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COMPETITIVE PRESSURES ON INCOME DISTRIBUTION IN CHINA

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Competitive Pressures on Income Distribution in China

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What would perfect competition do to income distribution in China? We analyze this question by determining personal income distribution under hypothetical, perfectly competitive conditions, where factors are rewarded according to their marginal productivities. Comparison with the observed personal income distribution reveals dramatic changes. In particular, the income inequality between social classes will grow. The income inequalities between areas and provinces will also increase, even though their shares in the overall income inequality will decrease.

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1 Introduction

Income distribution research consists of the functional income branch, which deals with income distribution to production factors, and the personal income distribution branch, which deals with income distribution among persons. We attempt to reconcile them.

We mimic perfect competition by maximizing the level of domestic final demand, fixing its proportions. China has 30 provinces and each provincial economy comprises 30 commodity and service sectors. (The commodity of the number 30 is a coincidence.) Trade between provinces is completely free, and 29 commodities are considered to be tradable, while public administration is considered to be nontradable, based on the observation of trade account that all provinces have no exports and imports in this commodity.[1]

Production and services have inputs of intermediate products, labor, and capital. Capital is assumed to be immobile between sectors and provinces. Labor is classified by skill level, namely unskilled, skilled, manager, and technician. The model incorporates three types of labor motions: substitution from high to low skill,[2] moving between sectors, and migration between regions. We assume that labor prefers any non-zero low income to migration. Skilled workers, if losing their jobs, will prefer occupying low positions to migrating. Unskilled workers have no room for substitution, and therefore have to migrate if their work becomes redundant in local markets.

The model allocates the provincial gross output vectors subject to material balances and factor constraints. The shadow prices determine the functional income distribution. The location and skills of workers and the property titles will determine the personal income distribution, of which we analyze the inequality components.

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[1] Provincial input-output tables in China, 1992. International trade is fixed in this study.

[2] According to human capital theory, different skilled labor matches different marginal productivity, higher skilled labor is able to replace lower skilled labor. A technician is able to substitute for the other three, a manager is able to substitute for skilled and unskilled, and a skilled worker is able to substitute only for an unskilled worker.

2 The general equilibrium model

The model aims to maximize China's domestic final uses. The objective function in the model is only a scalar, D, which represents the overall value of national final uses and in fact is the sum of the values of final uses in all sectors in all provinces:

$$\text{Max D} \tag{1}$$

The primal program includes commodity, labor, capital and nonnegativity constraints. The commodity constraints include 29 tradable commodity constraints for 27 of all 30 provinces, and 27 non-tradable commodity constraints, one for each province. The commodity balance requires that final supplies will not be less than final demands. Denote the variables which are exogenous to the linear program as follows:

A_t^i is a square matrix of intermediate input coefficients regarding tradable commodities, 30 by 30, of province i. The non-tradable commodity is not included: the bottom row is zero.

f_t^i is a 30-dimensional column vector of the proportions of province i's final uses regarding tradable commodities. Its last element is zero.

E^i is a 30-dimensional column vector of province i's net exports to outside China. The last element of the column is also zero.

d^i is a scalar of province i's overall final uses in overall domestic final uses.

The endogenous variables are:

X^i, a column vector of province i's 30 outputs and

D, a scalar of overall domestic final uses.

Balance of tradable commodities:

$$\sum_{i=1}^{27}(I - A_t^i)X^i \geq \sum_{i=1}^{27} f_t^i d^i D + \sum_{i=1}^{27} E^i \tag{2}$$

To model the non-tradable commodities, denote the following. A^i is a square matrix of intermediate input coefficients regarding the non-tradable commodity, 30 by 30, of province i. In the matrix, except for the elements in the last row, all other elements are zero, which means that tradable commodities are not included.

f^i is a 30-dimensional column vector of the proportions of province i's final uses regarding the non-tradable commodity. The first 29 elements of the column must be zero.

Balances of non-tradable commodities in provinces:

$$(I - A^i)X^i \geq f^i d^i D, i = 1, ..., 27. \tag{3}$$

The model has 82 labor constraints. Among them, each province has three labor constraints: namely technicians, managers, and skilled labor. The unskilled labor constraint is national, since unskilled labor is assumed to be mobile over the country. The hierarchy of substitution of high for low rank is embodied in the labor constraints. Let

L^i be the matrix of the input coefficients of three types of skilled and highly-skilled labor in province i, 3 by 30, and

N^i be a column vector of initial endowments of three types of skilled and highly-skilled labor.

Balances of the three types of labor resources in provincial markets:

$$L^i X^i \leq N^i, i = 1, ..., 27. \tag{4}$$

where

$$X^i = \begin{bmatrix} X_1^i & . & . & . & X_{30}^i & D \end{bmatrix}^T,$$

$$L^i = \begin{bmatrix} (L_{1,1}^i) & \ldots\ldots & (L_{1,30}^i) \\ (L_{1,1}^i + L_{2,1}^i) & \ldots\ldots & (L_{1,30}^i + L_{2,30}^i) \\ (L_{1,1}^i + L_{2,1}^i + L_{3,1}^i) & \ldots\ldots & (L_{1,30}^i + L_{2,30}^i + L_{3,30}^i) \end{bmatrix}$$

and

$$\mathrm{N}^i = \begin{bmatrix} \mathrm{N}_1^i \\ \mathrm{N}_1^i + \mathrm{N}_2^i \\ \mathrm{N}_1^i + \mathrm{N}_2^i + \mathrm{N}_3^i \end{bmatrix}$$

Let

L_u^i be a 30-dimensional vector of the input coefficients of both unskilled labor and the skilled and highly-skilled labor in province i, and

N_u^i be a scalar of endowments of both unskilled labor and the skilled and highly-skilled labor in province i.

