004. “Economic restructuring and income inequality in urban China,” *Review of Income and Wealth*, 50(3), pp.357–379.
- Quah, Danny. T. 1996. “Convergence empirics across economies with (some) capital mobility,” *Journal of Economic Growth*, 1, pp. 95–124.
- Quah, Danny. T. 1997. “Empirics for growth and distribution: Stratification, polarization, and convergence clubs,” *Journal of Economic Growth*, 2, pp. 27–59.
- Raiser, M. 1998. “Subsidizing inequality: Economic reforms, fiscal transfers and convergence across Chinese provinces,” *Journal of Development Studies*, 34(3), pp. 1–26.
- Ramstetter, Eric. D., Dai, Erbiao., and Sakamoto, Hiroshi. 2009. “Recent Trends in China’s

- Distribution of Income and Consumption: A Review of the Evidence,” in Islam Nazrul ed, *Resurgent China: Issues for the Future*, Palgrave Macmillan, pp. 149–180.
- Sakamoto, Hiroshi and Fan, Jin. 2010. “Distribution dynamics and convergence among 75 cities and counties in Yangtze River Delta in China: 1990–2005,” *Review of Urban & Regional Development Studies*, 22(1), pp. 39–54.
- Sakamoto, Hiroshi and Islam, Nazrul. 2008. “Convergence across Chinese Provinces: An analysis using Markov transition matrix,” *China Economic Review*, 19(1), pp. 66–79.
- Silverman, Bernard. W. 1986. *Density Estimation for Statistics and Data Analysis*, Chapman and Hall, London.
- Theil, H. 1967. *Economics and Information Theory*, Amsterdam: North-Holland Publishing Company.
- Tsui, K. 1991. “China’s regional inequality, 1952–1985,” *Journal of Comparative Economics*, 15, pp. 1–21.
- Tsui, K. 2007. “Forces shaping China’s interprovincial inequality,” *Review of Income and Wealth*, 53, pp. 60–92.
- Xu, Xianxiang. and Li, Xun. 2004. “Zhongguo Chengshi Jingji Zengzhang de Qutong Fenxi (The Chinese city’s convergence of economic growth),” *Economic Research*, 2004(5), pp. 40–48 (in Chinese).
- Xu, Xianxiang. and Wang, Haigang. 2008. “Woguo Chuci Fenpeizhong de Liangji Fenhua ji Chengyin (Dynamics of factor payment: Evidence from China),” *Economic Research*, 2008(2), pp. 106–118 (in Chinese).
- Zhou, H., and Zou, W., 2008. “Zhongguo Chengshi Jumin Shouru de Fenbu Dongtai Yanjiu: 1995–2004(A study on the dynamic of household income in urban China),” *Finance & Trade Economics*, 2008(10), pp.16–22 (in Chinese).

Table 1 Number of effective samples of cities in this study

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cities	203	206	212	220	228	236	276	276	278	284	286	286	286	287	287
East	77	78	81	82	83	83	87	87	87	87	87	87	87	87	87
West	126	128	131	138	145	153	189	189	191	197	199	199	199	200	200

(Source) All tables and figures are author's calculation.

Table 2 Comparing data with yearbook

	Author's Calculation			Yearbook 2009			Calc/YB		
	Population	GRP	GRP/Pop	Population	GRP	GRP/Pop	Population	GRP	GRP/Pop
1994	73,377	37,385	5,095	119,850	48,198	4,044	61.22	77.57	125.99
1995	76,470	47,875	6,261	121,121	60,794	5,046	63.14	78.75	124.08
1996	80,620	58,060	7,202	122,389	71,177	5,846	65.87	81.57	123.19
1997	88,203	68,492	7,765	123,626	78,973	6,420	71.35	86.73	120.95
1998	92,818	76,363	8,227	124,761	84,402	6,796	74.40	90.48	121.06
1999	97,423	81,774	8,394	125,786	89,677	7,159	77.45	91.19	117.26
2000	112,613	95,165	8,451	126,743	99,215	7,858	88.85	95.92	107.55
2001	113,253	104,897	9,262	127,627	109,655	8,622	88.74	95.66	107.43
2002	114,260	116,817	10,224	128,453	120,333	9,398	88.95	97.08	108.79
2003	116,500	135,947	11,669	129,227	135,823	10,542	90.15	100.09	110.69
2004	117,817	163,355	13,865	129,988	159,878	12,336	90.64	102.17	112.40
2005	118,552	193,956	16,360	130,756	183,217	14,053	90.67	105.86	116.42
2006	119,874	226,660	18,908	131,448	211,924	16,165	91.19	106.95	116.97
2007	121,209	270,992	22,357	132,129	257,306	19,524	91.74	105.32	114.51
2008	122,453	323,536	26,421	132,802	300,670	22,698	92.21	107.61	116.40

