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Value-Added Data:
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Regional Income Disparity in China using Value-Added Data: Decomposition and Distribution Dynamics

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Abstract

This study examines the regional income disparity in China's provinces using value-added data. The GRP (Gross Regional Product) of China's provinces is decomposed into four value-added data components: *laborers remuneration*, *operating surplus*, *depreciation of fixed assets*, and *net tax on production*. The disparity was measured by the coefficient of variation, and the contribution to the GRP disparity was measured based on these four components. The following results were obtained: decreasing tendencies were observed in the disparity of operating surplus and that of net tax on production, while increasing tendencies were observed in the disparity of laborers remuneration and that of depreciation of fixed assets. The coefficient of variation of all value-added components is thus almost similar. In addition, the contribution to the GRP disparity of laborers remuneration has greatly expanded. These results suggest that the factor of disparity in China is shifting from operating surplus to laborers remuneration. These results are related to the gradual improvement of low income groups such as rural workers and high income groups whose success can be attributed to foreign direct investment in China and expanding business opportunities. Furthermore, estimated present and future distributions of all components tend to follow a bi-modal (richer and poorer) distribution pattern.

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Keywords: China, Regional Disparity, Value-Added Data, Decomposition, Distribution Dynamics

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1. Introduction

This study captures the regional income disparity in China's provinces and examines the factor of disparity using value-added data. The regional disparity in China is a serious problem and is also an interesting topic of study for foreign and Chinese researchers. This issue can be examined from various perspectives such as the macro-, micro-, empirical-, and policy-based perspectives, as well as through methods such as descriptive and inferential statistics.

This study focuses on the macro aspect of disparity in order to understand the factor of disparity using value-added data. Theoretically, the GDP (gross domestic product) is measured by three equivalent approaches—production, (such as that from the primary, secondary, and tertiary industries), expenditure (such as (private) consumption, investment, government spending, and importing and exporting), and distribution (which is composed of *laborers remuneration*, *operating surplus*, *depreciation of fixed assets*, and *net tax on production*). This study examines disparity by measuring the distribution of the GDP. China is known for its huge income disparity among each province. For instance, the “China Statistical Yearbook,” which provides official statistics, indicates a vast difference in the GDP per capita (or GRP: Gross Regional Product) between the largest province, Shanghai (66,367 yuan in 2007) and the smallest province, Guizhou (6,915 yuan). It is thus important to examine the factor of disparity.

The purpose of this study is to estimate the disparity using value-added data.¹ Value-added data is not widely used in China as compared to other countries, perhaps because the data are not easily available. In addition to limited statistical data, consistency of the data is also a problem. The effort of the government to provide more accurate data is at least appreciable though a peculiar problem still persists. Fortunately, the value-added data at the provincial level is available in China. Therefore, the analysis conducted in this study is based on published data.

In this study, we will first show a decomposition analysis of disparity among four value-added data components for which we employ a simple statistical methodology. Second, we will show the distribution dynamics of each value-added data component by

¹ For a recent survey of China's income and/or regional disparity, see Ramstetter et al. (2009).

approximating present and future distributions. This is helpful for overcoming the shortcomings of statistical methodology. Sakamoto and Islam (2008) suggest the advantages of this analysis.

The remainder of this paper is organized as follows. The data of this study is explained in the next section. Decomposition analysis is introduced in section 3; the approximation of present and future distribution is introduced in section 4; and section 5 concludes this study.

2. Data

Before demonstrating the measurement procedure, we will first explain the data used in this study. The data provided in this study is based on the “China Statistical Yearbook” and the statistical yearbooks of each province; for instance, the statistical yearbook of the Guangdong (Canton) province is referred to as the “Guangdong Statistical Yearbook.”² Moreover, “The gross domestic product of China between 1952 and 1995 (National Bureau of Statistics of China, 1997, Dongbei University of Finance and Economics Press)” was used to evaluate the value-added data between 1978 and 1995.

China’s macro data has been radically revised based on the economic census of 2004. This revision reaches the provincial data, and the revised data was introduced as the GRP and related macro data of each province in 2005. These revised data are compiled in the “Data of Gross Domestic Product of China between 1952 and 2004 (National Bureau of Statistics of China, 2007, China statistics press).” We used these data to check for consistency between this data book and our data set corrected from each provincial yearbook.³

Some assumptions are necessary when creating a dataset for this study. Firstly, the

² However, parts of provinces are designated titles; for example, the Hebei and Gansu provinces are referred to as the “Hebei Economic Yearbook” and the “Gansu Yearbook,” respectively.

³ In the 2004 revision, although the dataset included data till 1993, there is only a marginal difference in percentage of the GDP between the new and old series during the 1993–1997 year range (however, there is more than a 10% increase shown after 2000).

sample period ranged from 1978 to 2005. This year range was opted as there was no value-added data prior to 1978. There are fewer problems when understanding a long-term trend after the reform opening; thus, due to the approximate 30 year gap, the selected years ranged from 1978 to 2005. Next, this dataset is assumed to be based on the prices of 2005. As the revised data was introduced in 2005, this data seems to be the most accurate. However, as there is no comparative data of price differential across each province, this study does not consider it. Further, the GRP is estimated by measuring the actual rate of growth or of the index based on the data of 2005 for each province. Thirdly, the ratio of the GRP is distributed by four value-added components (laborers remuneration, operating surplus, depreciation of fixed assets, and net tax on production); it is thus recalculated based on previous data obtained from several data sources. This is because each value-added data does not demonstrate a substantial growth rate. Finally, we analyzed 29 provinces, excluding the Tibet and Hainan provinces from the dataset, because the value-added data of these provinces has not been obtained for several years from 1978. For the reader's convenience, an explanation and/or definition of value-added data by the statistical authority of China is available in the appendix section at the end of the document.

3. Decomposition Analysis

3-1. Methodology

According to the statistical yearbook of China, the GRP of each province in China is decomposed into four value-added components—laborers remuneration, operating surplus, depreciation of fixed assets, and net tax on production. The (population weighted) coefficient of variation is the most appropriate method for decomposing the disparity of provincial GRP into four value-added components. The coefficient of variation is one of the indices of the disparity that is calculated by dividing the standard deviation by the average. Further, this standard deviation can decompose the standard deviation of each component of the data as well as the covariance between components. Therefore, using the coefficient of variation is the most appropriate method for this

study.