The balance of unskilled labor resources in the national market:

$$\sum_{i=1}^{27} L_u^i X^i \leq \sum_{i=1}^{27} N_u^i$$

where

$$\mathrm{L}_u^i = \left[\; (\mathrm{L}_{1,1}^i + \mathrm{L}_{2,1}^i + \mathrm{L}_{3,1}^i + \mathrm{L}_{4,1}^i) \;\; \ldots\ldots \;\; (L_{1,30}^i + L_{2,30}^i + L_{3,30}^i + L_{4,30}^i) \; \right]$$

and

$$\mathrm{N}_u^i = \left[\; \mathrm{N}_1^i + \mathrm{N}_2^i + \mathrm{N}_3^i + \mathrm{N}_4^i \; \right]$$

The model has 810 constraints of capital in total, 30 constraints for each province, as capital is completely immobile. Let

$\hat{K}^i$ be the diagonal matrix of input coefficients of fixed capital in province i, 30 by 30,

M^i is a 30-dimensional column vector of endowments of fixed capital in province i.

Balances of the capital resources in the provincial markets:

$$\hat{K}^i X^i \leq M^i, i = 1, ..., 27. \tag{5}$$

Nonnegative activity:

$$X \geq 0$$

For each vector of provincial shares of domestic final demand, d, the linear program determines an optimal allocation of gross outputs and shadow prices to (2) and (3). Denoting P_t as the shadow prices of tradable commodities, S_d^i as the overall value of net exports to the rest of China in province i, and S_o^i as the observed value of net exports to the rest of China in province i, the overall value of the net exports in each province can be expressed in the following equations:

$$S^i(d) = P_t[(I - A_t^i)X^i - f_t^i d^i D - E^i], i = 1, ..., 27. \tag{6}$$

The equilibrium provincial shares will be determined by the condition that the overall value of net exports for each province to the rest of China matches actual surplus on the trade account:

$$S^i(d) = S_o^i, i = 1, ..., 27. \tag{7}$$

The solution, d^*, of this non-linear equation is obtained by interactively solving the linear program and applying the Newton algorithm,

$$d_{n+1}^i = \frac{[S^i(d_n) - S_o^i]d_{n-1}^i - [S^i(d_{n-1}) - S_o^i]d_n^i}{S^i(d_n) - S^i(d_{n-1})}$$

3 The extended form of Theil's index

Assuming that there are N individuals, the income share of individual j is y_j, and these are such that $\sum_{j=1}^{N} y_j = 1$. First, divide all individuals into G groups, $S_1, ..., S_G$. Let N_g denote the number of individuals in S_g, $g = 1, ..., G$, summing to N, and the income share of S_g is

$$Y_g = \sum_{j=1}^{N_g} y_{gj}.$$

The entropy within group g is

$$H_g(y) = \sum_{j=1}^{N_g} \frac{y_{gj}}{Y_g} \log \frac{Y_g}{y_{gj}}.$$

A Theil entropy $H(y)$ may therefore be expressed as follows:

$$H(y) = \sum_{g=1}^{G} \sum_{j=1}^{N_g} y_{gj} \log \frac{1}{y_{gj}} = \sum_{g=1}^{G} Y_g \log \frac{1}{Y_g} + \sum_{g=1}^{G} Y_g H_g(y).$$

On the basis of the above entropies, Theil (1967) obtained an inequality measure by subtracting $H(y)$ from its maximum value, $\log N$, as follows:

$$\begin{aligned} \log N - H(y) &= \sum_{j=1}^{N} y_j \log y_j N \\ &= \sum_{g=1}^{G} Y_g \log \frac{Y_g}{N_g/N} + \sum_{g=1}^{G} Y_g \sum_{j=1}^{N_g} \frac{y_{gj}}{Y_g} \log \frac{y_{gj}/Y_g}{1/N_g} \end{aligned}$$

This is the well-known Theil index measure of income inequality. The left-hand side expresses the overall inequality. The first term on the right-hand side deals with the between-group inequality, while the second term reflects the average of total within-group inequalities.

Further, divide the individuals in S_g into F subgroups, $T_1, ..., T_F$, according to some other criterion. In this case,

$$\sum_{f=1}^{F} N_{gf} = N_g,$$

and

$$\sum_{g=1}^{G} \sum_{f=1}^{F} N_{gf} = N.$$

Let y_{gfj} denote the income share of individual j in the subgroup f in the group g in total income of the population, the income share of subgroup f is

$$Y_{gf} = \sum_{j=1}^{N_{gf}} y_{gfj},$$

the entropy of subgroup f can be written as

$$H_{gf}(y) = \sum_{j=1}^{N_{gf}} \frac{y_{gfj}}{Y_{gf}} \log \frac{Y_{gf}}{y_{gfj}},$$

and the entropy of group g can be written as

$$H_g(y) = \sum_{f=1}^{F} \frac{Y_{gf}}{Y_g} \log \frac{Y_g}{Y_{gf}},$$

then the overall Theil entropy $H(y)$ can be written as

$$\begin{aligned} H(y) &= \sum_{g=1}^{G}\sum_{f=1}^{F}\sum_{j=1}^{N_f} y_{gfj} \log \frac{1}{y_{gfj}} \\ &= \sum_{g=1}^{G} Y_g \log \frac{1}{Y_g} + \sum_{g=1}^{G} Y_g H_g(y) + \sum_{g=1}^{G} Y_g \sum_{f=1}^{F} \frac{Y_{gf}}{Y_g} H_{gf}(y). \end{aligned}$$