(Note) Population (10,000 person), GRP (100 million Yuan), GRP/Pop (Yuan), Calc/YB (%).

Figure 1 Theil index of city disparity with decomposition

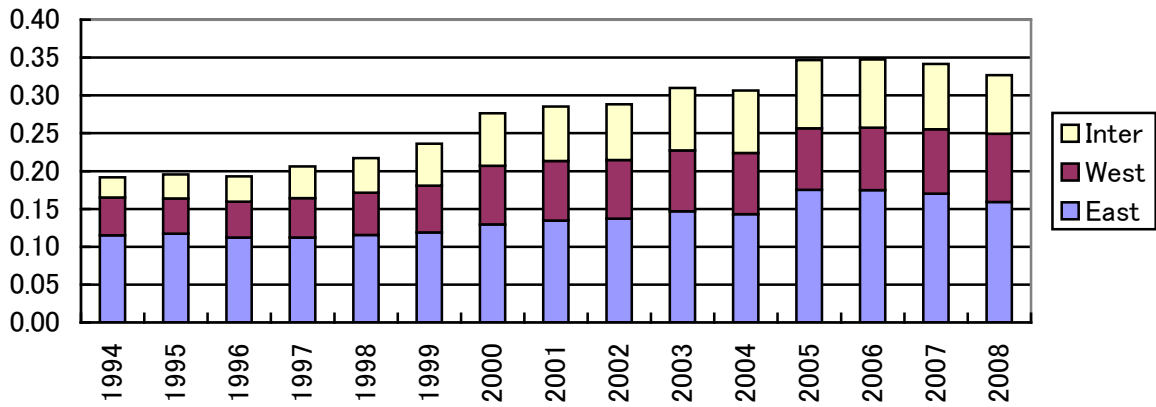


Table 3 Contribution to disparity index (%)

Year	1994	1995	1996	1997	1998
East	60.19	59.95	58.19	54.50	53.17
West	26.05	23.80	24.44	25.20	25.83
Inter	13.76	16.25	17.37	20.30	21.00
Year	1999	2000	2001	2002	2003
East	50.33	46.76	47.17	47.59	47.37
West	26.18	28.09	27.64	26.82	26.01
Inter	23.49	25.16	25.19	25.59	26.62
Year	2004	2005	2006	2007	2008
East	46.67	50.56	50.27	49.88	48.78
West	26.33	23.44	23.78	24.93	27.61
Inter	26.99	26.00	25.96	25.18	23.61