The Gini coefficient, which is one of the indices of the disparity, can also decompose disparity. In this case, the Gini coefficient of the data component is called a pseudo-Gini coefficient because it is measured based on the entire income order and not each component's income. Therefore, the pseudo-Gini coefficient does not offer an accurate disparity of the data component though it is possible to calculate the decomposition of the disparity. Moreover, the Theil and Atkinson indexes, which are disparity indexes, can similarly decompose a limited portion of the data sample; however, these indexes do not fall within the scope of the methodology employed in this study (Aoki, 1979 and Sato, 2003, etc.). Therefore, the disparity is decomposed by measuring the coefficient of variation. In earlier research, Akita and Lukman (1995) decomposed the income disparity of Indonesia's provinces into three industries (primary, secondary, and tertiary industries). This study will use a similar method to decompose data according to the value-added data of China's provinces.

The income disparity will then be measured in the following manner. Firstly, the population weighted coefficient of variation (CV) of the per capita provincial GRP is calculated as follows.

$$CV = \frac{1}{\bar{X}} \sqrt{\sum_{i=1} w_i \cdot (X_i - \bar{X})^2} \quad (1)$$

where, w_i is the population weight of province i .

$$w_i = n_i / \sum_{j=1} n_j \quad (2)$$

The average per capita GRP of province i (X_i), which is denoted by \bar{X} , is also population weighted.

$$\bar{X} = \sum_{i=1} w_i \cdot X_i \quad (3)$$

Next, the coefficient of variation of the provincial GRP (per capita) is decomposed into the covariance of pairing two of the four value-added components and the coefficient of variation of four value-added components. Based on the method proposed by Akita and Lukman (1995), the following specification is obtained.

$$CV = \sqrt{\begin{aligned} &(\omega_1 \cdot CV_1)^2 + (\omega_2 \cdot CV_2)^2 + (\omega_3 \cdot CV_3)^2 + (\omega_4 \cdot CV_4)^2 \\ &+ 2 \cdot \omega_1 \cdot \omega_2 \cdot COV_{12} + 2 \cdot \omega_1 \cdot \omega_3 \cdot COV_{13} + 2 \cdot \omega_1 \cdot \omega_4 \cdot COV_{14} \\ &+ 2 \cdot \omega_2 \cdot \omega_3 \cdot COV_{23} + 2 \cdot \omega_2 \cdot \omega_4 \cdot COV_{24} + 2 \cdot \omega_3 \cdot \omega_4 \cdot COV_{34} \end{aligned}} \quad (4)$$

where, ω_s denotes the share of value-added s (provincial total) for total GRP, and weighs each item of this equation.

$$\omega_s = Y_s / \sum_{r=1} Y_r \quad (5)$$

The population weighted covariance between the two value-added data is as follows.

$$COV_{rs} = \frac{1}{\bar{X}_r} \cdot \frac{1}{\bar{X}_s} \cdot \sum_{i=1} w_i \cdot (X_{i,r} - \bar{X}_r) \cdot (X_{i,s} - \bar{X}_s) \quad (6)$$

Therefore, when the coefficient of variation of the provincial GRP is decomposed into four value-added components, it will require six combinations of the covariance between the value-added components and four of the coefficient of variation of each value-added component—all ten items are necessary. By applying the appropriate weight for each item, the coefficient of variation of the provincial GRP can be calculated. An enumeration of the problem of this method indicates that the measurement item rapidly increases because of an increase of the covariance item, which occurs when there is an increase of the decomposed component.

3-2. Coefficient of Variation

Figure 1 shows the population weighted coefficient of variation of the provincial

GRP. An upward trend can be observed on the boundary of 1990 though the income disparity has been decreasing since the reform opening in 1978. Moreover, this upward trend can be observed even after 2000. The reduction tendency in the 1980s and the expansion tendency in the 1990s depicted in this figure are similar to the results in earlier research, thus requiring no further explanation.

On the other hand, the revised data shows a continuous expansion tendency in the disparity though the old data shows a reducing tendency in the disparity after 2000 (Sakamoto, 2005). Tertiary industries, which mainly comprise the service industry, have been greatly affected by this revision. The GRP of tertiary industries is revalued and greatly increased in the revised edition. The proportion of tertiary industries in the provincial GRP differs to a large extent. The highest of this ratio is about 70% in Beijing city, and the lowest is about 30% in the Henan province in the revised 2005 version. Generally, the share of tertiary industries is higher in developed provinces, and the revised (increased) GRP mainly reflects these industries, thus resulting in a higher possibility of the expansion tendency occurring in the disparity.

Next, Figure 2 shows the results of the population weighted coefficient of variation for each value-added component. In this figure, the ratio of disparity increases in order of laborers remuneration, depreciation of fixed assets, net tax on production, and operating surplus. However, interestingly, it is understood that the difference in the ratio among these four disparities has reduced. In other words, the low level disparity of the laborers remuneration is expanding comparatively, and the high level disparity of operating surplus shows a comparatively reducing tendency. Moreover, the disparity of depreciation of fixed assets and net tax on production has not undergone any considerable change. The disparity of depreciation of fixed assets shows a small increasing tendency and the disparity of net tax on production shows a small reducing tendency. Moreover, the ratio of these four disparities is about 0.60 in 2005.

With regard to the expansion tendency in the disparity of the laborers remuneration, the number of channels of income that the laborer obtains has increased due to the development of a market economy. The laborer who finds employment in a foreign company that has developed as a result of foreign direct investment is offered high income, which is not the case in state-owned corporations. Moreover, it is possible to

earn one's own income by establishing individual enterprises (operating profit in individual enterprises are included in laborers remuneration in the foregoing explanation). On the other hand, the income of rural workers has not increased greatly. Even if it is possible to earn a high income by working away from home, the wages are fairly low as compared to an executive job in an enterprise. Therefore, a substantial difference lies in the increasing income between the sections, and when this is seen in the regional data, the disparity expands due to the differences in the degree of development of each section even though there is an increase in the overall income.⁴

On the other hand, the disparity of depreciation of fixed assets maintained the expansion tendency. This indicates that the disparity of the fixed assets investments is not serious like laborers remuneration. When a basic production function of capital and laborer is assumed, the difference in each worker's capital stock is considered to be the cause of the disparity. Further, differences in economic growth are a result of differences in fixed assets investment. Because depreciation of fixed assets is measured in relation to the fixed assets investment and the capital stock and the disparity of this component has been maintained, it is inaccurate to assume that the fixed assets investment is a factor of the disparity change.⁵

The disparity of net tax on production is similarly a weak explanation of the disparity change. The coefficient of variation of the disparity of net tax on production is actually high, at about 0.8.⁶ This disparity is reflected by a policy intention which is the tax system, the collection ability of the provincial authority, and the subsidy distributions. However, the influence that the policy intention has on the disparity is not so significant though the tax system underwent major changes in 1994.⁷

⁴ On the other hand, the regional wage disparity of the data limited to the staff and workers has also expanded considerably (Sakamoto, 2009).

