

ESSAYS ON INCOME DISTRIBUTION AND
ECONOMIC GROWTH IN CHINA

by

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A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of
the requirements for the degree of Doctor of Philosophy, The City University of New
York

2009

This manuscript has been read and accepted for the
Graduate Faculty in Economics in satisfaction of the
dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

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Three papers comprise this dissertation. The first reexamines the relationship between the urbanization and the income inequality of the total China's residents. We start from the question whether the change of the income inequality of China's residents follows the Kuznets's Inverted-U hypothesis. Although the change of the income inequality inside the rural area and urban area doesn't follow the Kuznets's Inverted-U hypothesis, according to our research, the change of the income inequality of the total residents supports the Kuznets's Inverted-U hypothesis. The most important cause resulting in the change of the income inequality of the total residents appearing the inverted-U is that the change of the income inequality caused by urbanization has entered the decreasing phase during the recent years, which makes the income inequality of the total residents begin to decrease, or makes its increasing speed begin to decrease gradually. In the future, for decreasing the income inequality of the total residents, the two kinds of the policies will be provided: on the one hand, the barrier which

block the shift of the labor from the rural area to urban area must be broken, and the urbanization should be accelerated; on the other hand the income of the rural residents must be improved as soon as possible, the urban-rural gap will shrink.

The second paper more closely examines the main factors influencing income inequality of urban residents in China. Recently, the continuing enlargement of urban residents' income inequality in China has caused much concern from society, among which, the discussion on main factors leading to deteriorating income inequality becomes the focus of income distribution research. The author of this thesis uses two methods to reveal the contribution of urban population characteristics to income inequality based on the sampled data collected by Investigating Team of Urban Society and Economy of Tianjin from 3000 households in 2004. It shows that occupation or duty, education and industry differences are the three main factors effecting urban residents' income inequality, and they contribute up to 40% of urban residents' income differences. Specifically, surpassing industry features, the features of occupation or duty become the most significant factors influencing income, followed by the factors of education levels, and industry features retreat to be the least import among the three ones. Accordingly, the author proposes his suggestions to the adjustments of urban residents' income distribution, namely, the principle of "Controlling Two Ends of Income Ranks, and Increasing the Number of Residents with Intermediate Income". In other words, a diamond-shaped income

distribution system should be established by improving the condition of low-income residents and limiting the expansion of high-income stratum, and finally, enlarging the group in between.

The third paper studies education and environment in China. The paper uses two-stage Durbin method to analyze Chinese economic growth, we find that in China, labor market has redundant and labor elasticity of GDP is negative. Physical capital investment has wrong direction and physical capital elasticity of GDP is negative also, the reasons of GDP growth are human capital and “pollution”. So, if China plans to make a harmonious society, achieves its GDP target and control “environment”, the only way is increasing human capital investment to support China’s sustainable and green growth. We find China faced a policy dilemma between economic growth and environment. At the conclusion, we give following three suggestions: Increase investment in human capital, protect intellectual property right and privatization property right, “One Family, One Car” policy.

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**Chapter 1: The Impact of Urbanization on Income Inequality of the
Total Residents in China——a Theoretical and Empirical Test of
Kuznets's Inverted-U Hypothesis**

I. Introduction

In the 50s of last century, the well-known Kuznets's inverted-U hypothesis was brought forward (Kuznet, 1955). According to this hypothesis, income inequality increases during the early stage of economic development and after reaching a turning point declines. Subsequently, this hypothesis motivated many theoretical and empirical studies (S. Robinson, 1976; Glomm, 1992; Rauch, 1993; Anand, 1993; Chen Zongsheng, 1994 ; 2000; Paukert, 1973; Ahluwalia, 1976; Ashwani Saith, 1983; Papanek, Kyn, 1986; Ram, 1988; Chenery, 1988; Aldelman, 1995; Andreas Sawides, Thanasis Stengos, 2000,; Soltow, 1968; Williamsom, Lindert, 1979; Mizoguchi, 1985 ; Oshima, 1991, 1992; Ryoshin Minami, 1998).

Among the theoretical studies, many analyzed the impact of urbanization, namely the population shift from rural area (agricultural) to urban area (industry), on income inequality to test inverted-U hypothesis (S.

Robinson, 1976; Glomm, 1992, Rauch, 1993; Anand, 1993; Chen

Zongsheng, 1994, 2000). S. Robinson(1976) demonstrated how the income inequality changes in the course of the population shift from agricultural to industry and gave rise to Kuznets curve. Anand(1993) illuminated the relationship between the population shift and the change of income inequality, and put forward the required conditions for the existence of Kuznets phenomenon. Chen Zongsheng(1994, 2000) point out that as a matter of fact, if the income gap between the urban area and rural area exists, the income inequality caused by population shift from urban area to rural area will increase, and after the turning point will decrease. But until now, a strict mathematical proof of the relationship between the population shift and income inequality has not been provided.

Because of the data restriction, most of the empirical studies use the cross-country data to test the inverted-U hypothesis. But the cross-country data test depends on the following two rigorous assumptions: the first is that all the countries are homogeneous and the differences of economic structure, culture, history, and politics among the countries are ignored; the second is that the relationship between economic development and income inequality described by inverted-U hypothesis is not influenced by other independent factors, such as business cycle etc. Obviously, these two

assumptions are far from realistic. Therefore, with the perfection of the econometric method, the cross-country data test incurred more and more

criticism(Ashwani Saith , 1983 ; Ram , 1988 ; Andreas

Sawides 、 Thanasis Stengos , 2000), some scholars even point out that any cross-country data test which ignore the heterogeneity among the countries is ineffective(László Mátyás etc.,1998)

During last 30 years, China's economy has grown very quickly, and at the same time the income inequality also increases, which has motivated the attention of many researchers(Chen Zongsheng, 1991; Chen Zongsheng, Yunbo Zhou, 2002; Khan etc., 1992; Athar Hussain etc., 1994; TusiKai-yuen, 1998; Li Shi etc., 1999; Gustafsson, Li Shi, 2001, 2002; Guanghua Wan, 2004; Nong Zhu and Xubei Luo, 2006). One of the most important issues is whether the change of income inequality of China's residents accords with the Kuznets's inverted-U hypothesis. Because of the constraint of data and method, some researchers (Khan etc., 1992; Li Shi, 1993; Li Shi, Zhao Renwei, Zhang Ping, 1999) have tried to use the cross-province or cross-county data of income inequality inside the urban or rural

area to test it, but their results don't support the inverted-U hypothesis.

Some scholars point out that China is still in the early stage of economic development, and the data basis of the inverted-U hypothesis doesn't exist, so it is logical that the results of these studies didn't support the inverted-U hypothesis(Chen Zongsheng, 2002).

There are two tasks in this paper. The first one is to provide a strict mathematical proof of the relationship between the urbanization, namely the population shift from the rural area to urban area, and income inequality caused by the urbanization. At the same time the relationship between the urban-rural income gap and income inequality caused by the urbanization is also analyzed. The second is to test if the change of income inequality of total residents in China accords with the Kuznets's inverted-U hypothesis. In China, since 1978 the income inequality of the urban residents or rural residents still increases and doesn't give rise to the Kuznets's inverted-U curve, but because of the fast urbanization, the change of income inequality of the total residents maybe support the Kuznets's inverted-U hypothesis. To avoid the weakness of the cross-section data, the time-series data is used in this paper.

This paper is organized as follows. Section two provides a detailed

mathematical proof of the relationship between the urbanization and income inequality caused by the urbanization and analyzes the relationship between the urban-rural gap and income inequality caused by the urbanization.

Finally two hypotheses are put forward. Section three makes the empirical analysis for the relationship between China's economic growth and income inequality of the total residents to test Kuznets's inverted-U hypothesis by the time-series data from 1978 to 2005. Section four gives some main conclusions and the policy implications.

II. The Theoretic Analysis of the Inverted-U relationship between the Urbanization and the Income Inequality Caused by Urbanization

2.1 The Theoretical Analysis

2.1.1 Some Basic Assumptions

Some assumptions are quoted from other researchers (S.Robinson, 1976; Anand, 1993; Chen Zongsheng, 1994) and some modifications are made. These assumptions are as follows.

Assumption 1: the economy is divided into two parts: the urban area and the rural area;

Assumption 2: the total population is N , the rural population is N_r , and the urban population is N_u , then $N_r + N_u = N$. So the share of urban population in total population is $P = N_u / N$, accordingly, the share of rural population is $1 - P$;

Assumption 3: in the urban and rural area, income distribution is equal, namely: $G_r = G_u = 0$;

Assumption 4: the urban-rural income gap is a variable which is different from the former researches. We define x as the ratio of income in the urban area to income in the rural area, then the share of urban income in

total income is $Y = \frac{x N_u}{x N_u + N_r}$, the numerator and the denominator of

right side both divided by N, then: $Y = \frac{x \cdot P}{x \cdot P + (1 - P)}$, the share of rural

income is $1 - Y$.

According to above assumptions, we get Lorenz curve(Figure 1).