Figure 2 Density of income distribution in 1994

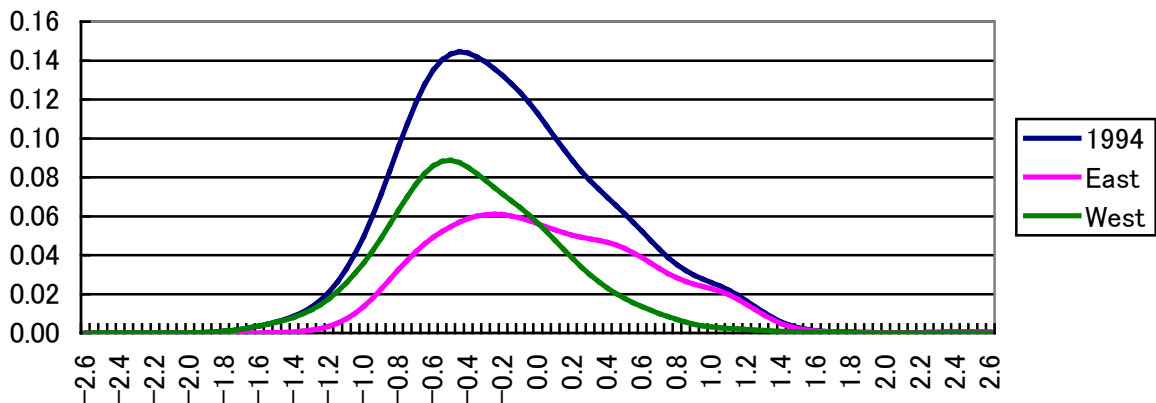


Figure 3 Density of income distribution in 2000

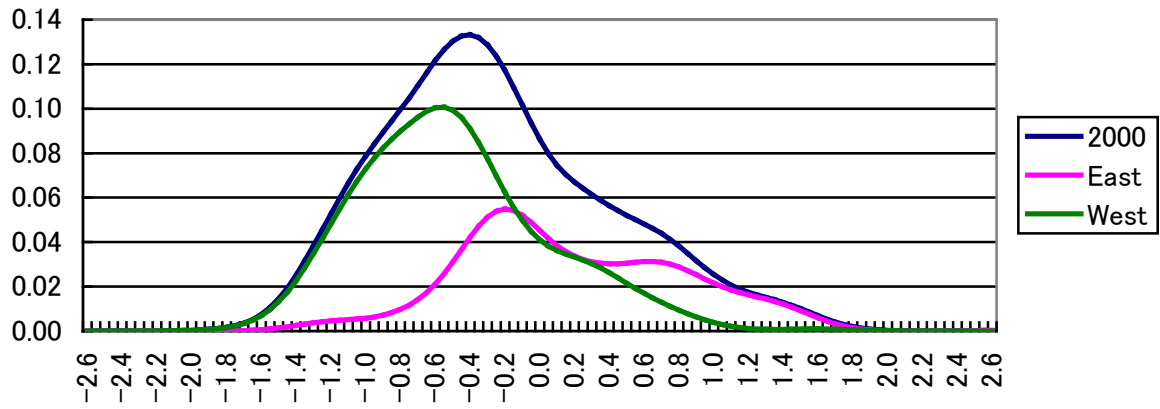


Figure 4 Density of income distribution in 2005

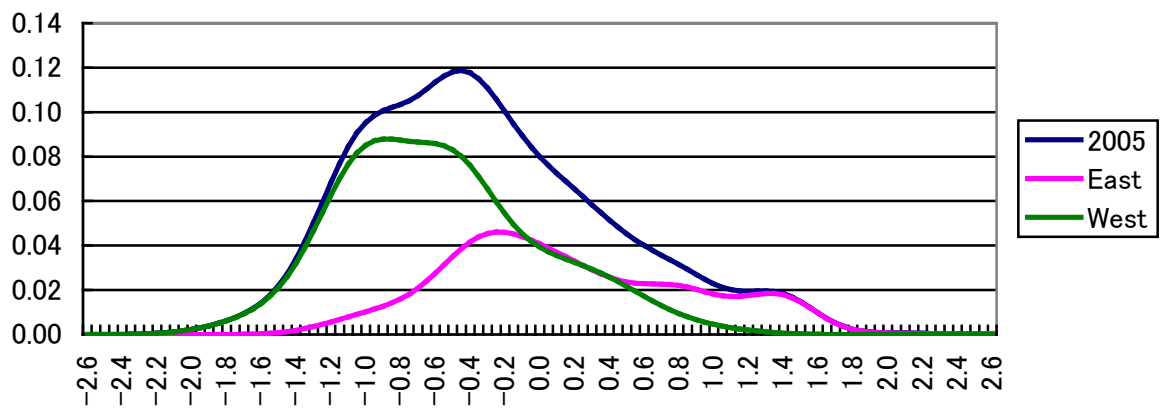


Figure 5 Density of income distribution in 2008

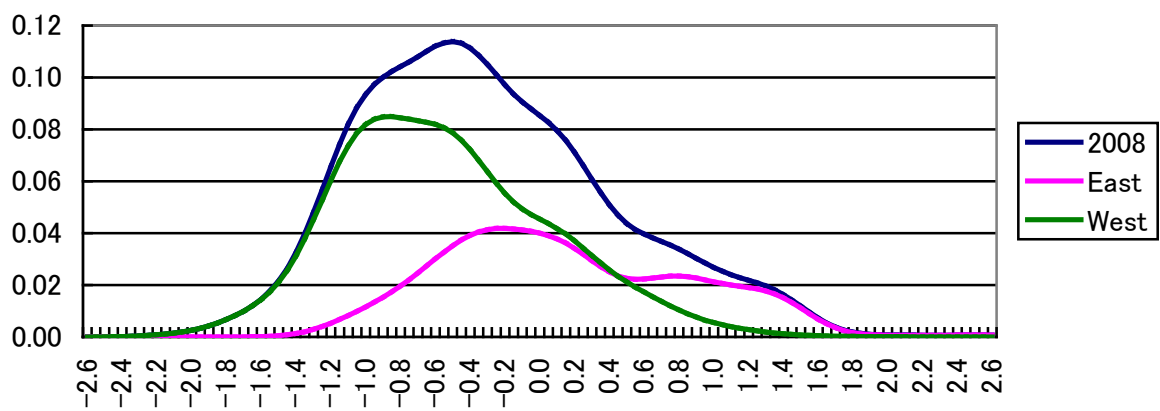