⁵ The center of investment shifted from the western to the eastern coastal region before and after the reform opening (Wang and Li, 2000, pp. 98–110 and Xie, 2003, pp. 47–51). However, in order to nullify the income disparity between the east and west regions, a development strategy was implemented in the western region (*Xibu Da Kaifa*) since 2000 and the center of investment is now shifting to the west. However, when examining the preparation for the Beijing Olympic Games and the Shanghai exposition, the infrastructure investment in the city area was insufficient. Therefore, the regional disparity in investment does not increase easily when considering the balance between such regions.

⁶ The regional disparity of fiscal revenue is higher than the disparity of GDP (Sakamoto, 2008).

⁷ The purpose of the tax reform is to clarify the distinction between the revenue collected by the central government and that of the local government. As a result, the central-local ratio of revenue prior to the

Therefore, the disparity of operating surplus is considered as one of the largest factors of income disparity and has been eased to a certain extent. It is possible that this has become an environment that any region invents the operating surplus by the market-oriented economic reform. On the other hand, the source to invent the operating surplus is considered to be human capital investment. Such vast differences exist in regions with a developing as well as an under-developed economy. Therefore, the level of the disparity is considerably high even though the disparity tends to be reduced.

Figure 3 shows the result of the covariance between each value-added component. Most of these results are related to that in Figure 2. In other words, the covariance associated with these results is to be assigned a similar rank though the ratio of the disparity increases in order of the laborers remuneration, depreciation of fixed assets, net tax on production, and operating surplus. This is easily understood based on the covariance results of the smallest laborers remuneration and depreciation of fixed assets and the largest covariance of net tax on production and operating surplus.

3-3. Decomposition of Disparity

Figures 4 to 7 show the decomposition of disparity (contribution), indicating which value-added component is formed by which year of the coefficient of variation by GRP. The disparity is calculated by the ratio of each squared item and squared coefficient of variation in equation 4. Figure 4 shows all the ten items, and Figure 5 shows the ratio of the total four value-added components and the total six covariance parts between the value-added components. Figure 6 shows the ratio among the four value-added components. Figure 7 shows the ratio among the six covariance items between the value-added components.

It is understood that the proportion of the covariance is high and an upward trend is observed in the ratio. However, an upward trend can also be observed with regard to the contribution of the disparity of and the covariance item related to laborers remuneration. One reason for this result can be attributed to an increase in the disparity of laborers remuneration. Another reason can be attributed to the high volume of share of the laborers remuneration to the GRP in the four value-added components, which is about

reforms is about 3:7 and changed to about 5:5 after the reforms.

50%. On the other hand, the contribution of the disparity of the operating surplus or the covariance item related to the operating surplus is greatly reduced. This arises as a result of the disparity tending to be reduced. Moreover, it is also clear that the contribution to the disparity of depreciation of fixed assets and net tax on production is very low.

Therefore, it is necessary to focus on the trend of the disparity of laborers remuneration in verifying the regional disparity in China. The disparity of laborers remuneration during the reform opening was very small. Because a planned economy still dominates and the payment made for regulations was provided in cash or material, the regional disparity does not seem to be high. Moreover, the labor market is not necessarily complete although it has gradually developed by means of the market-oriented economic reform from the time of the reform opening (Ito, 1998, for instance). For instance, skilled workers do not necessarily become complete despite the increasing demand of skilled workers by foreign direct investment companies. A short supply of skilled workers results in higher, and thus, better income. On the other hand, there is an excessive supply of factory workers because of the large rural population, and a majority of them are not paid their income.⁸ Such a market-oriented economic reform is connected with the payment gap by disarranging the demand-and-supply balance of the labor market.⁹ Needless to say, this leads to the expansion of the payment gap between regions because the market-oriented economic reform does not address issues related to the differences between regions.

On the other hand, the highest factor of the regional disparity prior to the reform opening was due to the disparity of the operating surplus. Perhaps, this reason was that the planned economy had remained in the first stage of the reform opening. In other words, the system by which the most of profit finally backs to the central government is adopted by the planned economy. Moreover, the resource allocation had been distorted because the central authority emphasized the importance of the heavy industry sector, and the surplus from the rural sector was distributed to the heavy industry sector

⁸ However, this surplus workforce has recently undergone a gradual change. Few younger workers are hired; thus, their income has increased, leading the enterprise to bear the burden of higher costs (*Min Gong Huang*).

⁹ Luo (2008) finds that the gap in labor earnings between a stable and unstable job was widened based on the survey data from 1995 and 2002.

especially through the price difference policy in the planned economy age (Watanabe, 1991 for instance). On the other hand, the payment originally distributed by the laborer remains as operating surplus because the central authority suppressed laborer's payment to premeditation.