2.1.2 The Relationship between the Urbanization and the Income

Inequality Caused by the Urbanization

From figure 1, we get the GINI coefficient:

$$G = 2 \cdot S_1 \quad (1)$$

And: $S_1 = \frac{1}{2} - (S_2 + S_3 + S_4)$, $S_2 = \frac{1}{2} P \cdot Y$, $S_3 = \frac{1}{2} (1 - Y) (1 - P)$, $S_4 = (1 - Y) P$.

S_2, S_3, S_4 are substituted into (1), Since $G \geq 0$, if $x > 1$ (Average income of urban area is higher than average income of rural area), then:

$$G = Y - P \quad (2)$$

Since $x > 1$, according to assumption 4, $Y = \frac{x \cdot P}{x \cdot P + (1 - P)}$, substituting Y into

(2), then we get:

$$G = \frac{P(1-P)(x-1)}{xP+(1-P)} \quad (3)$$

Solving derivative of the formula (3) for P , then we get:

$$\frac{dG}{dP} = \frac{(x-1)[(1-x)P^2 - 2P+1]}{[xP+(1-P)]^2} \quad (4)$$

Since $x-1 > 0, [xP+(1-P)]^2 > 0$, for solving $\frac{dG}{dP} = 0$, we can solve following

formula:

$$(1-x)P^2 - 2P+1 = 0 \quad (5)$$

Because of $(1-x) < 0$, the equation (5) represents a parabola with the downward

placket and the symmetry axis $P' = \frac{1}{1-x}$ (just as the Figure 2 shows), solving

equation(5), we get following results:

$$P_1^* = -\frac{x^{\frac{1}{2}}+1}{x-1} = \frac{-1}{x^{\frac{1}{2}}-1}, P_2^* = \frac{x^{\frac{1}{2}}-1}{x-1} = \frac{1}{x^{\frac{1}{2}}+1} \quad (6)$$

Since $x > 1$, then $P_1^* < 0$ and $P_2^* < 0$.

Since P_1^* contradicts with the assumption 2, it is forsaken, P_2^* is the solution of

equation 5. Then $P \in [0,1]$, when $P < P_2^*$, $\frac{dG}{dp} > 0$, then G is the increasing function of P

; when $P > P_2^*$, $\frac{dG}{dp} < 0$

then G is the decreasing function of P . Now, we have already proved that if the urban-rural income gap is fixed, with the growth of urban population share the income inequality caused by urbanization will increase at first, after turning point decrease.

Thereinto, P_2^* is the turning point. Substituting $P_2^* = \frac{1}{x^2 + 1}$ into formula (3), we get:

$$G^* = \frac{x^{\frac{1}{2}} - 1}{x^{\frac{1}{2}} + 1} \quad (7)$$

Thus, G^* is the maximum income inequality caused by the population shift from rural area to urban area. When G^* reaches the maximum, P_2^* is the turning point of the urban population share. The formula (6) and (7) show that P_2^* and G^* is the function of the urban-rural income gap (namely x).

2.1.3 The Impact of the urban-rural income gap on the position and that shape of the Inverted-U curve

Now, we will discuss the impact of x on G and P_2^* . Firstly, we solve the derivative of the formula (3) for x , then we get:

$$\frac{dG}{dx} = \frac{P(1-P)}{(xP+1-P)^2} > 0 \quad (8)$$

Since $\frac{dG}{dx} > 0$, G is an increasing function of x , namely the increase of the urban-rural income

gap will make the increase of income inequality caused by the urbanization. Namely the increase of the urban-rural income gap makes the inverted-U curve shift upward.

Secondly, we solve the derivative of P_2^* for x , we get:

$$\frac{dP_2^*}{dx} = \frac{-1}{2x^{\frac{1}{2}}(1+x^2)^2} < 0 \quad (9)$$

From formula (9), we can see that P_2^* is a decreasing function of x , namely with the increase of x , P_2^* decreases. Then we solve the limit value of P_2^* , when x is close to 1 or $+\infty$ separately. The results are as follows:

$$\lim_{x \rightarrow 1} P_2^* = \lim_{x \rightarrow 1} \frac{1}{1+x^2} = 0.5, \lim_{x \rightarrow +\infty} P_2^* = \lim_{x \rightarrow +\infty} \frac{1}{1+x^2} = 0 \quad (10)$$

It means that when the urban-rural income gap approaches zero gradually, the share of urban population with the maximum of income inequality will approach 50%; on the contrary, when the urban-rural income gap approaches zero infinite, the share of urban population with the maximum of income inequality will approach 0.

In summary, under the condition of the constant urban-rural gap, the income inequality will increase, and after turning point decline, which give rise to an inverted-U curve. At the same time, with the increase of the urban-rural income inequality the entire inverted-U curve will shift upward, the share of the urban population of the maximum of income inequality will decrease gradually, which means the inverted-U curve will shift to top-left corner.

2.2 Simulative test of the model

Now we use some data to make simulative test of some conclusions from the theoretical analysis. First, we calculate the pair value of the share of the urban population and income inequality, when the urban-rural gap(x) equals to 1.5, 2, 2.5, 3, 3.5, 4, 5 and 10, which is shown in figure 3:

Clearly shows that with the increase of the share of the urban population, the income inequality caused by the urbanization follow an inverted-U pattern. At the same time, as the urban-rural income inequality increases, the inverted-U curve will shift to up-left corner. According to formulae (6) and (7), we calculate the maximum of the

income inequality caused by the urbanization, and the corresponding share of urban population(in table 1).

From the table 1, we can see that with the increase of urban-rural income gap, the maximum of income inequality caused by urbanization will increase and the corresponding share of urban population will decrease, which proves the conclusion from theoretical analysis. we calculate the China's urban-rural income gap from 1978—2005 by the data of disposable income of urban residents and net income of rural residents. By using formula (6), we further calculate the share of urban population with the maximum of income inequality caused by urbanization which is corresponding with each year's urban-rural gap, and compare it with the share of urban population of each year(in figure 4).

Figure 4 shows that since 2001 the share of China's urban population has gone beyond the share of urban population of the maximum of income inequality. The above phenomenon means that in China, after 2001 the income inequality caused by the urbanization has entered the decline stage. Because of the large urban-rural income gap, the income inequality caused by the urbanization is main part of the income inequality of the total residents, and its share in total inequality is more than 50%(Chen Zongsheng, Zhou Yunbo, 2002). In addition, in China the income inequality inside the urban area is larger than that of the rural area, the population migration from the urban area to the rural area means the share of population with large inequality in total population decline, and the share of the population with small inequality in total

population increase, so the income inequality of the total population will decrease. Thus the urbanization will lessen the income inequality of the total residents from two angles: on one hand, the income inequality caused by the urbanization has entered the decline stage; on the other hand, the urbanization makes the share of the population with large inequality decline, and the share of the population with small inequality increase. Then, the following hypotheses are put forward.

Hypothesis 1: Since the Reform and Opening-up, income inequality inside urban area and rural area increases quickly, they don't give rise to the inverted-U curve, but the change of the income inequality of the total residents maybe supports the Kuznets inverted-U hypothesis.

Hypothesis 2: If hypothesis 1 is proved, the urbanization is the main cause which makes the change of the income inequality of the total residents follows the inverted-U pattern.

III. Empirical Test of the Impact of urbanization on Income Inequality of China's Total Residents

3.1 Econometric model and the data

In this part, we will make the empirical test for above two hypotheses. Because the time-series data from 1978 to 2005 is used in this paper, the shortcoming from the cross-section data can be shunned. The empirical model is as follows:

$$G = \beta_0 + \beta_1 RJGDP + \beta_2 RJGDP^2 + \beta_3 UPHARE + \beta_4 UPHARE^2 + \beta_5 URGAP + \beta_6 X + \mu \quad (11)$$

Where G is GINI coefficient of the income of the total residents. The independent variables totally include four groups: $RJGDP$ is Per Capita GDP and $RJGDP^2$ is its square, which will be used to test the Kuznets inverted-U hypothesis (namely hypothesis 1). $UPHARE$ is the share of urban population and $UPHARE^2$ is its square, which will be used to test the impact of urbanization on the income inequality of the total residents (namely hypothesis 2). $URGAP$ is the ratio between the disposable income of urban residents and net income of rural residents, which will be used to test the impact of urban-rural income gap on the income inequality of the total residents. X is control variables, including a dummy variable to test the influence of the transfer of the reform emphasis from rural area to urban area after 1984, it is 0 from 1978 to 1983 and is 1 after 1984; at the same time, the inflation rate and the dependence degree of the foreign trade are also included in the control variable to test the impact of macroeconomic fluctuation and opening-up on income inequality of the total residents.