Figure 6 Theil index of city disparity after simulations (base year is 2007)

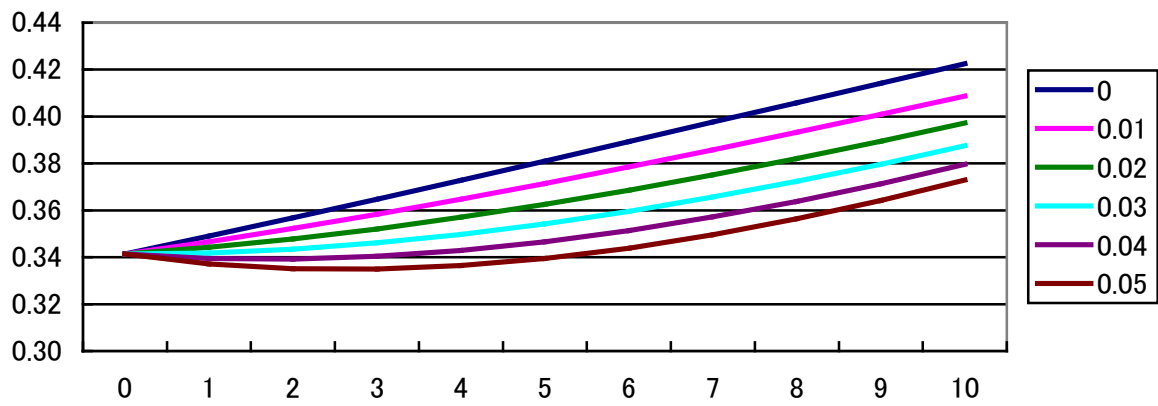


Figure 7 Theil index of city disparity with decomposition after simulation ( $\epsilon = 0.00$ )

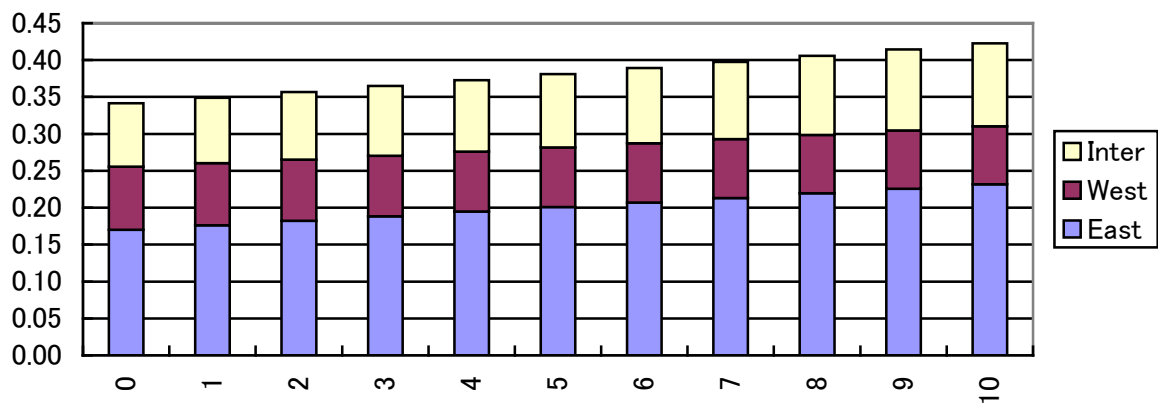


Figure 8 Theil index of city disparity with decomposition after simulation ( $\epsilon = 0.05$ )