On the right-hand side, the first term is the entropy between G groups, the second term is the average of the entropies between F subgroups in all G groups, and the third term is the average of the entropies in all F subgroups and in all G groups. Following Theil, an extensive form of Theil's index with respect to a two-times classification can be developed as follows:

$$\begin{aligned} \log N - H(y) &= \sum_{g=1}^{G} Y_g \log \frac{Y_g}{N_g/N} \\ &+ \sum_{g=1}^{G} Y_g \sum_{f=1}^{F} \frac{Y_{gf}}{Y_g} \log \frac{Y_{gf}/Y_g}{N_{gf}/N_g} \\ &+ \sum_{g=1}^{G} Y_g \sum_{f=1}^{F} \frac{Y_{gf}}{Y_g} \sum_{j=1}^{N_{gf}} \frac{y_{gfj}}{Y_{gf}} \log \frac{y_{gfj}/Y_{gf}}{1/N_{gf}}. \end{aligned}$$

In this research, we use a three-way classification. Overall Theil's inequality consists of the inequality between rural and urban areas, the inequality between provinces, and the inequality between social classes.

4 Data

We want to calculate Theil's index of income inequality in the current Chinese economy, compute the general equilibrium model and transform functional to personal income distribution. With regard to the first objective, we need data on population and personal incomes in China. Appendix A outlines the collection procedure and Appendices B and C the data on population and personal incomes, respectively. With regard to the second objective, we need data of China's and provincial input-output tables, data on capital usage and stocks, data on employment and labor resources. Appendix D outlines the collection procedure, while the data are available from the authors upon request. The transformation of functional to personal incomes is reported in Appendix E.

5 Overall personal income inequality

As China is a socialist country, China's inequality has been an attractive topic: does China have less inequality compared to other developed or less developed countries? Many economists and analysts conjecture that China still has less inequality. Some studies used the Gini coefficient to investigate the overall inequality for China. The State Statistical Bureau calculated that the Gini coefficient for China was 0.33 in 1979. The special research project conducted by Griffin, et al. (1994) found that the Gini coefficient for China was 0.38 in 1988. Griffin, et al. compared their results with other Asian developing countries and concluded that overall inequality in China was low. Wang, et al. (1995) found out that Gini coefficients in 1993 were 0.33 for rural areas and 0.24 for urban areas.

Based on the data collected in the last section, this research now measures income inequality by Theil's index. The results are presented in Table 1. The figure in row 33 and column 5 indicates a very low value of Theil's index regarding the overall

Table 1

Income Inequality in the Observed Economy

		Rural inequality	Urban inequality	Across areas	Between areas	Provincial inequality	Across areas	Between areas	Per capita final uses
		1	2	3	4	5	6	7	8
Shanghai	1	0.032	0.021	0.024	0.006	0.030	79%	21%	8529
Tianjin	2	0.052	0.026	0.032	0.004	0.036	89%	11%	4535
Beijing	3	0.055	0.033	0.037	0.006	0.043	86%	14%	6378
Sandong	4	0.048	0.045	0.047	0.002	0.049	97%	3%	2467
Jiangshu	5	0.029	0.030	0.030	0.022	0.052	57%	43%	2903
Zhejiang	6	0.056	0.052	0.054	0.001	0.055	99%	1%	2875
Liaoning	7	0.033	0.040	0.038	0.019	0.057	67%	33%	3204
Guangdong	8	0.039	0.066	0.051	0.005	0.057	90%	10%	3441
Fujian	9	0.025	0.091	0.047	0.019	0.066	71%	29%	2556
Hebei	10	0.046	0.033	0.041	0.034	0.075	55%	45%	1853
Heilongjiang	11	0.016	0.044	0.032	0.011	0.044	74%	26%	2655
Hubei	12	0.025	0.036	0.030	0.022	0.052	58%	42%	1376
Jianxi	13	0.028	0.059	0.038	0.016	0.054	70%	30%	1560
Jilin	14	0.018	0.046	0.034	0.024	0.058	59%	41%	2369
Hunan	15	0.026	0.052	0.035	0.030	0.064	54%	46%	1522
Neimeng	16	0.023	0.046	0.036	0.030	0.065	55%	45%	0
Henan	17	0.023	0.046	0.030	0.040	0.070	43%	57%	1405
Anhui	18	0.027	0.058	0.038	0.039	0.077	49%	51%	1192
Sanxi	19	0.043	0.033	0.038	0.042	0.080	47%	53%	2735
Guizhou	20	0.017	0.063	0.032	0.026	0.058	56%	44%	1062
Shichuan	21	0.028	0.047	0.034	0.026	0.060	57%	43%	1477
Guangxi	22	0.023	0.068	0.037	0.036	0.073	51%	49%	1535
Yunnan	23	0.025	0.045	0.032	0.049	0.080	39%	61%	646
Shanxi	24	0.028	0.039	0.033	0.059	0.092	36%	64%	1721
Xinjiang	25	0.033	0.050	0.042	0.060	0.103	41%	59%	3708
Ningxia	26	0.024	0.037	0.031	0.077	0.108	29%	71%	2182
Gansu	27	0.026	0.041	0.033	0.080	0.114	29%	71%	1517
Tibet	28	0.018	0.105	0.048	0.082	0.131	37%	63%	0
Hainan	29	0.027	0.108	0.067	0.065	0.132	51%	49%	0
Qinghai	30	0.023	0.046	0.037	0.098	0.134	27%	73%	2257
Acroos provinces		0.032	0.046	0.038	0.028	0.067	57%	43%	
Between provinces		0.024	0.016	0.021		0.021	100%	0%	
Theil's inequality		0.057	0.062	0.059	0.028	0.087	67%	33%	
Across provinces		57%	74%	65%	100%	76%			
Between provinces		43%	26%	35%	0%	24%			