4. Distribution Dynamics

4-1. Approximation of the Distribution Density of Each Value-Added Component

In this section, the change of the disparity of the four value-added components is investigated by approximating the density function. The decomposition of the disparity using the coefficient of variation provides only summarized information about the distribution. Therefore, with regard to the details of the distribution change, it is more effective to examine the density function estimation (Quah, 1996c, 1997; Sakamoto and Islam, 2008).¹⁰

The procedure of the approximation of distribution density is described as follows. Let X_i denote the per capita GRP (and/or each value-added component) of province i based on the prices of 2005, and \bar{X} be the cross-section average of X_i (see equation 3). We first want to abstract from the shift in the mean of the distribution as reflected in the secular movement in \bar{X} . We therefore normalize the data from different years by their respective cross-section means, and take the log of the ratio X_i to \bar{X} as the variable for analysis. We denote this variable by Z_i , so that

$$Z_i = \ln\left(\frac{X_i}{\bar{X}}\right) = \ln X_i - \ln \bar{X}. \quad (7)$$

We begin by approximating the actual distribution of Z_i for the selected years using the Gaussian normal kernel (Silverman, 1986). The density function used for the approximation is as follows:

¹⁰ Other applications of this approach are given by Hao and Zou (2008), He and Zhang (2007), Xu and Wang (2008), and Yang and Sun (2009).

$$\tilde{f}(Z) = \frac{1}{h} \sum_{i=1} \frac{w_i}{\sqrt{2\pi}} \exp\left(-\frac{1}{2} \left(\frac{Z - Z_i}{h}\right)^2\right), \quad (8)$$

where Z_i is an observed value of the variable, w_i is the population weight of province i , and h is the window width (assumed to be 0.2 in this study). The range of Z is assumed to lie between -2.30 and 2.30 .

Figure 8 shows the distribution density of each value-added component in 1978. The distribution of operating surplus is considerably distorted while other distributions including the GRP exhibit a single peak. The higher the distortion of the distribution, the larger is the level of disparity. This means that the disparity of operating surplus is not only large but its distribution also distorted. On the other hand, the disparity of laborers remuneration is considerably small. These results reflect that of the coefficient of variation.

Figure 9 shows the distribution density in 1985. Compared with 1978, the distribution of net tax on production is slightly distorted while the distribution of operating surplus has improved slightly. This skewed distribution is also seen in the distribution of GRP and depreciation of fixed assets in 1995 (see Figure 10). These distributions are bi-modal characteristic (though part of the distribution of operating surplus has an extremely low distribution in Figure 10). Moreover, the distribution of laborers remuneration is also bi-modal characteristic in 2005 (see Figure 11). However, it is interesting that the shape of each distribution becomes similar as it is understood that these results reflect that of the coefficient of variation.

4-2. Distribution Dynamics using the Markov Chain

Next, we will examine the ergodic (future) characteristics of the income distribution structure by using the Markov chain. Quah (1993, 1996a, 1996b) has developed a methodology for implementing this approach. The methodology is based on the use of the Markov transition matrix to model the change in the distribution from one period to

the next.¹¹ In the following section, we briefly present the essentials of this methodology.

Let $n \times 1$ vector F_t give the distribution at time t , with n being the number of states distinguished to represent the distribution. In case of income distribution, as is in this paper, each state represents an income interval. Let M be the (n by n) Markov transition matrix governing the transformation of F_t into F_{t+1} , the distribution for $t+1$, so that we have

$$F_{t+1} = M^t \cdot F_t. \quad (9)$$

The Markov matrix assumes the following form.

$$M = \begin{pmatrix} a_{11} & \dots & a_{1k} \\ \vdots & \ddots & \vdots \\ a_{j1} & \dots & a_{jk} \end{pmatrix}, \quad (10)$$

with each element of the matrix, a_{jk} , giving the probability of transition from state j during the initial period to state k during the next period. These elements are therefore referred to as Markov transition probabilities.

Assuming that the Markov transition matrix remains unchanged, the distribution after several periods can be obtained by continually repeating equation (9). If the equation is repeated an infinite number of times, the distribution converges to an ergodic distribution, sometimes also referred to as the steady state distribution, \bar{F} . The ergodic or steady state distribution does not change, so that

$$\bar{F} = M^t \cdot \bar{F}. \quad (11)$$

Equation (11) shows that for a particular transition matrix M , it is possible to obtain a

¹¹ For more details, see the convergence literature of Durlauf and Quah (1999), Islam (2003), and Magrini (2004). Sakamoto and Islam (2008) also introduce a more detailed explanation.

corresponding steady state or ergodic distribution. Technically, the ergodic distribution is computed as the left eigenvector corresponding to the unit eigenvalue. The ergodic distribution shows what the long-run distribution is going to be like if the observed dynamics continue to hold.

An important issue in modeling distribution dynamics using Markov transition matrix concerns discretization. It involves determining the number of states and the grid values to demarcate these states. In this paper, we report a five-grid (five states) analysis. With regard to the grid values to demarcate the states, there are several possibilities. This paper chooses grid values that are fixed in a way for all components and determines which values are relative to the averages, 0.6, 0.8, 1.0, and 1.2. These corresponding log values are -0.5108 , -0.2231 , 0 , and 0.1823 , respectively.¹² Next, we estimate the transition matrix using 29 provincial data during 1978–2005; therefore, there altogether are 783 observations in the annual transition. Because we assume a fixed grid line, the observation numbers vary in each state and in each component (see Table 1's sample number).

Table 1 shows the Markov transition matrix and corresponding ergodic distributions based on annual transition data from 1978 to 2005. As we can see, ergodic distributions of all components including GDP show a bi-modal pattern. For example, the second lowest income state (0.6–0.8) is the highest share of the distribution (0.4533) in the GDP. The second highest share is the lowest income state (0.0–0.6, 0.2146) and the third highest share is the highest income state (1.2–Infinity, 0.1755). Because, the share of the distribution in other income states are lower than that of the second lowest income state and the highest income state (0.1052 and 0.0514, respectively), we can interpret it as a bi-modal distribution pattern. In line with the same interpretation, the distributions of the other four value-added components also show a bi-modal pattern, such as 0.3700 at the lowest and 0.1599 at the highest in laborers remuneration, 0.2794 at the lowest and 0.2131 at the highest in depreciation of fixed assets, 0.3400 at the second lowest and 0.2632 at the highest in net tax on production, and 0.3525 at the lowest and 0.3064 at

¹² Choosing gridlines to make the distribution uniform is a popular option. For example, Quah (1996a) too uses this option in his analysis of the US. Another option is to choose the gridlines by fixed length, say by number of standard deviation or some other chosen interval. In his analysis of 119 countries, Quah (1993, 1996a, 1996b) opts for such arbitrarily chosen gridlines.

the highest in operating surplus, respectively.

These results correspond to the results in the previous section. The approximation of the present distribution suggests that distributions form a bi-modal pattern for all the components through time. It is also consistent with the results of the coefficient of variation, which is almost the same for all the components. The differences between regions of the progress level in the labor market causes a bi-modal pattern of distribution. The other components will be examined in a similar manner. For instance, depreciation of fixed assets might be related to the investment demand in the region, net tax on production to the income, and operating surplus to the profit factor.