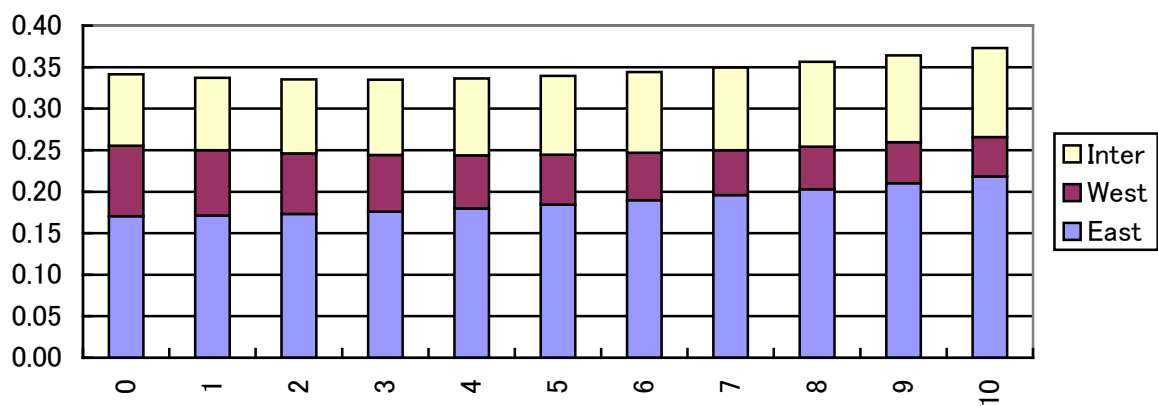


Table 4 Contribution for disparity index (%)

$\varepsilon$	Time	0	1	2	3	4	5	6	7	8	9	10
0.00	East	49.88	50.51	51.11	51.68	52.21	52.72	53.19	53.63	54.05	54.44	54.80
	West	24.93	24.06	23.25	22.49	21.80	21.16	20.57	20.03	19.53	19.06	18.64
	Inter	25.18	25.43	25.64	25.83	25.99	26.12	26.24	26.34	26.43	26.50	26.56
0.01	East	49.88	50.56	51.22	51.84	52.45	53.02	53.57	54.09	54.59	55.06	55.51
	West	24.93	23.91	22.95	22.05	21.21	20.43	19.71	19.03	18.41	17.82	17.27
	Inter	25.18	25.53	25.84	26.11	26.34	26.55	26.72	26.87	27.00	27.12	27.21
0.02	East	49.88	50.61	51.32	52.01	52.68	53.33	53.96	54.57	55.15	55.71	56.25
	West	24.93	23.76	22.65	21.61	20.63	19.72	18.87	18.08	17.34	16.65	16.00
	Inter	25.18	25.63	26.03	26.38	26.68	26.94	27.16	27.35	27.51	27.65	27.76
0.03	East	49.88	50.66	51.43	52.19	52.93	53.66	54.36	55.05	55.72	56.37	57.00
	West	24.93	23.60	22.35	21.17	20.07	19.04	18.07	17.17	16.33	15.54	14.81
	Inter	25.18	25.73	26.22	26.64	27.00	27.31	27.57	27.78	27.95	28.09	28.20
0.04	East	49.88	50.72	51.55	52.37	53.18	53.99	54.77	55.54	56.30	57.04	57.76
	West	24.93	23.45	22.05	20.74	19.51	18.37	17.30	16.30	15.37	14.51	13.70
	Inter	25.18	25.83	26.40	26.89	27.30	27.65	27.93	28.16	28.33	28.46	28.54
0.05	East	49.88	50.78	51.67	52.56	53.44	54.32	55.19	56.04	56.89	57.71	58.53
	West	24.93	23.30	21.76	20.32	18.97	17.72	16.56	15.48	14.48	13.55	12.68
	Inter	25.18	25.93	26.57	27.12	27.58	27.96	28.25	28.48	28.64	28.74	28.79