inequality for China: 0.0873 in 1992. This result is consistent with the conclusion in other research that income inequality in China is not high until now. Moreover, the overall inequality is composed of the following: 43% by the inequality between social classes in row 34 and column 6, 24% by the inequality between provinces in row 35 and column 5, and 33% by the inequality between rural and urban areas in row 33 and column 7. The sum of the first two, 67% in row 33 and column 6, shows the contribution by the inequality in rural and urban areas. The low inequality in the current Chinese market reflects the fact that the income differences between social classes, between regions and between rural and urban areas are relatively small in the current market. Among the overall Theil's inequality, the inequality between social classes is less than 0.04, the inequality between rural and urban areas is about 0.03, and the inequality between provinces is a little over 0.02.

From Appendix C, the small difference in income between persons can be seen directly. In rural areas, the highest income, the rural capitalist's income, is 15 times that of the lowest income, that earned by the rural unskilled. In urban areas, the figure is nearly 20 times. With respect to each social class, the income in urban areas is higher than in rural areas. The urban mean income, moreover, is over two times higher than the rural mean income. Among the provinces, Shanghai has the highest income, while Guizhou has the lowest income. The former has income over five times higher than that of the latter.

Table 2 shows that the overall inequality increased about seven times - from 0.09 in the observed market to 0.65 in the competitive market, among which the inequality between social classes increased about 12 times, from 0.04 to 0.47, the inequality between areas increased nearly four times, from 0.03 to 0.11, and the inequality between provinces increased three and a half times, from 0.02 to 0.07.

Table 2

Inequality Changes in the Competitive Economy (ratios)

		Rural inequality	Urban inequality	Across areas	Between areas	Provincial inequality	Across areas (shares)	Between areas (shares)	Per capita final uses
		1	2	3	4	5	6	7	8
Shanghai	1	25.88	22.31	22.26	4.48	18.6	90%	10%	1.02
Tianjin	2	10.73	14.36	12.08	13.36	12.25	84%	16%	1.16
Beijing	3	6.34	8.84	7.9	5.84	7.63	88%	12%	1.62
Sandong	4	11.35	9.27	9.88	60.38	11.53	90%	10%	0.55
Jiangshu	5	19.27	18.38	18.84	2.09	11.69	95%	5%	1.73
Zhejiang	6	7.65	9.33	8.39	105.8	9.28	83%	17%	0.74
Liaoning	7	18.87	13.71	15.03	3.46	11.2	76%	24%	0.83
Guangdong	8	16.56	9.73	12.61	18.41	13.17	92%	8%	0.75
Fujian	9	13.57	3.96	7.3	3.35	6.17	90%	10%	0.58
Hebei	10	11.21	12.24	10.93	4.14	7.85	87%	13%	0.65
Heilongjiang	11	29.54	9.25	13	5.5	11.04	55%	45%	0.67
Hubei	12	16.5	13.8	15.4	3.51	10.35	96%	4%	0.62
Jianxi	13	13.59	7.3	10.61	3.49	8.49	80%	20%	0.54
Jilin	14	22.84	8.09	11.19	3.19	7.94	88%	12%	0.52
Hunan	15	18.91	11.01	15.22	3	9.57	84%	16%	0.61
Neimeng	16	1	1	1	1	1	86%	14%	
Henan	17	17.93	9.05	13.6	1.74	6.87	87%	13%	0.5
Anhui	18	7.03	4.44	6.09	0.25	3.12	86%	14%	3.71
Sanxi	19	7.64	9.16	8.18	1.78	4.81	86%	14%	0.61
Guizhou	20	20.05	7.61	12.31	2.81	8.08	37%	63%	0.49
Shichuan	21	19.83	15.48	18.37	3.35	11.94	51%	49%	0.57
Guangxi	22	18.77	6	11.39	3.13	7.32	86%	14%	0.51
Yunnan	23	4.14	4.3	4.98	0.52	2.27	95%	5%	3.97
Shanxi	24	17.32	14.76	16.18	1.79	6.94	87%	13%	0.58
Xinjiang	25	4.18	5.34	5.33	0.56	2.53	79%	21%	1.36
Ningxia	26	4.08	7.44	7.38	0.79	2.7	85%	15%	2.25
Gansu	27	4.53	7.12	7.25	0.16	2.24	79%	21%	3.88
Tibet	28	1	1	1	1	1	92%	8%	
Hainan	29	1	1	1	1	1	83%	17%	
Qinghai	30	21.23	11.53	13.98	0.44	4.12	88%	12%	0.54
Across provinces		14.59	10.16	12.27	3.82	8.65	81%	19%	
Between provinces		3.29	4.09	3.45		3.45	100%	0%	
Theil's inequality		9.75	8.56	9.14	3.82	7.41	83%	17%	
Across provinces (shares)		86%	87%	87%	100%	89%			
Between provinces (shares)		14%	13%	13%	0%	11%			

6 Inequalities in rural and urban areas

Inequalities in rural and urban areas are about the same in China. Within the areas, inequality differs by stage of development. In lesser- and under-developed provinces, inequality is mostly in urban areas, whereas in the developed provinces inequality is mostly in rural areas. All these findings will remain valid under perfect competition.