5. Concluding Remarks

This study examines the regional disparity in China that was decomposed into four value-added components of *laborers remuneration*, *operating surplus*, *depreciation of fixed assets*, and *net tax on production*. This study also examines the tendency and contribution of the disparity. The disparity was measured using the coefficient of variation. The following results were obtained: the disparity of operating surplus and net tax on production decreases while that of laborer's remuneration and depreciation of fixed assets rises. As a result, the coefficient of variation of any value-added component is almost the same. Next, the contribution ratio to the GRP disparity of the disparity of laborers remuneration and related items has expanded greatly. These results suggest that the factor of the regional disparity in China is shifting from operating surplus to laborers remuneration. Furthermore, an approximation of the present distributions by using kernel density estimation suggests that they tend to form a bi-modal (richer and poorer) distribution pattern through time. Similar results have been observed in future ergodic (convergence) distributions by using the Markov chain for all components.

The labor market was formed after the reform opening, and it makes various forms in the process, thus causing the disparity. In other words, the decisions concerning labor and payment do not reflect the economic realities in the planned economy age. Therefore, the regional disparity might have expanded while the labor market was

formed. However, two types of income groups have been formed: one from the rural setting that acquires few cash earnings and another whose income is earned from foreign companies or by means of individually owned enterprises. Because generating a new income group after the opening of the reforms is incontrovertible, the income improvement of the rural sector and the farmers will become a key issue for resolving the disparity problem.

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Figure 1. Coefficient of Variation (GRP)

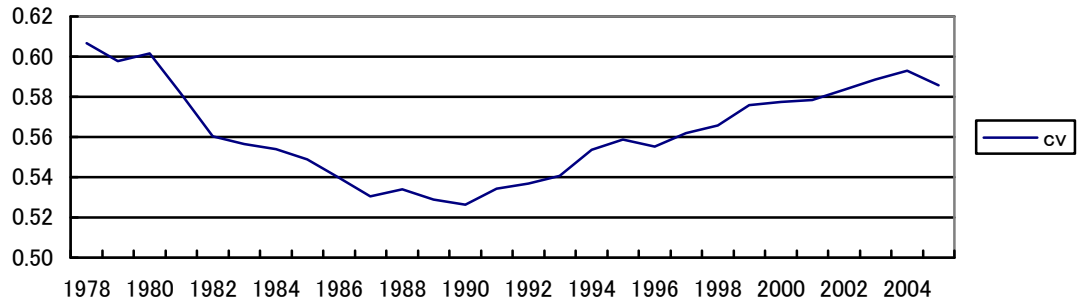


Figure 2. Coefficient of Variation (4 Value-Added Components)

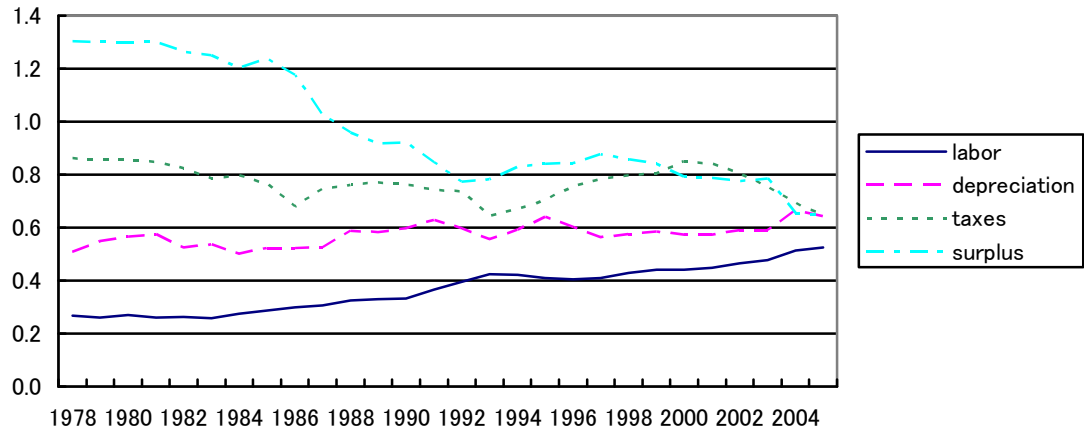


Figure 3. Coefficient of Variation (Between Value-Added Components Covariance)

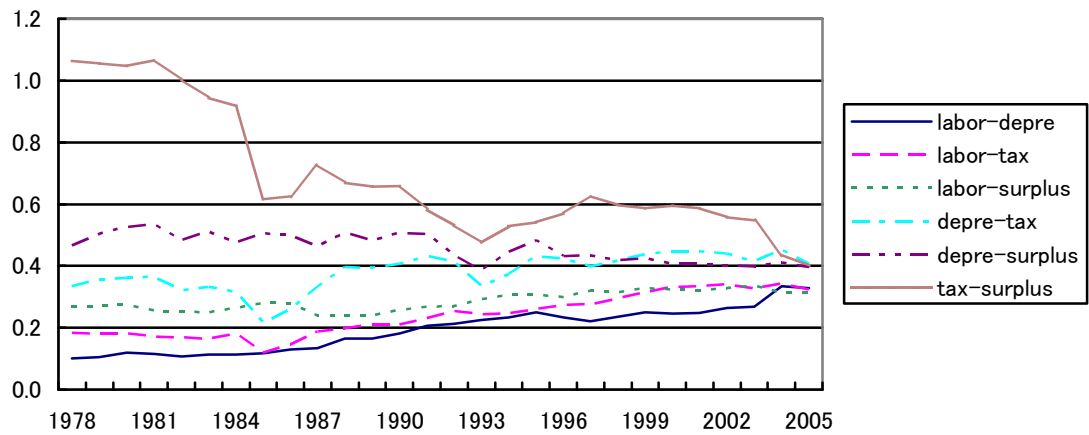


Figure 4. Decomposition of Disparity (All)