All the data in this paper comes from China Statistical Yearbook from 1979 to 2006. The GINI coefficient of the total residents is calculated from the GINI coefficient of the urban and rural residents by the “urban/rural weighted method”¹. While the GINI

¹ This method is proposed by Sundrum(1990), and the detailed calculation procedure is shown in “Income Distribution during System Reform and Economic Development in China ” published by Nova Science Publishers, Inc. (Chen Zongsheng, Yunbo Zhou, 2002). In the process of calculating GINI coefficient of the total residents, the difficulty of the methodology is how to combine the income inequality inside urban and rural area with the urban-

coefficient of the urban and rural residents is calculated from grouped income data of urban and rural residents in China Statistical Yearbook. These data was adjusted by some methods(Chen Zongsheng, Yunbo Zhou,2002). Per capita GDP is calculated according to 1978's fixed price. The share of urban population is directly from the data of China Statistical Yearbook. The ratio between urban income and rural income is the ratio between urban per capita disposable income and the rural per capita net income². The per capita disposable income of the urban residents is the incomes which can be used for the final consumption expenditure, other non-duty expenditure and savings. It is the balance that the income tax, the social security expenditure and the subsidy for accounting are deducted from the total income. The per capita net income of the rural residents is the balance that the expenditure of all kinds of tax, the expenditure of the household business, depreciation of the productive fixed assets, the subsidy for accounting and the donated income for the relatives and friends are deducted from the total income. It can be used for the living expenditure, the reproduction input, savings and all kinds of non-duty expenditure. Therefore the per capita disposable income of the urban residents and the per capita net income of the rural residents are consistent. Moreover, the inflation rate is the consumer price index, and the degree of dependence on foreign trade is the ratio between the total amount of the imports plus exports and GDP. The statistical characteristics of these variables are shown in Table 2.

rural gap. This problem is solved by the urban/rural weighted method.

Because the statistical calibers of some statistical indexes have changed during the period of our research, some necessary adjustments were made accordingly when we use these indexes. Totally speaking, the data of each year is comparable.

² Because the statistical calibers of some statistical indexes have changed during the period of our research, some necessary adjustments were made accordingly when we use these indexes. Totally speaking, the data of each year is comparable.

3.2 The Empirical Results

The OLS estimation are used in this paper. Because of serious multi-colinearity between the GDP Per Capita and the share of urban population³, as well as between the inflation rate and the degree of dependence on foreign trade. They are estimated separately in above models, and the detailed results being shown in Table 3 as model 1,2,3,4. Moreover, as all the data in this paper are time-series, and ADF tests show that all the variables is I(1). For guaranteeing the reliability of the OLS estimation, ADF tests of the residuals of each model are made. The results show that the residuals of all models are highly stable, and accordingly the results of each model are credible.

From table 3, the following conclusions can be drawn.

1. The estimated coefficients of the per capita GDP and its square are both highly significant in model 1 and 2. The quadratic term of per capita GDP is negative, and it means that since 1978 the relationship between income inequality of the total residents and economic development gives rise to an Inverted-U pattern, so the hypothesis 1 is proved.

2. In model 3 and model 4, the estimated coefficients of the share of urban population and its square are also highly significant, so the hypothesis 2 is proved. It means urbanization has begun to decrease income inequality of the total residents. However, the estimated coefficient of quadratic term of the share of urban population is very small, which means its effect is still small.

³ The correlation coefficient between GDP and the share of urban population is 0.9884. Because of the high correlation between these two variables, some researchers usually make the share of urban population as an index to measure the economic development level, and according to this they get the inverted-U relationship between economic development and income inequality.

3. In the model 1-4, the estimated coefficients of the urban-rural income gap are highly significant and big enough, which means that the influence of the urban-rural income gap is very obvious. If the ratio between urban per capita disposable income and the rural per capita net income increases by 1, the GINI coefficient of the total residents will increase by 0.08—0.09.

4. In the model 1-4, the estimated coefficients of dummy variable are significant so it means that the influence of the transfer of the reform emphasis from rural area to urban area has an obvious influence on the increase of income inequality of the total residents. The GINI coefficient increases by about 0.003-0.016. Macroeconomic fluctuation and opening-up also have some effect on income inequality of the total resident, but is very small, so they aren't discussed in this paper.

Generally speaking, the econometric results show that since the reform and opening-up, with economic development, the change of income inequality of the total residents gives rises to the inverted-U pattern. Namely the Kuznets's inverted-U hypothesis is supported. The main causes that result in the inverted-U pattern of the change of income inequality of the total residents are the urbanization. On the one hand, after 2001 the income inequality caused by the urbanization has entered the decline stage; on the other hand, the urbanization makes the share of the population with large inequality decline, and the share of the population with small inequality increase. Then the urbanization makes the change of the income inequality of the total residents give rise to Kuznets's inverted-U curve, which is important to constitute policies about income distribution in the future.

IV. The Main Conclusions and Policy Implication

From former analysis, it can be concluded that because of the urbanization the relationship between the income inequality of the total residents and economic development in China follows the Inverted-U hypothesis. In addition, the enlargement of urban-rural income gap and the transfer of the reform emphasis from rural area to urban promote the increase of the income inequality of the total residents. Therefore, in the future the policies for decreasing the income inequality of the total residents are as follows.

1. The barrier which hinders the population migration from the rural area to the urban area must be broken to promote the uniform labor market in the whole country and the urbanization must be accelerated. Concretely: the household registration system which partitions the labor market must be abolished gradually; the urbanization in rural area should be propelled etc..

- 2 The income of the residents must be improved and the urban-rural income gap must be decreased. Concretely, the government should increase the investment in the education of the rural area, especially the professional and technical education to improve the quality of the rural labor; the agricultural technology, especially the agricultural biologic technology should be popularized to improve the agricultural productivity; the infrastructure in the rural area such as road, bridge, electric power, irrigation must be perfected further; some agricultural product with high added value should be encouraged to plant; the private and town-village ownership enterprises

should be developed greatly to increase the non-farm incomes of the rural residents and
so on.

Chapter 2

The Main Factors Influencing Income Inequality of Urban Residents in China —An Analysis from the Aspect of Population Characteristic Based on Residents’

Data in Tianjin

1. Introduction

From the end of 1980s, the per capita disposable income of urban residents in China has increased dramatically, from 1166.03 Yuan in 1988 to 7278.75 Yuan in 2003, 2.45 times in terms of comparable price, at a growth rate of 6.17% per year. Accompanying a rapid income growth, the income inequality of urban residents has enlarged quickly, represented by an increase of Gini Coefficient from 0.23068 to 0.39196, the latter figure 1.7 times higher than the former one, at a growth rate of 3.6% every year, faster than that of rural residents' income inequality. (Please refer to table 1 for details)

Similar to the condition national wide, the income distribution inequality of urban residents in Tianjin has widened continuously. Indicated by data of per capita GDP, the annual growth rate of economy in Tianjin has maintained to be over 10% from 1988 to 2003, and in the meantime, the per capita disposable income of its urban residents has risen from 1329.7 Yuan to 10312.91 Yuan, with an annual growth rate of 6% after inflation rate was considered and deduced. Meanwhile, Gini Coefficient shows that income inequality expanded from 0.23047 to 0.41243, a growth rate of 79% in total and 3.96% annually.

The enlargement of income inequality has become an undeniable problem that is attracting much attention from society. However the crucial part of this problem is what are the factors causing the amplification of income differences. Given the fact that China is experiencing the dual transition of economic

structure and economic system pattern, there are a number of factors influencing income inequality of urban residents, which can be undoubtedly divided into two categories: economy development and system reform. Some belongs to the first category, such as transformation of industrial structure and human resources' accumulation, and some others can be put into the second such as the development of non-public ownership economy, the reform of interior income distribution patterns in state-owned enterprises and state organs, etc. This research is devoted to the extent of these factors' influences on income inequality of national urban residents from the angle of population features. The materials used in this thesis are mainly from the database made by Investigating Team of Urban Society and Economy of Tianjin, collected from sampled households in 2004.

2. Analysis of Groups with Different Population Characteristic

First, we divide urban residents into groups according to population features and measure the income inequalities within group and between groups of different population features with Theil index. Below is the formula of decomposing Theil

Index :

$$T = \sum P_g \log(Y_g/Y) + \sum P_g \sum 1/N_g \log(Y_i/Y_g) \quad (1)$$

The first item in the formula denotes the inequality between groups; the second item suggests the inequality within groups; P_g represents the proportion of population of group g to the total population; Y_g indicates the average income of group g ; N_g tells the number of people in group g ; Y_i means the income of the person with a serial number of i ; Y equals to the average income of the whole population. Next we will decompose and analyze the problem according to the population features of gender, age, education background, employment property, industry, occupation or duty respectively.

2.1 Decomposition of Theil Index According to Gender

Replace the items of the formula above with the data, we obtain table 2 with the detailed calculated figures.

Table 2 suggests that generally speaking, income inequality within each group contributes the most part of income inequality, approximately 89.06%, and its complementary part, the income inequality between groups affects overall income inequality at a scale of 10.94%. To put it specifically, the contribution rate of income inequality within men's group to income differences as a whole is 45.96%, the women's group 43.10%, the former 2.86 points higher than the latter. But a close scrutiny finds that the income inequality within men's group is less

obvious than that of women's group as the number indicates, and actually, men's higher contribution compared with women's can be attributed to the fact that population of male out-weights female. In other words, the problem of women's income inequality is graver than men's among national urban residents, in view of inequality extent.

2.2 Decomposition of Theil Index According to Age Features

Please refer to table 3 for details. It can be concluded that roughly, the total contribution rate of income inequality within each group exceeds 90%, and contribution rate between groups is less than 10%. Further analysis reveals that the population between 30 to 60 years old contributes more than 60% to overall income inequality, the highest rate among the other groups, the cause of which lies with their social roles: this group constitutes the majority of labor forces and it is their incomes that urban families rely upon. Different education backgrounds, industries, occupations or duties can explain their relatively larger income inequality, and further more, their higher contribution rate to the whole urban population's income inequality. The income of the population above 60 years old is lower, relatively simpler in structure and not prone to show sharp contrasts in that this population is consisted of elder people who are retired or have no fixed income, so they contribute little to income inequality although their number occupies a considerable proportion in urban population, namely, about 25%. The

population below 20 years old contributes less than 1%, little to overall income inequality as well because of its small proportion among the total population, namely, 0.8%, in spite of the dramatic income inequality within group.