The distinction between rural and urban economies in China is so stark that income distribution in rural and urban areas has a marked difference. Most research, therefore, studies personal income distribution separately with respect to rural and urban areas. Some research found that income inequality in rural areas was higher than in urban areas. The conclusion is the opposite of the situation in other developing countries in Asia. Zhu and Wen (1990) calculated a Gini coefficient in rural areas of 0.3 in 1988. Griffin, et al. (1994) found that the Gini coefficients were 0.33 in rural areas and 0.23 in urban areas in 1988. Wang, et al. (1995) calculated the Gini coefficients for China, which were 0.33 in rural areas, and 0.24 in urban areas in 1993. Most of these studies argued that the differences in inequality between rural and urban areas resulted from the fact that the income sources that were more unequally distributed had more shares in rural areas than in urban areas. According to Griffin, et al. (1994), the inequality in rural areas resulted mainly from farmer's non-production rather than production income, whereas the small difference between staff and worker's money income resulted in the low inequality in urban areas.

Is it really true that China is different from the other developing economies in Asia? Our calculation of Theil's index give a negative answer to the question. We find that China has a similar situation of inequality as found in other developing countries in Asia, that the inequality in rural areas is nearly the same or slightly lower than in urban areas. The results in Table 1 reveal that, the inequality in rural areas is nearly 0.06 (in row 33 and column 1), and the inequality in urban areas is a little over 0.06 (in row 33 and column 2). Our conclusion differs from the others in that the inequality in rural areas is found to be slightly less than the inequality in urban areas. Griffin, et al. (1994) and Zhu (1990) concluded that the inequality in rural areas was usually greater than in urban areas in all provinces. This research distinguishes China's provinces into developed, less-developed and under-developed.[3] Through our calculation, we find that the inequality in rural areas is larger than the inequality in urban areas in only six of ten developed provinces; the inequality in rural areas is less than the inequality in urban areas in the remaining 22 less- and under-developed provinces.

The competitive market will be similar, as the third line to bottom line of Table 2 shows that rural and urban inequalities are affected by roughly equal factors, 9.75 and 8.56, respectively. A careful check with respect to provinces shows that in eight of the ten provinces in the eastern part, in four of the nine provinces in the middle part, and one of the 11 provinces in the western part, the rural inequalities will be larger than the urban inequalities; in other 17 provinces, however, most of which are the less- and least-developed provinces, urban areas will have more inequalities than rural areas. This phenomena may be understood by reasoning that in developed provinces there are relatively larger proportions of high-income people in rural areas, whereas in under-developed provinces, there are relatively larger proportions of low-income people in rural areas.

[3]Administratively, China has 30 provinces. Along the east coast, there are ten provinces: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangshu, Zhejiang, Fujian, Sandong, and Guangdong. In 1994, this part was home to 36.5% of China's population and contributed 55.6% to national GDP. (The data are from the 1995 China Statistical Yearbook.) Per capita GDP for the east coast was 5720 Yuan. In the middle part of the country, there are nine provinces: Sanxi, Neimeng, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hunan and Hubei. This part was home to 35.6% of China's population and contributed 27.6% to national GDP. Per capita GDP in the middle part was 2913 Yuan. The western part has the remaining 11 provinces: Guangxi, Hainan, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia, and Xinjiang. This part was home to 27.9% of China's population and contributed 16.8% to national GDP. Per capita GDP in the western part was 2260 Yuan. In general, the eastern, middle and western parts are referred to, respectively, as developed, less-developed and under-developed zones.

7 Inequality between rural and urban areas

There exists a notable difference in income between rural and urban areas in the current Chinese market. This problem will become more serious in the competitive market. However, the share of the income inequality between the areas in the overall measure of inequality will go down.

It has been a popular argument that inequality between rural and urban areas is significant and rigid in China because of the greatly unbalanced development of rural and urban economies. In the actual current economy, income differences between rural and urban areas is observed by most research. Wang, et al. (1995) compared the income means between rural and urban areas from 1978 to 1994. They found that income inequality between rural and urban areas in China had gone through two stages. In the first stage, between 1978-1985, the inequality between rural and urban areas had decreased. The reason was that rural economic reform caused farmers' income to increase faster than that of the urban-dweller during the period. The period from 1985 to 1994 was the time for urban economic reform. In this stage, urban-dwellers' income grew faster than that of the farmers, which expanded the income difference between rural and urban areas. So far, the difference is increasing.

This research observed the income difference between rural and urban areas. In Appendix C, urban income was over two times higher than rural income in China. Except for Zhejiang (where rural income is higher than urban income), all other provinces reported higher urban income than rural income. Theil's index in Table 1 shows that the inequality between rural and urban areas is 0.0284 for the nation in row (33) and column (4), which is the average of the Theil's inequalities between rural and urban areas in all provinces. Moreover, column 7 shows that the inequality between rural and urban areas contributes 33% of the overall inequality in the nation, and also large proportions in provinces, especially in the less- and least developed provinces.

In the competitive market, the share of inequality between rural and urban areas in the overall inequality decreases relatively, as its level increases by a factor 3.82 only, whereas the inequality across areas goes up by a factor 9.14 (Table 2, the third line to bottom line). By comparing the figures in column 7 in Tables 1 and 2, one can see the decrease in share in most of the provinces (except for the four developed provinces, Tianjin, Sandong, Zhejiang and Guangdong, as the levels in the provinces increase by factors 13.36, 60.38, 105.8 and 18.41, whereas the inequalities across areas go up by factors 12.08, 9.88, 8.39 and 12.61, respectively (Table 2, cells on column 7 and rows 2,, 4, 6 and 8).), which means that in the other 23 provinces the growth rate of the inequality between social classes is higher than the growth rate of the inequality between rural and urban areas - but that in the four developed provinces the opposite is true.