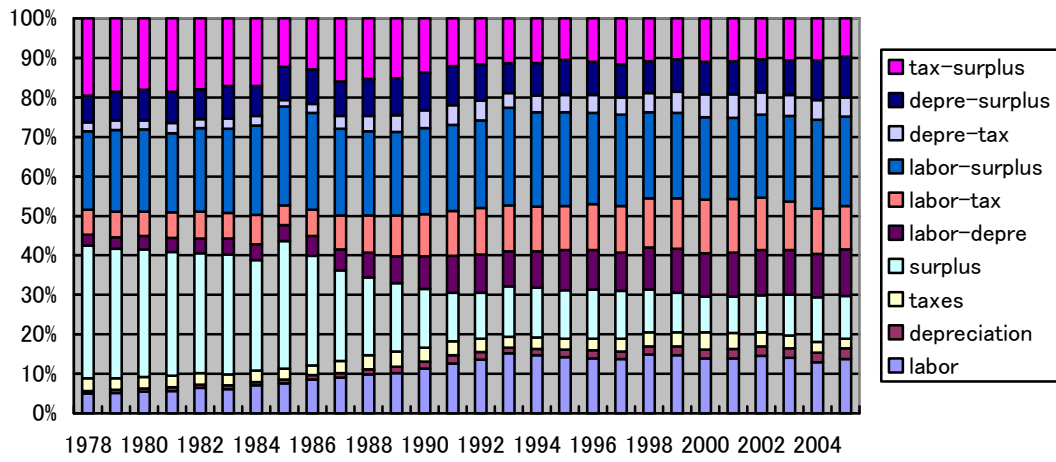


Figure 5. Decomposition of Disparity (Inter- and Intra-Value-Added)

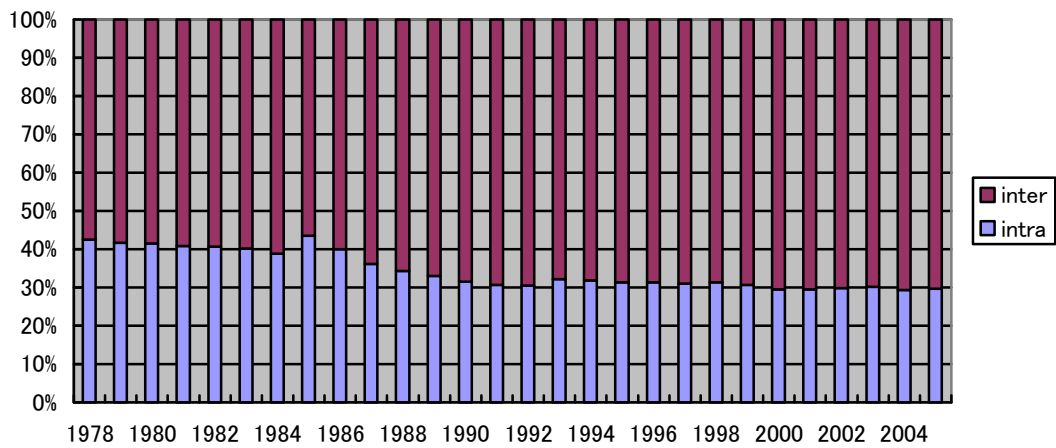


Figure 6. Decomposition of Disparity (4 Value-Added Components)

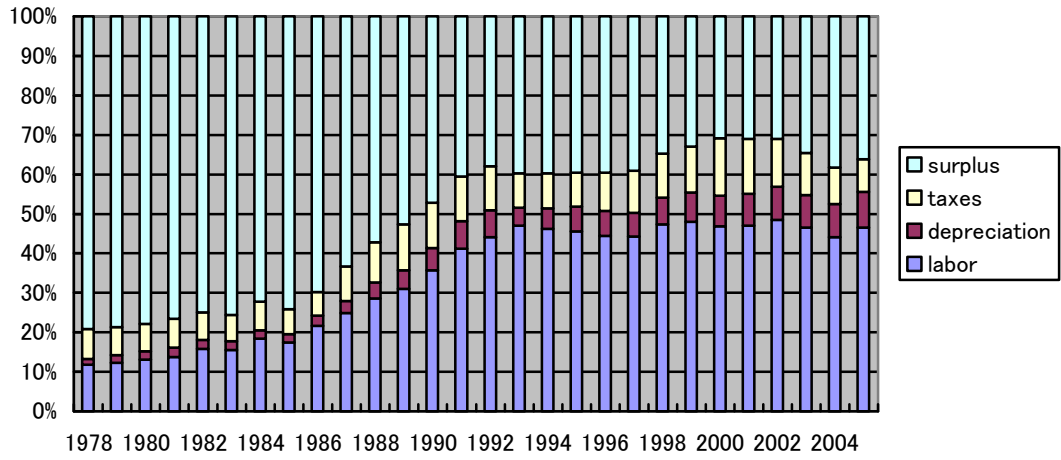


Figure 7. Decomposition of Disparity among Value-Added Components

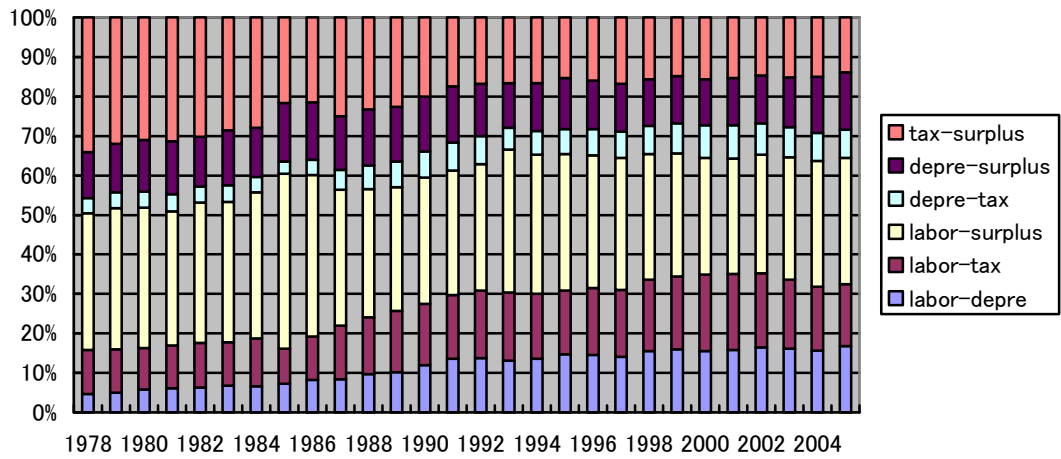


Figure 8. Distribution Density of Each Value-Added Component (1978)