2.3 Decomposition of Theil Index According to Education Features

Please refer to table 4 for detailed calculations. Taken as a whole, income inequality within and between groups contribute 80.10% and 19.90% to the overall condition respectively, with a tremendous increase of income inequality between groups compared with the situation of 1988 and 1998. This is suggesting a rapidly widening gap among the income of urban citizens with different education backgrounds.

A further analysis shows that the first five big contributors to urban residents' income inequality are population with the education backgrounds of junior high school, senior high school, junior college, technical secondary school and undergraduate, displaying 22.39,19.89,10.75,10.26 and 6.56 percentage respectively, adding up to 70% approximately. This phenomenon can be explained by the Nine Years Compulsory Education System carried out in China, which enables the majority of the citizens to finish their education at junior high school level or above. Meanwhile, part of urban citizens are able to complete their junior college or even undergraduate education by passing college entrance examination or self-teaching examination. Therefore, the people who have received compulsory education or above constitute the main part of urban residents and in addition, they are employed in industries and positions of wide range and sophisticate

structures, leading to large income inequality. In a word, they contribute a considerable amount to income inequality. On the contrary, the group of illiteracy or with elementary education, along with post-graduates and doctors, belong to the minority of the population, so they hardly account for income differences.

2.4 Decomposition of Theil Index According to Employment Property Features

As it is shown in table 5, the contribution rate of income inequality within group and between groups is 17.81% and 82.19% respectively, the latter lower compared with the figure of 1998.^① This is probably because along with the extension of income distribution reform in administrative units, state-owned enterprises and state organs, the increase of income inequality within these units surpasses the growth speed of inequality between these units and non-state-owned enterprises, especially foreign-capital corporations.

A detailed research on inequality within group will expose that (1) speaking of concrete number, the income inequality in state units such as administrative organs, state organs, state-owned enterprises and collective-owned enterprises is much less obvious than the inequality in non-state-owned units, including share-holding corporations, foreign-funded ventures, individual and private-owned organs. The fact can be explained through the existence of the so-called average distribution theory in state units, a traditional practice that is not eliminated. In the meantime, due to the

^① Income inequality between units of different ownerships contributes 18.61% to overall inequality measured by Theil Index in 1998. See Chen Zongsheng and Zhou Yunbo(2002), “*On Income Distribution During Reform and Development*”. Economic Science Press, pp.168.

slower reform speed in administrative and non-profit state units compared with that of state-owned enterprises, the intensity of income inequality within those units also shows positive correlativity. (2) Unemployed people make quickly expanding contribution that increases by less than 20% compared with 1998, to 37.21% ^①The reason lies with the rapid growth of unemployed workers' proportion due to the policy of laying-off, early retirement ahead of due time and inner retirement accompanying the strategic adjustment to economy and structure distribution and the expansion of inner reform in state-owned enterprises since 1998, which constitute a significant part of overall economy in Tianjin, a traditional industrial base. (3) Among the people employed, those working in state-owned enterprises make the greatest contribution to overall income inequality, namely, 14.04%, because the city has a relatively larger proportion of state-owned enterprises providing jobs to a great number of citizens. (4) Recently, individual and private proprietorship have been developing rapidly, offering more vacancies than ever before, and this explains the total 15.48% contribution made by working staff of these two kinds of ownership enterprises, and this figure is next to that of state-owned ones, over 10 points higher than their proportion of 4.7 percentage in 1998.

2.5 Decomposition of Theil Index According to Industry Features

^① Income inequality of unemployed people contributes 9.18% to overall income inequality, measured by Theil Index in 1998. See Chen Zongsheng and Zhou Yunbo(2002), "*On Income Distribution during Reform and Development*", Economic Science Press, pp.168.

With the economic development and improvement of industry structure, some traditional industries are doomed to abandoned, and some new industries representing future grow rapidly, inevitably bringing income changes in each industry. Hence, the industry features stand out to be an important factor influencing urban residents' income during the transformation to market economy. Table 6 tells that income inequality within group and between groups contributes 82.11% and 17.89% to the city's residents' income differences respectively, and in relation to 1998, the contribution rate between groups reduces by 4.5%. Put it in another word, the increase of income inequality between industries falls behind the growth of income inequality within the same industry. This is probably because one the one hand, income inequality between industries caused by administrative monopoly decreases owe to execution of market economy system reform and a complete opening of various economy areas. One the other hand, with the implementation of inner reform of systems and patterns within each organization, some income distribution practices with equalitarianism are removed, leading to a quick growth of income inequality within each group.

For the inequality within group, the first point we should pay attention to is that the unemployed people contribute 37.60%, the most part to overall income inequality, and as the reason was mentioned before, repetition is not necessary. The second, employees in the field of manufacturing contribute the second largest proportion, as much as 13.03%. It can be inferred as the result of Tianjin's status in China, namely, a traditional industrial base with a strong manufacturing

foundation. And meanwhile, following the development strategy set for Tianjin to be the largest manufacturing base in China, it has been inviting foreign capital and prompting the inflow of foreign-capital enterprises, and new light spot of economy growth is formed in Bohai Coastal Areas. Both of the two factors encourage the rapid increase of income inequality in manufacturing field. The third, the working staff in wholesale, retail trade and restaurants make a contribution of 9.21%, and the employees for social services contribute 4.65%, behind the proportion of manufacturing industry. Their high contribution rate is due to the fact that traditional areas of services constitute the majority of tertiary industry in Tianjin, offering most employment opportunities in this industry. The last to be noted lies with the small contribution by areas of modern services including banking, portfolio, insurance, telecommunication, computer and software services, scientific researches, poly-technical services, a problem goes with backwardness in those fields in Tianjin.

2.6 Decomposition of Theil Index According to Occupation or Duty Features

Different occupations or duties play important roles in the formation of income levels. The income differences along the hierarchy of occupations enlarged these years following the expansion of income distribution reform in urban areas. The calculation in table 7 reveals the contribution rate of 79.86% within group and 20.14% between groups. Compared with the situation in 1998, contribution rate increases by more than one time. It should be noticed that the fact of a higher

income inequality between occupations or duties than that between industries is slightly different from conclusion made before. (Huang Zongsheng, Zhouyun Bo: 2001)

Further analysis of income inequality brings two points worth noting: the first, workers in production and office or management staffs, the majority of employers in all kinds of industries in urban areas, contribute 20.55% and 9.94% to income inequality of urban residents respectively, a total of over 30% to put them together; the second, junior technical personnel contribute 3.45%, higher than division or section chiefs' contribution rate of 2.51% and senior technical personnel's contribution rate of 1.62%, because the population of the two latter is relatively smaller.

3. Decomposition in Light of Population Characteristic

We have divided urban population according to different population features into groups using Theil Index and analyzed the contribution rate within group and between groups in relation to each population characteristic. As a conclusion of the previous researches, we have discussed the influences of reform and economic development on income inequality of national urban residents. Next, we will mainly concentrate on the contribution of each population characteristic to income differences following the guidance of decomposition methodology of Ranis-Fei Model.

3.1 Basic Method of Decomposition

The equation is as follows:

$$G = \Phi_1 R_1 G_1 + \Phi_2 R_2 G_2 + \dots + \Phi_i R_i G_i + \dots + \Delta \quad I=1,2,\dots \quad (2)$$

Hereinto, R_i is the characteristic-income correlative coefficient of characteristic i , which measures the correlative degree between the population characteristic i of urban residents and personal income. G_i is the Gini coefficient of each characteristic, which expresses the degree of inequality of the population characteristic i . Φ_i is the revenue weight of each population characteristic, which tells the proportion of the income rate of population characteristic i in the average income of a person or a family. Δ is the rank-weighted error term.

The formula of calculating Φ_i in the above equation is as follows as this item is relatively sophisticated to decompose.

$$\Phi_i = a_i \times (X_i^* / Y^*) \quad (3)$$

In the formula above, a_i represents the income rate of each population characteristic, X_i^* denotes the characteristic's average value, Y^* means average personal income. In order to obtain the revenue weight of each population characteristic, we need to calculate the income rate of each population characteristic.