8 Inequality between provinces

Income inequality between provinces contributes significantly to the overall inequality, to the inequality in rural areas, and to the inequality in urban areas. This inequality will increase under perfect competition, but its shares in the overall inequality, in the inequality in rural areas, and in the inequality in urban areas will decline.

In a big country like China, income differences certainly exist between regions. The existing studies provide few numerically explicit results on the inequality between provinces. Griffin, et al. (1994) compared the income in rural areas among all provinces, and the income in urban areas among ten provinces in 1988. They were unable to justify the inequalities between the provinces in either rural or urban areas. Wang, et al. (1995) compared the income levels in rural areas between the eastern, the middle and the western parts, and found out that the ratio was 2.58 : 1.16 : 1 in 1992. Further, they compared income levels in rural areas between provinces for each of the three parts. They concluded that there was big difference in income between the eastern part and the middle and western parts, a small difference in income between the middle and the western parts, a big difference in income between the provinces within the eastern part, and small difference in income between the provinces within the middle and the western parts. With respect to the difference in urban income between regions, they found out that the ratio of income in the three parts was 2.13 : 0.89 : 1, and made a similar conclusion as they did for rural income. Their analysis was rather rough, because they used the income of a special province in each part to represent the income of the part. Yang (1992) calculated the relative mean deviation of per capita GNP in 1989 with respect to the eastern, the middle and the western part, and the provinces in the parts. He got a similar conclusion as Wang, et al. (1995). Wei (1992) calculated the weighted relative mean deviation of per capita national income, and also obtained a similar result. All these research attempts were unable to come up with some answers about the income inequality between provinces in China.

Appendix C confirms that the eastern part is richest and that the middle and the western parts are close. In the current Chinese market, the inequality between provinces contributes significantly to the overall income inequality. According to the results in Table 1, the inequality between provinces in rural areas accounts for 43% of the overall inequality in rural areas; the inequality between provinces in urban areas accounts for 26% of the overall inequality in urban areas; and, the inequality between provinces accounts for 33% of the overall inequality in China.

Under perfect competition, the inequality between provinces will increase, but its share in the overall income inequality will decrease. According to Table 2, the inequality between provinces in rural areas will increase over three times, but it is only 14% of the inequality in rural areas; the inequality between provinces in urban areas will increase slightly over four times, but it is only 13% of the inequality in urban areas; and the inequality between provinces will increase three and a half times, but it is only 17% of the overall inequality in China.

9 Inequalities in the provinces

In the observed markets, there is a negative relationship between income inequality and economic development. But, under perfect competition, this relationship will vanish.

The inequality in each province is investigated frequently, because each province is a relatively independent economy. Comparable with the study on income inequality for the national economy, almost all the studies for each province have investigated income inequality with respect to rural and urban areas. Zhu and Wen (1990) and Griffin, et al. (1994) calculated the rural Gini coefficients in 1988 for each province. The results of their research and this research are listed jointly in decreasing order of the levels of per farmer income in Table 3. The data show no systematic relationship between income inequality and economic development in rural areas. The income inequality in urban areas has not been studied as much as the income inequality in rural areas by province. Griffin, et al. (1994) calculated the urban Gini coefficients in ten provinces. They also did not find any relationships between the inequality in urban areas and economic development. They finally argued that the inequality might be related to income structures or other unknown factors.

Comparing the figures in column (3) and (4) of Table 1, it can be found out that the income inequality between social classes is higher than the income inequality between rural and urban areas in all developed provinces, in six of the nine less developed provinces, and in four of the eleven least developed provinces. Roughly speaking, there is a negative relationship between the income inequality between areas and their economic development, a positive relationship between overall income inequality and the income inequality between areas, and the income inequality between social

Table 3

Inequalities in Rural Area in China

	Per capita income of farmers in 1988	Gini coefficient in 1988 *	Gini coefficient in 1988 **	Theil's index in 1992 ***
Shanghai	1301	0.222	0.215	0.0323
Beijing	1063	0.305	0.233	0.0553
Zhejiang	902	0.286	0.298	0.0555
Tianjin	891	0.394	0.256	0.0521
Guangdong	809	0.306	0.305	0.0392
Jiangsu	797	0.383	0.299	0.0294
Liaoning	700	0.33	0.3	0.0333
Jilin	628	0.354	0.264	0.0184
Fujian	613	0.29	0.218	0.0245
Sandong	584	0.285	0.267	0.0484
Hainan	567	0.276	0.283	0.0267
Heilongjiang	553	0.368	0.294	0.0157
Hebei	547	0.293	0.289	0.0459
Hunan	515	0.255	0.212	0.0257
Neimenggu	500	0.339	0.293	0.0233
Hubei	498	0.231	0.229	0.0252
Xinjiang	497		0.323	0.0325
Qinghai	493	0.313	0.325	0.0232
Jiangxi	488	0.23	0.201	0.028
Anhui	486	0.249	0.207	0.0267
Ningxia	473	0.273	0.315	0.024
Sichuan	449	0.265	0.241	0.0276
Sanxi	439	0.32	0.275	0.0431
Yunnan	428	0.287	0.259	0.0249
Guangxi	424	0.291	0.279	0.0231
Shanxi	404	0.289	0.263	0.0275
Henan	401	0.299	0.25	0.023
Guizhou	398	0.295	0.234	0.0167
Tibet	374		0.279	0.0181
Ganshu	340	0.263	0.248	0.0262

Sources:

* Griffin, et al. (1994)

** Zhu and Wen (1990)

*** this research.

classes is irrelevant with the development of the province. The result, therefore, shows that the difference in the overall income inequality among provinces was approached mainly by the difference in the income inequality between areas among provinces.