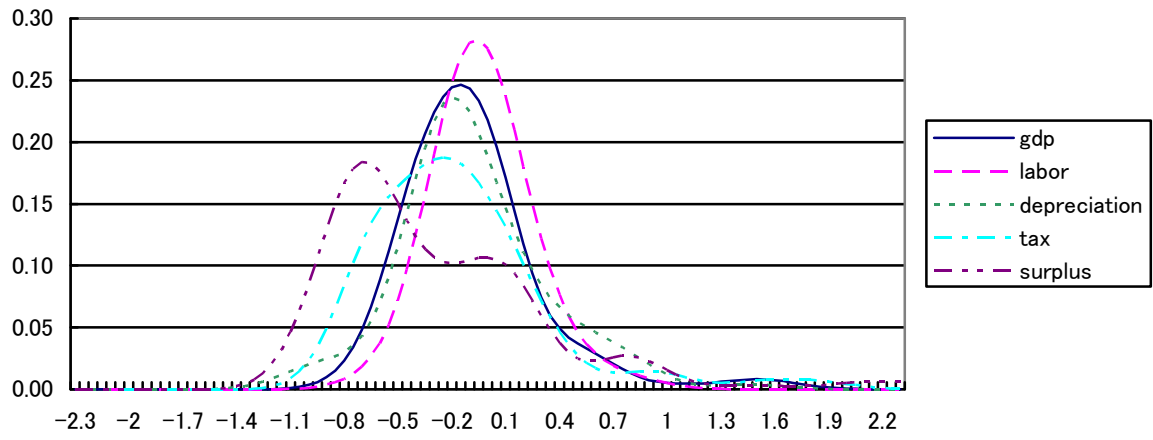


Figure 9. Distribution Density of Each Value-Added Component (1985)

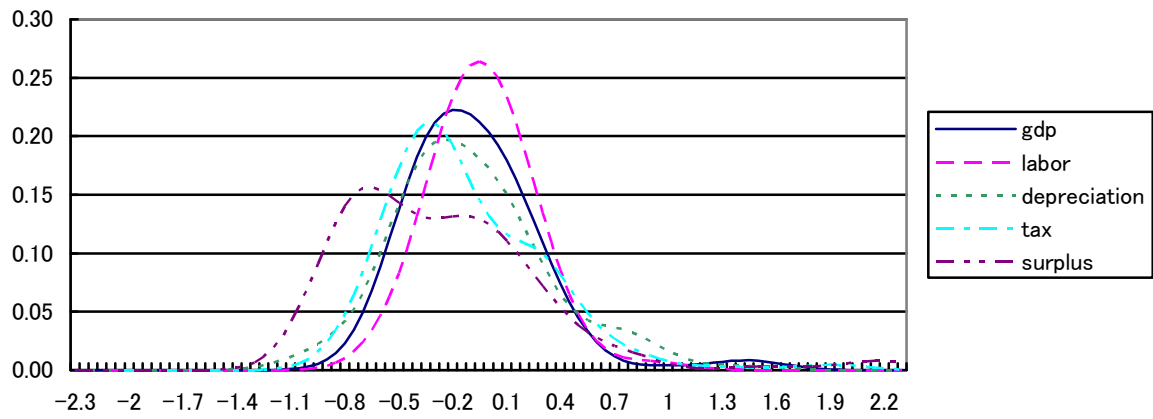


Figure 10. Distribution Density of Each Value-Added Component (1995)

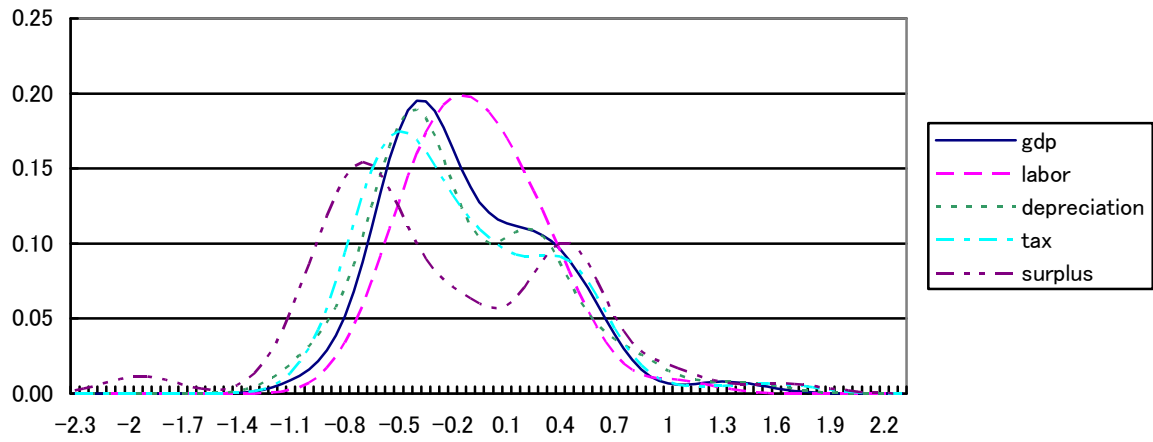


Figure 11. Distribution Density of Each Value-Added Component (2005)

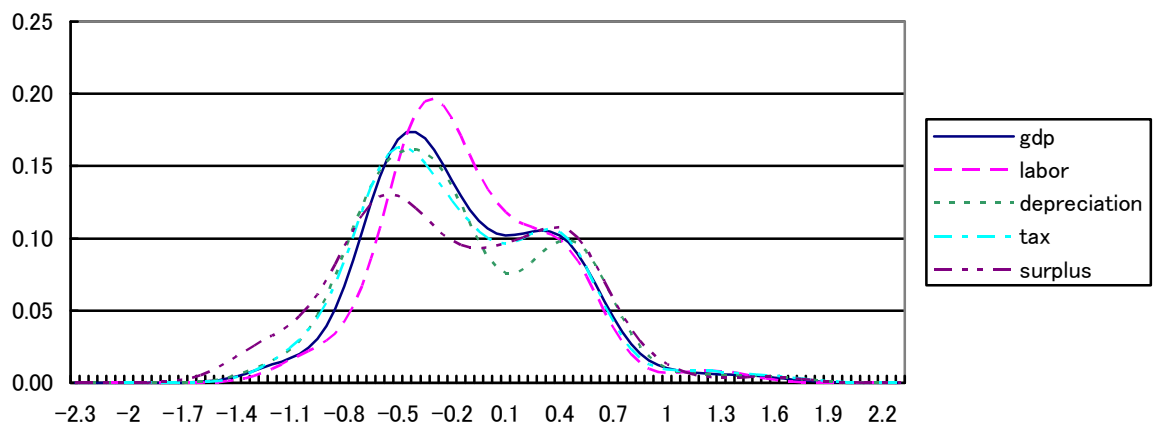


Table 1. Distribution Dynamics (Markov Transition Matrix and Corresponding Ergodic Distribution, 1978–2005)