3.2 The Income Rate of Each Population Characteristic of Urban Residents

The income rate of population characteristic equals to the proportion of contribution by individual characteristic of urban residents to personal income. In other words, it means the increase or decrease amount of urban residents' income if a certain characteristic factor of a certain unit is altered, with the other variables unchanged. Below is the formula of calculating the income rate of each population characteristic on the basis of multi-regression method:

$$Y=a_0+ a_1X_1+\dots+a_iX_i\dots+a_nX_n+\Delta \quad (4)$$

Hereinto, Y is the per capita income; X_i is the explaining variable, namely the population characteristic; n is the number of explaining variables; Δ is the random error; a_i is regression coefficient, which represents the income rate of population characteristic. The purpose of multi-regression is to estimate the regression coefficient of each explaining variable. Obviously, we cannot take all the population characteristics of urban residents as variables into a regression equation, so we only pick up some of them. The principles for choice are: (1) strongly integrated; (2) strong ability of explication; (3) simple meanings; (4) no correlativity among the variables to the greatest extent, so we can avoid multi-linearity of regression equation. By several choices with multi-regressions, we choose gender, age, industry, occupation and duty as well as education as the

variables to measure the income rate of each population characteristic, and the results are shown as follows after related data is put into the formula above:

It is clear in the table that (1) the income rate of occupation or duty is the highest, to put it in another word, individual's income per month will increase 240 Yuan, when he moves up to one higher income group with just one grade;(2) gender stands next, namely men's income per month is 175 Yuan higher than women's income on average;(3) the third is education, specifically, for every additional year of education, income of every month will increase approximately 40 Yuan;(4) industry is located in the fourth position, namely income per month would increase 28 Yuan when a person shifts to one higher income group with just one grade; (5) the last is age, which means a monthly income increase of 11 Yuan by every additional year in age.

3.3 Extent of Each Population Characteristic's Impact on Income Inequality of Urban Residents

The revenue weight of population characteristics Φ_i can be figured out based on formula (3), with the calculation results of income rate of population characteristics. And characteristic-income correlative coefficient R_i and the Gini coefficient of each characteristic G_i can be obtained without difficulties. Therefore, we come up with the calculations shown in table 9 focusing on the impact of each population characteristic of urban residents and all the characteristics as a whole on the income inequality:

An analysis of the table reveals five points to be noticed:

(1) Generally speaking, 43.53% of urban residents' overall income inequality in Tianjin can be explained by the following five factors: gender, age, education, industry and occupation or duty. Simply put, the explanation is sound and reasonable in that over 40% of total income inequality is the consequence of one of the five causes.

(2) As a result of the implementation of income distribution reform in state administrative units or organs and state-owned enterprises, occupation or duty features have surpassed industry features to be the biggest contributor to income differences among urban residents in China, reaching 24.52%.

(3) Education background makes the second largest contribution to overall income inequality, as much as 9.55%. This can be interpreted as the upwardness of education's status in influencing national urban residents' income levels. The increase of education's contribution rate reflects a climbing of return-rate for knowledge due to income distribution reform and additional attention society pays to knowledge and education.

(4) The third largest contributor to income differences is industry, and the rate is 6.62%. Its influence pattern on income inequality lies with the fact that some new and high technology-demanded industries prosper while some traditional industries in lack of technological requisites retreat to marginal areas, accompanying the improving of industrial structures during economic

development, namely, science and technology development and changes occurring in consumption structures.

(5) The contribution rate of gender and age add up to less than 3%, a small proportion compared with the others.

In conclusion, occupation or duty, education and industry become the main three factors affecting income inequality of urban residents.

4 A brief Conclusion and Advices to Policy-Making

4.1 A Brief Conclusion

A brief conclusion based on the previous analysis is introduced as follows:

(1) The increase speed of urban residents' income differences in China have exceeded that of rural residents since the end of 1980s, and city inhabitants' income inequality is continuing to enlarge.

(2) Recently, the proportion of unemployed urban residents among total urban population shows an upward tendency. The contribution rate of unemployed people to total income inequality ranks first reaching over 37%, no matter the categorization and calculation are conducted with occupation or duty features, industry features, employment property features,

(3) Among people who are employed, in terms of employment propriety, those working for governmental administrative units or state organs and state-owned

enterprises, due to their large population, make the biggest contribution to total income inequality; from the aspects of industry features, employees in manufacturing industry rank first in their contribution to total income inequality, working staffs of traditional services covering wholesale, retail trade, restaurants and social services the second, and the contribution rate of modern services such as banking, insurance, portfolio, telecommunication, computer and software services, scientific researches, technique services is small; in view of occupation or duty features, workers in production, common management or office staffs are the biggest factor influencing total income inequality, making a contribution rate of about 30%.

(4) Quantitative research tells that the main three factors affecting income inequality lies with occupation or duty, education and industry, which explain over 40% of income inequality problems among urban residents. To put it specifically, owe to the income distribution reform in governmental or state organizations and state-owned enterprises, occupation or duty features have surpassed industry features, ranking first in the order of essential contributors, with a record of 24.52%; education background is the second biggest factor, contributing 9.55% to income inequality; the last is industry characteristic with a contribution rate of 6.62%.

4.2 Advices to Policy-Making

In view of the steady enlargement of urban residents' income inequality recently, an

overriding principle of adjusting income distribution should be “Controlling Two Ends of Income Ranks, and Increasing the Number of Residents with Intermediate Income”. In other words, a diamond-shaped income distribution system should be established by improving the condition of low-income residents and limiting the expansion of high-income stratum, and finally, enlarging the group in between. Below are the specific practices to this orientation:

(1) We should improve the social welfare system and raise the minimum living standard and standard of unemployment insurance in urban areas to increase the earnings of low-income stratum.

(2) The growth of individual entrepreneurs or private economy and labor-intensive industries should be encouraged to provide more opportunities of employment for those unemployed in all kinds of channels and on various levels.

(3) We should promote the development of vocational education and education of adults, and by establishing lifelong learning system, urging employees to continue learning after graduation and increasing the revenue rate of higher education, meet the needs of a study-oriented society where lifelong education system is established.

(4) An extra-expansion of high-income social class should be restrained, the implementation of which depends upon punishing the practices of grasping abnormal or even illegal incomes by taking advantage of resources controlled by

those high-income strata unduly. In addition, tax of luxury can be imposed so that more resources can be introduced into productive investment fields and more working opportunities can be provided.

(5) We can also help to form a middle-income social class by boosting modern service industry such as banking, insurance or portfolio services and telecommunication, computer, software or technique services and scientific researches.

Chapter 3

Education and Environment

---Dilemma between economic growth and environment in China

1. Introduction

Since economic reform and opening up to the world, China has achieved rapid economic growth, industrialization, and urbanization. Annual GDP growth rate is more than 8%. But at the same time, lack of property protection and lower proportion resource investment on human capital, people no incentive to prove technology; few original, creative men would like to stay in China and the natural resources that such growth demands and the environmental pressures it brings have raised grave concerns about the long-term sustainability and hidden costs of growth. Harmonious society and green GDP are the government targets. But they did not make the specific strategy plan to achieve this target.

History reason, they still think physical capital investment is the most important factor for economic growth. Roughly 30% of its GDP is devoted to physical investment. Only 2.5% of its GDP on investment is in schooling (Heckman [2002]). Industry investment share is very high compare to other countries. It results huge pressure on environment. The World Bank uses people's willingness to pay to avoid mortality risks method to calculate China damage cost of pollution. It shows the cost is more than 5.7% of its GDP. This number only includes directly health damage. Consider some other damages such as losses from soil erosion, traffic congestion, noise, global warming, deplete water resource etc, the number is higher than this. If we compare this to the GDP growth rate, we know the real "green GDP" growth rate is flat.

Currently policies just go to two wrong directions. Higher share of physical investment

on industry ignores the pollution spillover effects and lower share on human capital investment ignores the benefit bestowed by the investor. Government only care about physical “building”, “road” stock, ignore the investment return, externality cost, and long-run sustainable economic growth. The first reason is that there is under investment in human capital because potential investors cannot legally be guaranteed its return in the future and even government does not encourage people investment in human capital. The second reason is no enforcement to protect intellectual property right, people does not respect knowledge, people no incentive to investment in invention and research. The third reason is investing in physical capital has more chance to get “bribe”.

On the demand side, school tuition fees are very high, especially university fees. Ordinary rural citizen’s income cannot support the tuition fees. And even worse, the skills they get from university do not response the market requirement. Students have no freedom to choose their major or change their major. Most of them have already made the major decision in high school. Even they get higher degree, cannot guarantee to find a job in the future job market. So, people prefer short time return from labor market to taking the risk going to university.

Most of economists think education is the best way to solve poverty and income inequality, China is among the highest income inequality countries, since government decentralization process, local rural government has no resource to investment in education. In rural area, they suffer poverty, pollution, and lower level education.

The following will arrange as this, section 2 discusses literature review; section 3

discusses methodology and shows the regression of China economic growth; section 4 gives some suggestions; and section 5 is the conclusion.

2. Literature Review

Before 1950s, growth theory focuses on natural resource, physical capital and labor. Most of economists believe that physical capital was the most important factor of economic growth. Solow [1957] observed that only capital and labor can not explain the economic growth in the United States. Becker [1962, 1964] suggests that the rate of return on investment in human capital is higher than in physical capital in the United States. Mincer [1958] explains log wage and the number of years S of schooling using cross section data. The regression coefficient of S is positive. At the same time, Japan's rapid economic recovery and growth prove the importance of human capital from macro side. Grossman [1972] suggests that higher educated people have productive and allocative effect for health production, which will increase productive time and utility. Lucas [1988] suggests that the accumulation of human capital has an external effect. If other people have accumulated human capital, I will be more productive for any given amount of human capital.