Although Griffin, et al. (1994) argued that there was no relationship between income inequality and economic development in either rural or urban areas in provinces, Theil's index in Table 1 in our research shows, however, that the inequality within each province is related to its economic development. In the developed provinces, the inequalities between rural and urban areas were less. However, the less developed the province is, the greater the inequality between rural and urban areas. The overall inequality in each province consists of the inequality between social classes and the inequality between areas. In the current market, the former is not related to economic development, while the latter is. Because the latter contributes significantly to the overall inequality, the overall inequality is therefore related to development in each province. In the competitive market, the share of the inequality between areas in the overall income inequality will decrease; the overall inequality will thus be approached mainly by the inequality between social classes, which is not related to the development.

10 Labor substitution and migration

In the competitive market, unskilled labor will migrate out of the under-developed western part; the less-developed middle part will not be affected, but the developed eastern part will "import" the migration of the western part's unskilled labor. The migration of unskilled labor significantly influences local economies. The provinces from which the unskilled labor and their families emigrate will see an increase in mean income levels, whereas the provinces that welcome the immigrant unskilled labor and their families will experience a decrease in mean income levels.

Labor substitution and migration happen in all provinces when competition forces resources to be allocated optimally. Table 4 shows the situation. In the technician's column, a zero means the full employment of the technician in the corresponding province; a negative figure indicates the redundancy and substitution of the technician for the manager. In the manager's column, a zero means the full employment of the manager in the corresponding province; a negative figure indicates the redundancy and substitution of the manager for skilled labor. In addition, the positive figure shows how many manager positions have been substituted by technician. The same meaning is also applied to the column of skilled worker. A positive figure in the column of unskilled worker represents a combined result of both the substitution of skilled labor for unskilled labor and the migration of unskilled labor from other provinces. A negative figure shows the redundancy and immigration of unskilled labor by province. The last column shows the immigration and migration of unskilled worker by negative and positive signs.

In the twelve provinces of Hebei, Jilin, Heilongjiang, Fujian, Jiangxi, Sandong, Hunan, Guangxi, Shichuan, Guizhou, Shanxi, and Qinghai, redundant technicians substitute for managers. In the provinces of Beijing, Liaoning, Zhejiang, Anhui, Henan, Guangdong, Yunnan, Gansu, Ningxia and Xinjiang, redundant managers substitute for skilled labor. In the provinces of Beijing, Tianjin, Heilongjiang, Shanghai, Jiangshu, Shichuan, and Qinghai, some skilled labor is redundant, and substitute for unskilled labor. In total, the provinces of Beijing, Tianjin, Sanxi, Shanghai, Jiangshu, Anhui, Yunnan, Gansu, Ningxia, and Xinjiang have immigration, while other provinces face migration.

The so-called "Hukou" is a special system of residence registration conducted by the Chinese government. The economic reform has weakened the action of the "Hukou", which has given more freedom to the labor markets. Labor moves under the incentive to survive or to improvethe the standard of life. Currently, the mobility

Table 4

Labor Substitution and Migration

		Technician	Manager	Skill	Unskill	Total
1	Beijing	0	-18880	-532592	-1255984	-1807456
2	Tianjin	0	0	-365537	206990	-158547
3	Hebei	-26928	26928	0	6610557	6610557
4	Sanxi	0	0	0	-3515805	-3515805
6	Liaoning	0	-43212	10963	2643557	2611308
7	Jilin	-17447	17447	0	1756577	1756577
8	Heilongjiang	-9330	9331	-409936	2097754	1687819
9	Shanghai	0	0	-1223838	202818	-1021020
10	Jiangshu	0	0	-646014	-17553709	-18199723
11	Zhejiang	0	-189	189	3301172	3301172
12	Anhui	0	-29213	29210	-26523541	-26523544
13	Fujian	-4884	4884	0	2495875	2495875
14	Jianxi	-10923	10923	0	3802483	3802483
15	Sandong	-45590	45590	0	9803246	9803246
16	Henan	0	-7886	7886	10329699	10329699
17	Hubei	0	0	0	5570242	5570242
18	Hunan	-26048	26048	0	6886476	6886476
19	Guangdong	0	-26833	26833	4757735	4757735
20	Guangxi	-14820	14820	0	4790687	4790687
22	Shichuan	-18005	18005	-412573	14125543	13712970
23	Guizhou	-7450	7450	0	3856868	3856868
24	Yunnan	0	-40025	40025	-17528785	-17528785
26	Shanxi	-7465	7465	-37648	3442003	3404355
27	Gansu	0	-17063	17063	-10512968	-10512968
28	Qinghai	-753	753	-2584	399822	397238
29	Ningxia	0	-4621	4621	-1704259	-1704259
30	Xinjiang	0	-23685	23685	-4803195	-4803195
	China	-189631	-21959	-3470240	3681858	5

of labor, particularly farmers, is steadily increasing. In current years there have been tens of millions of farmers moving around the country in search of work. Wang, et al. (1995) estimated that, at that time, China had in fact 130 million surplus farmers, and that this number would increase to 230 million in the next ten years.