Figure 9 Density of income distribution after simulation 10 times ( $\varepsilon = 0.00$ )

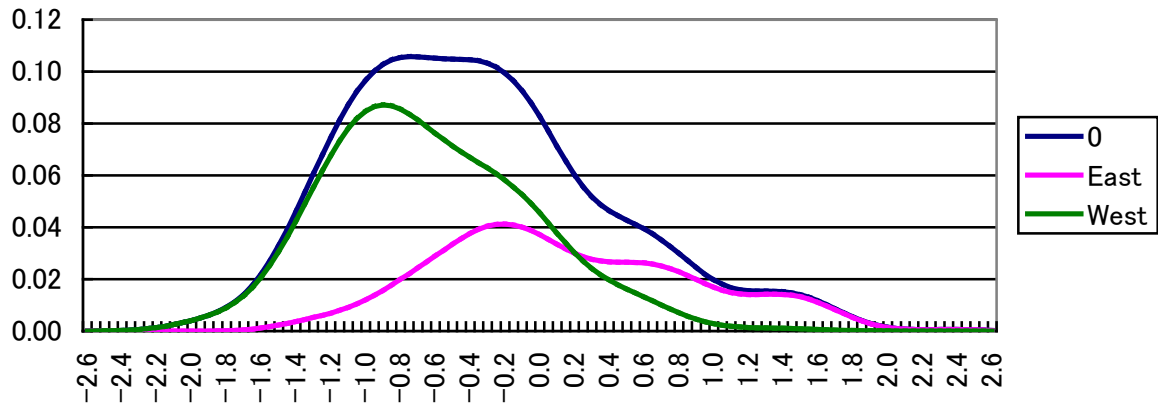


Figure 10 Density of income distribution after simulation 10 times ( $\varepsilon = 0.01$ )

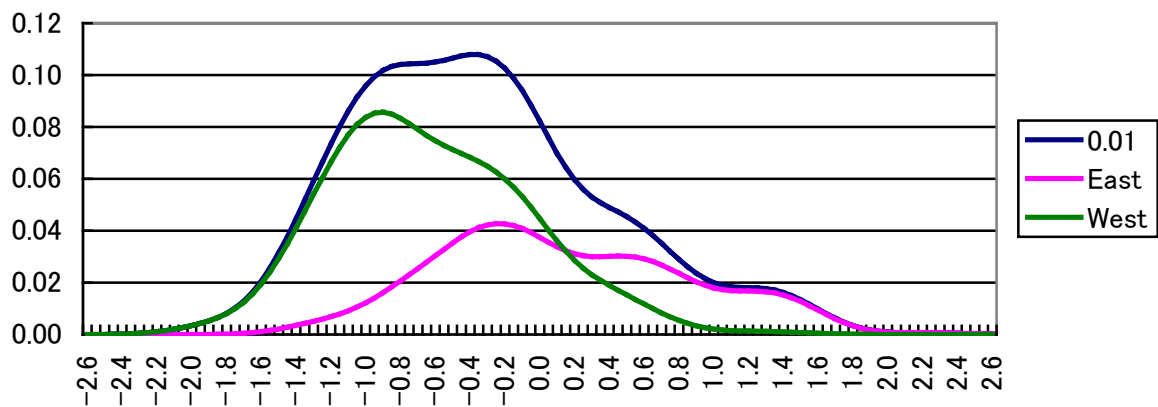


Figure 11 Density of income distribution after simulation 10 times ( $\varepsilon = 0.02$ )