Increasing human capital investment not only increases productivity directly, it also increases the knowledge about evaluating health risks, about identifying pollution sources, about estimating abatement costs, about setting enforcement priorities, about designing cost-effective regulatory instruments, about rearrange resource effectively,

and increases the consumer's utility standard. For example, pollution has adverse effects on others, but the polluter typically does not have to compensate them. When such spillover effects, or externalities, occur, the cost of pollution to society is greater than the cost to the polluter. There is then too much pollution because individuals and firms do not have the right incentives to reduce it. And human capital also improves the adaptability and allocative efficiency of resources in society. Since China joined the World Trade Organization, foreign direct investment increased very quickly. The new technology being brought into China by its investment in physical capital requires more skilled workers to operate it. Capital and skill are complementary. Each factor raises the productivity of the other. That requires government invests more resource in human capital.

3. Methodology

According to augmentation of the Solow [1957] growth accounting model, GDP growth relate with its capital, labor and technology. Since pollution is the by-product of the growth. We can think it is also relation with its input factor. So, we have implied relationship between GDP and emission $g(G,E)=f(K,L,H)$. Here we assume the technology is the accumulated graduated students. Solve this implied function, we get the production function of $G=F(K,L,A,E)$. For the analyses reason, we assume this is augment Cobb-Douglas function

$$G = F(A, K, L, H, E) = AK^\alpha L^\beta H^\lambda E^\mu$$

$$\ln G = \ln A + \alpha \ln K + \beta \ln L + \lambda \ln H + \mu \ln E$$

From Table 1,

Regression, we get the following result:(Table 2).

$$\ln(G) = -5.77 + 1.202 \ln(K) + 0.329 \ln(L) - 0.202 \ln(H) - 0.084 \ln(E)$$

Durbin-Waston D=0.4728

1% level D=0.83

$D < 0.83$, so, we get the conclusion, the error term has positive correlation.

We do two-stage Durbin process(Table3):

$$\ln(G) = -0.60874 - 0.1655 \ln(K) - 0.21602 \ln(L) + 0.147437 \ln(H) + 0.354436 \ln(E)$$

$$+ 1.031131 \ln(G^{-1}) - 0.00787 \ln(K^{-1}) + 0.36636 \ln(L^{-1}) - 0.09068 \ln(H^{-1}) - 0.31081 \ln(E^{-1})$$

Since the coefficient of $\ln(G^{-1})$ is 1.031131, Here we have Unit Root.

We do regression on difference.

And get the table 4 result

$$D=1.6681>1.52$$

$$(d^u(25,4,0.01)=1.52)$$

Negative sign of $\ln(L)$ means, in China they have redundant labor force, this is consistent with our previous study [yanqin2007], to keep society stable, government has to control state owned enterprise lower employment rate. Negative sign of $\ln(K)$ means in China, industry share is very high, investment in physical capital is wrong direction. Higher positive of $\ln(H)$ means education is very important for economic growth. Unfortunately, we have very high $\ln(E)$, means, pollution by-product will continue contribute higher share for economic growth and currently is the main factor of

economic growth.

4. Suggestions and Conclusion

From above analysis, we know if China plans to make a harmonious society, achieves its GDP target and control “environment”, the only way is increasing human capital investment to support China’s sustainable and green growth. History reason, China follows Karl Marx theory on socialist. All properties belong to government, but as the economic growing, externalities effects grow quickly. Without clearly property right, it is very difficult to prove public environment. So, property privatization is very important in China now.

Control car market. Free market will make car demand and supply increase very quickly in the future. But China’s land resource and oil reserve are scarce. They constrain the development. Consider the pollution cost, congestion, and noise. It becomes more and more important for control the car market. They should use “One Family, One Car” regulate people behavior.

Cancel “Urban-Rural Citizen” control system, making rural citizens’ children have the chance to go to school. China’s faster urbanization speed will continue in the future, but there are more than 100 million rural citizens still have no chance to register their children to school. That is big mistake policy. A huge number of children lost the chance. Government should guarantee at least children are equal to register even their

parent come from rural area. Government can think investment more on Internet and television system. That is cheap and it can guarantee higher quality especially in rural area without enough educated people volunteer to teach.

Change industry structure from heavy industry to service and high-technology industry.

Use energy more efficient.

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Chapter 1

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Tables and Figures

Chapter 1:

Table 1 The maximum of GINI coefficient (G^*) and the

corresponding share of urban population (P_2^*)

x	G^*	P_2^* (%)
1.00	0.00000	50.00
1.50	0.10102	44.95
2.00	0.17157	41.42
2.50	0.22515	38.74
3.00	0.26795	36.60
3.50	0.30334	34.83
4.00	0.33333	33.33
5.00	0.38197	30.90
10.00	0.51949	24.03

Source: calculated by the authors.

Table 2 The Statistical Characteristics of Main Variables

	Average	Standard deviation	Minimum	Maximum
GINI	0.35797	0.06423	0.25310	0.46785
Per capita	1356.97	877.94	381.00	3348.61
GDP (Yuan)				
Share of urban	28.67	7.25	17.92	42.99
population (%)				
Ratio of urban and	2.50	0.44	1.70	3.23
rural income				
Inflation rate (%)	5.86	6.76	-1.40	24.10
Degree of dependence	30.60	13.91	63.86	9.74
on foreign				
trade (%)				

Source: Calculated by the authors according to China Statistical Yearbook 1978-2006.

Table 3 Model (10) OLS estimation results and test

Variable	Model 1	Model 2
Constant	0.0748 ^{***}	-0.11182 ^{***}
	(11.054)	(-6.6681)
GDP Per Capita(100 Yuan)	0.005652	—
	(9.75177)	
The square of GDP Per Capita	-0.0000953 ^{9*}	—
	*	
	(-6.1612)	
Share of urban population (%)	—	0.01260 ^{***}
		(10.8829)
The square of share of urban population	—	-0.00015 ^{***}
		(-8.37176)
The rate between urban and rural income	0.08235	0.09275 ^{***}
	(23.50834)	(34.6397)
Share of exports and imports in GDP (%)	0.000486 ^{**}	0.000232 ^{**}
	(2.389566)	(1.77402)
Time intercept variable	0.013873	0.003809 ^{***}
	(3.487938)	(1.223482)
Equation appraisal	overall A-R ² =0.9961	A-R ² =0.9979
	F=1371.908	F=2684.13

Source: China statistical yearbook 1978--2006.

Chapter 2

Table 1 the changes of urban and rural residents' income and income inequality in

China from 1988 to 2003

Year	National Urban Residents		Urban Residents in Tianjin		Gini Coefficient of National Rural Residents' Income Inequality
	Gini Coefficient of Income Inequality	Per Capita Disposable Income (RMB)	Gini Coefficient of Income Inequality	Controllable Per Capita Income (RMB)	
1988	0.23068	1166.03	0.23047	1329.70	0.30285
1993	0.27244	2453.38	0.29543	2769.26	0.31812
1998	0.32303	5148.81	0.34431	7110.54	0.34097
2003	0.39196	7278.75	0.41243	10312.91	0.41044
Average	3.60	6.17	3.96	6.0	2.05
Growth Rate (%)					

Source: calculated with the data in *Chinese Statistical Yearbook* .Gini Coefficients from 1988to 1998 come from Chen Zongsheng and Zhou Yunbo: “*On Income Distribution during Reform and Development-Does Social Polarization Appear in China?*” Economic Science Press.

Table 2 Calculated Theil Index and Its Components after Dividing the Urban

Population According to Gender Features

Gender	Components of Theil Index			Contribution Rate (%)
	T_i	$P_i (\%)$	$T_i \times P_i / 100$	
Inequality	0.5391	51.83	0.2794	45.96
within Men's				
Group Inequality	0.5439	48.17	0.2620	43.10
within				
Women's				
Group				
Sum of Inequality within Each Group			0.5414	89.06
Inequality between Groups			0.0665	10.94
Total			0.6079	100

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

Note: T_i denotes Theil Index of Inequality within groups not weighted; P_i represents the proportion of each group's population to the total .