| | | Grid line (relative to average) | | | | |
|--------------|---------|---------------------------------|--------|--------|--------|----------|
| | Samples | 0.6 | 0.8 | 1.0 | 1.2 | Infinity |
| GDP | 77 | 0.8831 | 0.1169 | 0.0000 | 0.0000 | 0.0000 |
| | 253 | 0.0553 | 0.9328 | 0.0119 | 0.0000 | 0.0000 |
| | 137 | 0.0000 | 0.0511 | 0.9124 | 0.0365 | 0.0000 |
| | 107 | 0.0000 | 0.0000 | 0.0748 | 0.8598 | 0.0654 |
| | 209 | 0.0000 | 0.0000 | 0.0000 | 0.0191 | 0.9809 |
| | Ergodic | | 0.2146 | 0.4533 | 0.1052 | 0.0514 |
| Labor | 48 | 0.8750 | 0.1250 | 0.0000 | 0.0000 | 0.0000 |
| | 173 | 0.0462 | 0.8844 | 0.0694 | 0.0000 | 0.0000 |
| | 202 | 0.0000 | 0.1139 | 0.8267 | 0.0594 | 0.0000 |
| | 145 | 0.0000 | 0.0000 | 0.1172 | 0.7931 | 0.0897 |
| | 215 | 0.0000 | 0.0000 | 0.0047 | 0.0558 | 0.9395 |
| | Ergodic | | 0.1369 | 0.3700 | 0.2254 | 0.1079 |
| Depreciation | 142 | 0.8732 | 0.1268 | 0.0000 | 0.0000 | 0.0000 |
| | 181 | 0.1326 | 0.7624 | 0.1050 | 0.0000 | 0.0000 |
| | 135 | 0.0074 | 0.1556 | 0.7185 | 0.1111 | 0.0074 |
| | 85 | 0.0000 | 0.0118 | 0.2000 | 0.6824 | 0.1059 |
| | 240 | 0.0000 | 0.0000 | 0.0000 | 0.0500 | 0.9500 |
| | Ergodic | | 0.2794 | 0.2582 | 0.1598 | 0.0895 |
| Taxes | 131 | 0.7405 | 0.2366 | 0.0076 | 0.0076 | 0.0076 |
| | 262 | 0.1183 | 0.7824 | 0.0878 | 0.0038 | 0.0076 |
| | 108 | 0.0278 | 0.1944 | 0.6296 | 0.1481 | 0.0000 |
| | 66 | 0.0000 | 0.0455 | 0.2273 | 0.5000 | 0.2273 |
| | 216 | 0.0046 | 0.0046 | 0.0139 | 0.0602 | 0.9167 |
| | Ergodic | | 0.1749 | 0.3400 | 0.1427 | 0.0792 |
| Surplus | 298 | 0.8993 | 0.0940 | 0.0034 | 0.0034 | 0.0000 |
| | 116 | 0.2328 | 0.6034 | 0.1638 | 0.0000 | 0.0000 |
| | 96 | 0.0208 | 0.1458 | 0.5833 | 0.2292 | 0.0208 |
| | 65 | 0.0000 | 0.0769 | 0.2462 | 0.4769 | 0.2000 |
| | 208 | 0.0000 | 0.0000 | 0.0096 | 0.0529 | 0.9375 |
| | Ergodic | | 0.3525 | 0.1422 | 0.1153 | 0.0837 |

Corresponding log value is -0.5108 (0.6), -0.2231 (0.8), 0 (1), 0.1823 (1.2).

Appendix

Explanation and/or definition of the value-added data in this study (“China statistical yearbook 2007,” pp.98–99)

Labourers Remuneration refers to the whole payment of various forms earned by the labourers from the productive activities they are engaged in. It includes wages, bonuses and allowances the labourers earned in monetary form and in kind. It also includes the free medical services provided to the labourers and the medicine expenses, traffic subsidies and social insurance, housing fund paid by the employers. As the individual economy is concerned, since the labourers remuneration is not easily distinguished from the operating profit, both are treated as labourers remuneration.

Net Taxes on Production refers to the difference of the taxes on production minus the subsidies on production. The taxes on production refers to the various taxes, extra charges and fees levied on the production units on their production, sale and business activities as well as on the use of some factors of production, such as fixed assets, land and labour force in the production activities they are engaged in. In contrast to the taxes on production, the subsidies on production refer to the unilateral government transfer to the production units and are therefore regarded as negative taxes on production. They include subsidies on the loss due to implementation of government policies, price subsidies, etc.

Depreciation of Fixed Assets refers to the depreciation of fixed assets of a given period, drawn in accordance with the stipulated depreciation rate for the purpose of compensating the wear loss of the fixed assets or the depreciation of fixed assets calculated in a fictitious way in accordance with the stipulated unified depreciation rate in the national economic accounting system. It reflects the value of transfer of the fixed assets in the production of the current period. The depreciation of fixed assets in various enterprises and institutions managed as enterprises refers to the depreciation expenses actually drawn. In government agencies and institutions not managed as enterprises which do not draw the depreciation expenses, as well as for the houses of residents, the depreciation of fixed assets is the imputed depreciation, which is calculated in accordance with the stipulated unified depreciation rate. In principle, the depreciation of fixed assets should be calculated on the basis of the repurchased value of the fixed assets. However, there is no actual condition to re-evaluate all the fixed assets in China. Therefore, the above-mentioned methods are temporarily adopted at present.

Operating Surplus refers to the balance of the value added created by the resident units deducting the labourers remuneration, net taxes on production and the depreciation of fixed assets. It is equivalent to the business profit of the enterprises plus subsidies on production, but the wages and welfare expenses paid from the profits should be deducted.