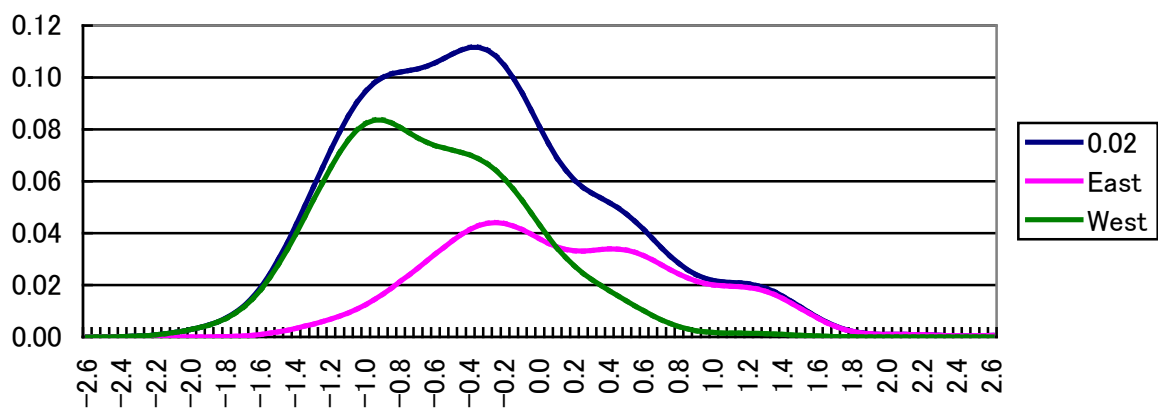


Figure 12 Density of income distribution after simulation 10 times ( $\varepsilon = 0.03$ )

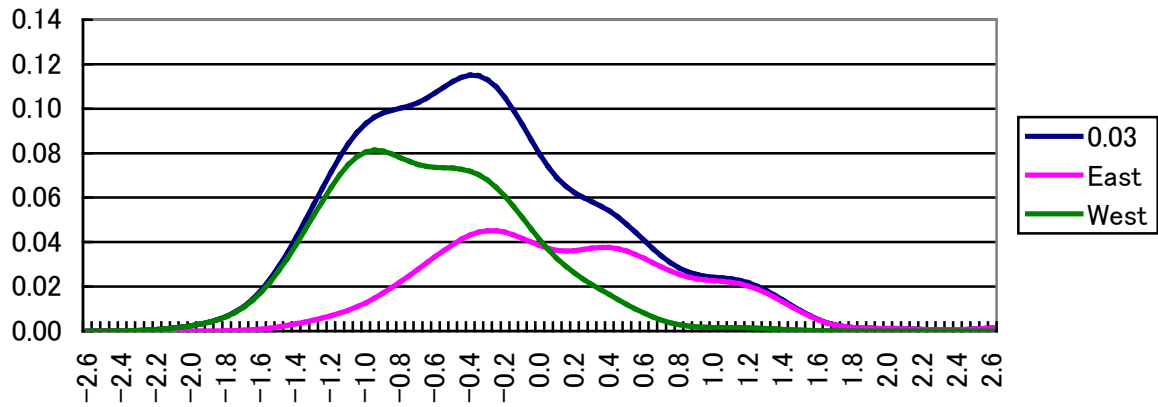


Figure 13 Density of income distribution after simulation 10 times ( $\varepsilon = 0.04$ )

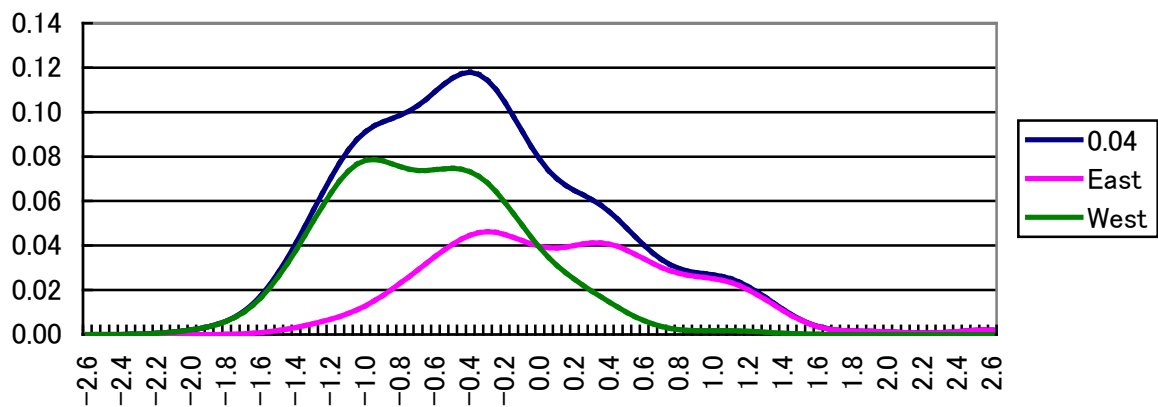


Figure 14 Density of income distribution after simulation 10 times ( $\varepsilon = 0.05$ )