Table 3 Calculated Theil Index and Its Components after Dividing the Urban

Population According to Age Features

Features of Age Order	Components of Theil Index			Contribution
	T_i	P_i (%)	$T_i \times P_i / 100$	Rate (%)
Below 20	0.7138	0.80	0.0057	0.96
21—30	0.4952	12.27	0.0608	10.29
31—40	0.6311	15.56	0.0982	16.63
41—50	0.5976	26.28	0.1571	26.58
51—60	0.5052	20.83	0.1052	17.81
Above 60	0.4661	24.26	0.1131	19.15
Sum of Inequality within Each Group			0.5400	91.42
Inequality between Groups			0.0507	8.58
Total			0.5907	100

Source: calculated with the data provided by Investigating Team of Urban Society and

Economy of Tianjin

Table 4 Calculated Theil Index and Its Components after Dividing the Urban Population According to Education Features

Features of Education Backgrounds	Components of Theil Index			Contribution Rate (%)
	T_i	$P_i (\%)$	$T_i \times P_i / 100$	
Doctoral Education	0.2941	0.09	0.0003	0.05
Post-graduate	0.3163	0.47	0.0015	0.26
Undergraduate	0.4153	9.01	0.0374	6.56
Junior College	0.4455	13.75	0.0613	10.75
Secondary Education	0.4290	13.64	0.0585	10.26
Senior High School	0.5342	21.23	0.1134	19.89
Junior High School	0.4509	28.32	0.1277	22.39
Elementary School	0.3176	8.55	0.0272	4.77
Illiteracy	0.5988	4.92	0.0295	5.17
Sum of Inequality within Group			0.4567	80.10
Inequality between Groups			0.1135	19.90
Total			0.5702	100

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

Table 5 Calculated Theil Index and Its Components after Dividing the Urban Population According to Employment Property Features

Employment Property	Theil Index			Contribution Rate (%)
	T_i	P_i (%)	$T_i \times P_i / 100$	
Unemployment	0.4909	45.14	0.2216	37.21
Administrative Units	0.3873	1.86	0.0072	1.21
State Organs	0.3424	7.71	0.0264	4.43
State-Owned Enterprises	0.4624	18.07	0.0836	14.04
Collective-Owned Enterprises	0.3943	1.81	0.0071	1.19
Joint-Stock Enterprises	0.5462	3.56	0.0194	3.26
Private Companies	0.5631	7.30	0.0411	6.90
Foreign-Capital Corporations	0.5148	4.18	0.0215	3.61
Individual Proprietor	0.6179	8.26	0.0511	8.58
Other Employment	0.4969	2.12	0.0105	1.76
Sum of Inequality within Group			0.4895	82.19
Inequality between Groups			0.1061	17.81
Total			0.5956	100

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

Table 6 Calculated Theil Index and Its Components

Industry Features	Components of Theil Index			Contribution Rate (%)
	T_i	P_i (%)	$T_i \times P_i$	
Unemployment	0.4909	45.14	0.2216	37.60
Farming, Forestry, Animal Husbandry and Fishery	0.4617	0.20	0.0009	0.15
Mining and Quarrying	0.5794	0.80	0.0047	0.78
Mining and Quarrying	0.4497	17.07	0.0768	13.03
Electricity, Gas and Water Production and Supply	0.3652	1.06	0.0039	0.66
Construction	0.6012	2.01	0.0121	2.05
Transport, Storage and Communications	0.4747	4.85	0.0230	3.90
Telecommunication, Computer and Software Services	0.4891	1.04	0.0051	0.87
Wholesale and Retail Trade, Restaurants	0.5613	9.68	0.0544	9.21
Banking, portfolio and Insurance	0.4284	1.06	0.0045	0.76
Real Estate	0.5769	0.95	0.0055	0.93
Lease and Commercial Services	0.4826	0.97	0.0047	0.80
Scientific Research and Poly technical Services	0.3671	0.69	0.0025	0.43
Water Conservancy, Environmental and Public Infrastructure Management	0.3876	1.02	0.0040	0.69
Social Services	0.5333	5.14	0.0274	4.65
Health Care, Sporting and Social Welfare	0.3806	2.01	0.0076	1.31
.Education, Culture and Arts, Radio and Television	0.3616	4.36	0.0158	2.68
Government Agencies, Party Agencies and Social Organizations	0.4851	1.95	0.0095	1.61
Sum of Inequality within Group			0.4838	82.11
Sum of Inequality between Groups			0.1054	17.89
Total			0.5892	100

Table 7 Calculated Theil Index and Its Components after Dividing the Urban

Population According to Occupation or Duty Features

Occupation and Duty	Theil Index			Contribution Rate (%)
	T_i	$P_i (\%)$	$T_i \times P_i / 100$	
Unemployment	0.4909	0.4514	0.2216	37.83
Division or Section	0.6205	0.0237	0.0147	2.51
Chief Senior Technical	0.4140	0.0230	0.0095	1.62
Personnel Junior Technical	0.3690	0.0547	0.0202	3.45
Personnel Office Staff and	0.4171	0.1395	0.0582	9.94
Management Staff Worker in	0.4430	0.2717	0.1204	20.55
Production Others	0.6456	0.0359	0.0232	3.96
Sum of Inequality within Group			0.4678	79.86
Inequality between Groups			0.1180	20.14
Total			0.5858	100

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

**Table 8 OLS Estimation of the Income Rate of Main Population
Characteristics of Urban Residents**

Income	Constant	Gender	Age	Education	Industry	Duty
Y	C ₀	a ₁	a ₂	a ₃	a ₄	a ₅
	-903.72	175.37	11.00	39.43	27.53	
	240.12	(-19.64)	(9.42)	(7.34)	(16.22)	(8.02)
	(26.28)					
R²=0.35 F=694						

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

Note: The figures in the brackets are T-statistics of related regression coefficient

Table 9 Contribution of Each Population Characteristic of Urban Residents on

Individual Characteristics	Income Inequality				Contribution Quantum of Each Characteristic to Gini Coefficient Explained
	Φ_i	R_i	G_i	$R_i \times G_i \times \Phi_i$	
Gender	0.2963	0.1934	0.1673	0.0096	2.33%
Age	0.5894	0.0174	0.2067	0.0021	0.51%
Education	0.4677	0.3879	0.2173	0.0394	9.55%
Industry	0.1162	0.4267	0.5513	0.0273	6.62%
Occupation or Duty	0.5555	0.5136	0.3544	0.1011	24.52%
Gini Coefficient Explained				0.1795	
Rate of Explanation (%)				43.53%	43.53%
Gini Coefficient not Explained				0.2329	
Rate of un-explanation				56.47%	56.47%
Total				0.4124	100%

Source: calculated with the data provided by Investigating Team of Urban Society and Economy of Tianjin

Chapter 3, Table 1 1980---2005 Data

Year	GDP	Capital	Labor	Human Capital	CO ² Emission
1980	4203.956	16438	42361	39.7	1,454.65
1981	4425.026	19948.3	43725	53.7	1,420.86
1982	4823.677	23531.5	45295	99.4	1,489.07
1983	5349.172	27362.1	46436	132.9	1,577.13
1984	6160.97	31556.6	48197	161.6	1,707.91
1985	6990.889	36385.9	49873	193.2	1,838.47
1986	7610.61	41841.3	51282	232.5	1,949.68
1987	8491.266	47686.2	52783	285.7	2,080.20
1988	9448.029	54165.1	54334	341	2,216.30
1989	9832.183	61327.4	55329	398.6	2,241.97
1990	10209.09	68571.5	64749	460	2,241.19
1991	11147.73	71272	65491	521.4	2,345.67
1992	12735.09	75272	66152	581.8	2,421.77
1993	14510.9	81056	66808	638.9	2,586.79
1994	16409.92	88701	67455	702.6	2,797.60
1995	18203.85	96989	68065	783.1	2,844.56
1996	20026.78	106063	68950	867	2,878.25
1997	21885.94	115589	69820	949.9	3,068.95
1998	23600.14	126665	70637	1032.9	2,968.48
1999	25401.32	137915	71394	1117.66	2,931.64
2000	27539.54	150358	72085	1212.64	2,912.59
2001	29826.34	164885	73025	1316.27	3,050.88
2002	32537.17	182623	73740	1450	3,376.15
2003	35798.86	206363	74432	1637.7	3,983.12
2004	39408.46	235864	75200	1876.8	4,753.33
2005	43442.09	269353.8	75825	2183.596	5,322.69

Data Source: China Statistical Yearbook 2006

Table2 Regression Result

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.99457
R Square	0.98917
Adjusted R Square	0.987107
Standard Error	0.08208
Observations	26

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	12.92242	3.230606	479.5211	2.63E-20
Residual	21	0.14148	0.006737		
Total	25	13.0639			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-5.76615	4.227001	-1.36412	0.186972	-14.5567	3.024385
Ln(K)	1.202456	0.18651	6.447123	2.17E-06	0.814586	1.590325
Ln(L)	0.329379	0.423006	0.778663	0.444864	-0.55031	1.209067
Ln(H)	-0.20189	0.077396	-2.60855	0.016406	-0.36285	-0.04094
Ln(CO2)	-0.08432	0.236922	-0.3559	0.725464	-0.57703	0.408385

Table3 Two Stage Result

First stage result:

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.999777
R Square	0.999554
Adjusted R Square	0.999287
Standard Error	0.018581
Observations	25

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	9	11.61355	1.290395	3737.453	1.8E-23
Residual	15	0.005179	0.000345		
Total	24	11.61873			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-0.60874	2.922435	-0.2083	0.837799	-6.83776	5.620291
Ln(K)	-0.1655	0.88743	-0.1865	0.854555	-2.05702	1.726012
Ln(L)	-0.21602	0.186279	-1.15966	0.264314	-0.61306	0.181024
Ln(H)	0.147437	0.070132	2.10227	0.052829	-0.00205	0.296921
Ln(E)	0.354436	0.158918	2.230308	0.041424	0.01571	0.693161
Ln(G-1)	1.031131	0.148931	6.923561	4.86E-06	0.713692	1.34857
Ln(K-1)	-0.00787	0.803774	-0.00979	0.992314	-1.72108	1.705332
Ln(L-1)	0.36636	0.400916	0.913806	0.375274	-0.48817	1.220893
Ln(H-1)	-0.09068	0.05699	-1.59111	0.132435	-0.21215	0.030794
Ln(E-1)	-0.31081	0.118319	-2.62683	0.019052	-0.563	-0.05861

Table 4 Regression on difference

<i>Regression Statistics</i>	
Multiple R	0.730371
R Square	0.533442
Adjusted R Square	0.44013
Standard Error	0.019869
Observations	25

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	0.009027	0.002257	5.71678	0.003096
Residual	20	0.007895	0.000395		
Total	24	0.016923			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.112692	0.014049	8.021388	1.12E-07	0.083386	0.141997
Ln(K)-Delta	-0.4456	0.159045	-2.8017	0.011016	-0.77736	-0.11383
Ln(L)-Delta	-0.26848	0.147591	-1.81908	0.083905	-0.57635	0.03939
Ln(H)-Delta	0.125537	0.040515	3.098564	0.005663	0.041025	0.210049
Ln(E)-Delta	0.264662	0.083423	3.172545	0.004787	0.090645	0.438678

Figure 1 The lorenz curve according to above assumptions

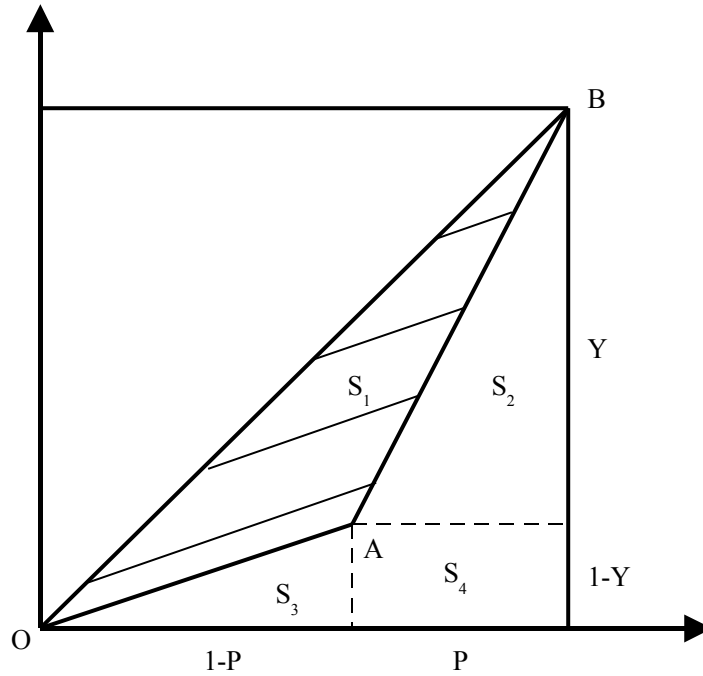


Figure 2 The parabola from equation (5)

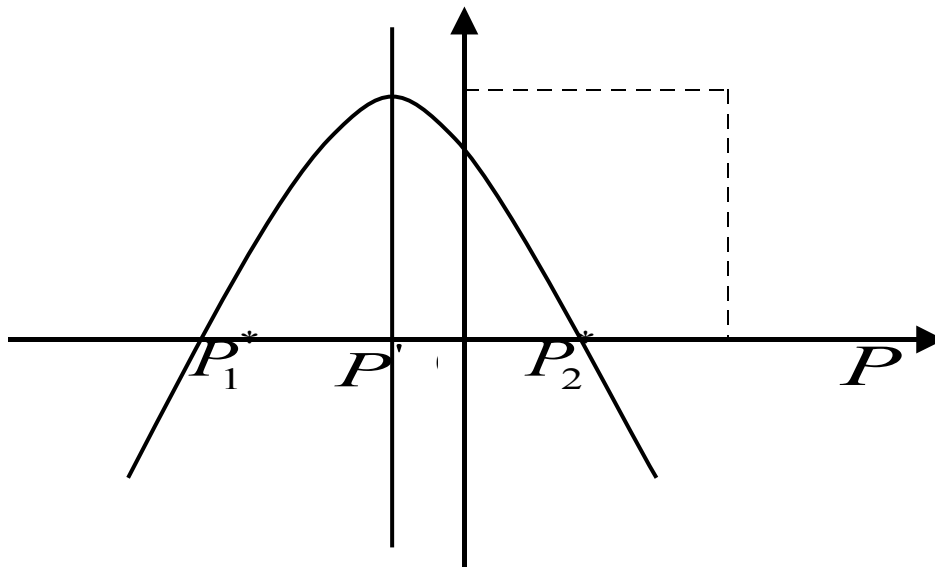
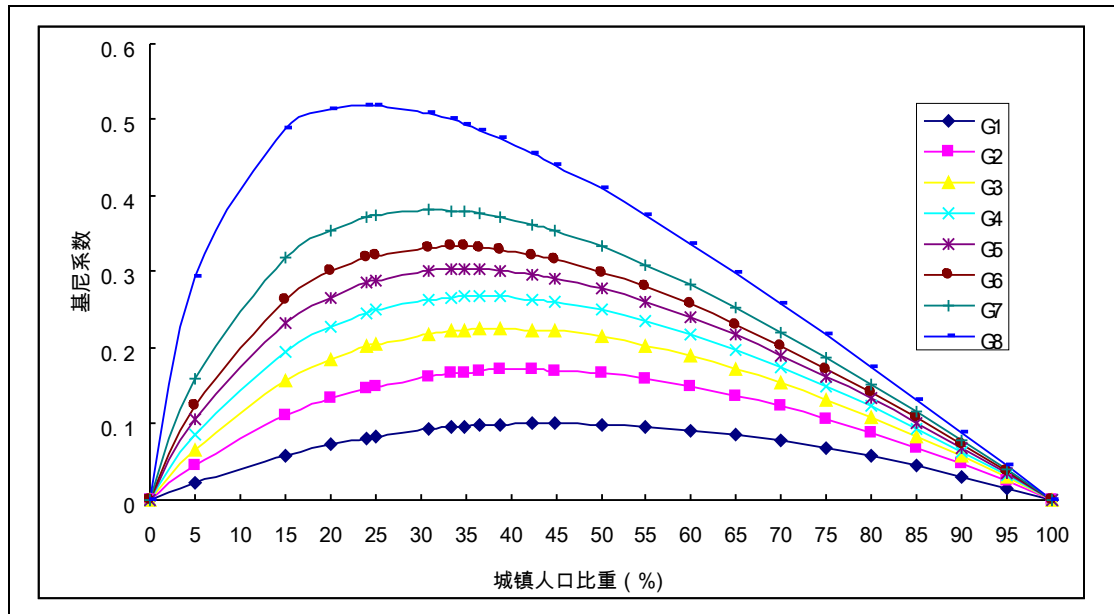


Figure 3 The inverted U relationship between the income inequality and the share of the urban population



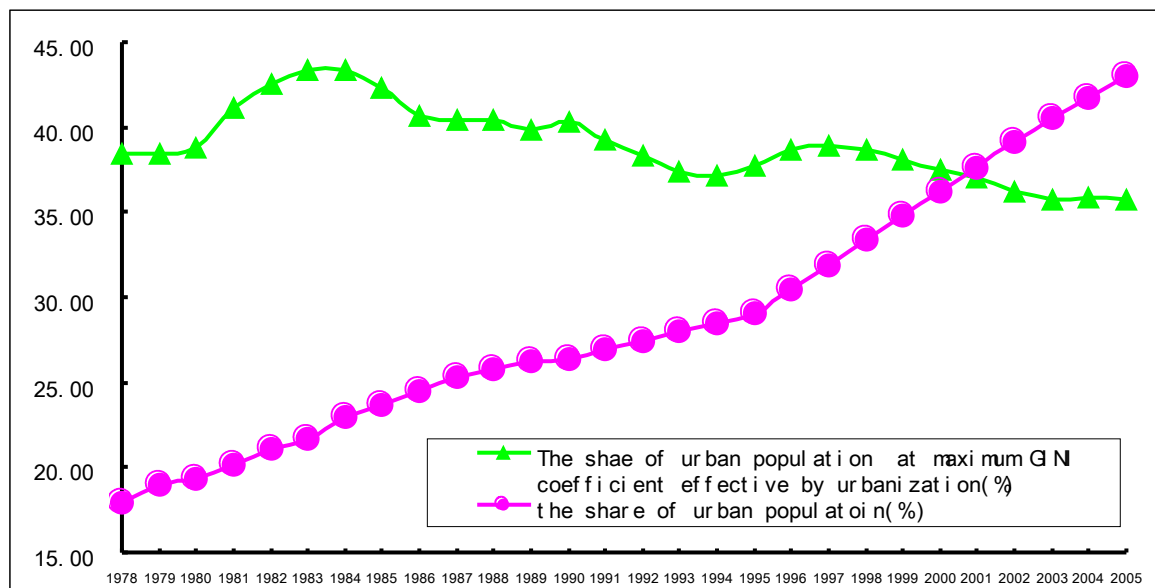
Note: G_1 is the GINI curve when x equals 1.5. G_2 is the GINI curve when x equals 2.

G_3 is the GINI curve when x equals 2.5. G_4 is the GINI curve when x equals 3.

G_5 is the GINI curve when x equals 3.5. G_6 is the GINI curve when x equals 4.

G_7 is the GINI curve when x equals 5. G_8 is the GINI curve when x equals 10.

Figure 4 the share of urban population from 1978 to 2005 and the share of urban population with the maximum of income inequality caused by the urbanization



Source: China Statistical Yearbook (1978—2006).