In the competitive market there will be nearly 86 million unskilled laborers ready to migrate.[4] Table 5 shows that total amount of the migrants that is including with the family members,[5] will be about 150 million.[6] Table 5 also shows that the provinces with the exodus of unskilled labor will have higher income ranks, and the provinces experiencing immigration will have lower income ranks. In the eastern part, Shanghai, Beijing, Jiangsu and Tianjin will have 37 million immigrants; the other six provinces will have 52 million immigrants, and the net number of immigrants will be nearly 15 million. In the middle part, only Anhui and Sanxi will have numbers of immigrants over 53 million. Neimeng's population will remain constant, as it does not participate in the competitive market; the other six provinces will have 53 million migrants, with the immigrants almost matching the emigrants. In the western part, Xingjiang, Ningxia, Gansu and Yunnan will have over 61 million immigrants, the populations in Hainan and Tibet will remain as constant as Neimeng. The other five provinces will have over 46 million migrants. The western part will have over 15 million net immigrants.

11 Conclusion

The most important result from the research is the revelation of both observed and hypothetical, competitive distributions of personal income. From the current to the market economy, personal income distribution will change considerably. In particular,

[4]This is the sum of either all the positive or all the negative entries of the column of totals of Table 4. The labor substitution figures cancel out.

[5]The family members are accounted for based on the dependency ratios in each province, which are presented in appendix B.

[6]This is the sum of either all the positive or all the negative entries of last column of of Table 5.

Table 5

Migration in the Competitive Economy

	Mean income	Migration out	Migration inward	Net migration out
Beijing	10361	3154313	0	3154313
Shanghai	8706	1763622	0	1763622
Tianjin	5271	284480	0	284480
Jiangsu	5022	32138700	0	32138700
Liaoning	2659	0	4554553	-4554553
Guangdong	2589	0	8464158	-8464158
Zhejiang	2118	0	5781061	-5781061
Fujian	1471	0	4434715	-4434715
Sandong	1345	0	17137073	-17137073
Hebei	1211	0	11636488	-11636488
Eastern part		37341115	52008048	-14666933
Anhui	4424	47192609	0	47192609
Heilongjiang	1782	0	2962822	-2962822
Sanxi	1662	6240171	0	6240171
Jilin	1242	0	3090346	-3090346
Neimeng	937	0	0	0
Hunan	935	0	12190874	-12190874
Hubei	848	0	9867711	-9867711
Jiangxi	843	0	6760587	-6760587
Henan	696	0	18335609	-18335609
Middle part		53432780	53207949	224831
Gansu	5882	18632325	0	18632325
Xinjiang	5056	8584547	0	8584547
Ningxia	4920	3054507	0	3054507
Yunnan	2565	31128881	0	31128881
Hainan	1290	0	0	0
Qinghai	1228	0	704016	-704016
Tibet	1117	0	0	0
Shanxi	997	0	6040128	-6040128
Sichuan	845	0	24150559	-24150559
Guangxi	784	0	8510678	-8510678
Guizhou	523	0	6857153	-6857153
Western part		61400260	46262534	15137726
China	1618	152174155	151478531	695624

the income inequality between social classes will grow. This is because there are an abundance of unskilled and a scarcity of highly skilled labor in China; skilled labor will be rewarded much more than unskilled labor when work is rewarded according to marginal productivity. Competition would dissolve the negative relationship between the level of economic development and of income inequality across provinces.

A The data on population and personal incomes in the current Chinese economy

The population data with respect to the eight social classes (unskilled worker, skilled worker, manager, technician, self-employed, capitalist, retiree and dependant), with respect to rural and urban areas, and with respect to provinces, are directly available from the China Population Census (1990), except for the number of capitalists and self-employed. The data on the classes of unskilled, skilled, manager and technician are obtained from the China Population Census Vol. 2 (1990)[7], which presents the data originally with eight occupations: technician, manager, staff, business, servant, farmer, worker and others. We aggregate staff, business and worker into the skilled class, and aggregate servant, farmer and others into the unskilled class. The data on retirees are available from the other three tables in the China Population Census Vol. 2 (1990).[8] The first two are for urban data and the third is for rural data. The data on family-income dependants is obtained by extracting the number of laborers and retirees from the total population. Because the population census data are in the year 1990, they are adjusted into the year 1992 according to the population in 1992 in China from the source in Statistical Yearbook of China, 1993.[9] The data on the number of capitalists and self-employed are collected separately from another source, the China Labour Statistical Yearbook (1993).[10] Instead of presenting the data on

[7]Table 6-15 "City Working Persons by Two Digits Classification of Occupation and Province", Table 6-16 "Town Working Persons by Two Digits Classification of Occupation and Province", and Table 6-17 "County Working Persons by Two Digits Classification of Occupation and Province" in the China Population Census Vol. 2 (1990). Among the three, the first two are for urban data, the third is for rural data.

[8]Table 6-28 "City Non-working Persons by Province", Table 6-29 "Town Non-working Persons by Province", and Table 6-30 "County Non-working Persons by Province" in the China Population Census Vol. 2 (1990).

[9]Table 3-3 "Total Population and Birth Rate, Death Rate and Natural Growth Rate of Population by Province, 1992" in the Statistical Yearbook of China (1993).

[10]Table 6-3 "Urban Employment in Private Enterprises and Individual Households by Province" and Table 6-4 "Rural Employment in Private Enterprises and Individual Households by Province" in the China Labour Statistical Yearbook (1993).

capitalist and self-employed directly, the China Population Census (1990) already has the data included in the labor categories. Therefore, to make the data consistent, a number of laborers corresponding to the number of capitalists and self-employed are extracted out of the labor categories. Neither the China Population Census (1990) nor the China Labour Statistical Yearbook (1993) provides information on the occupation of capitalists and the self-employed. It remains unclear how many of the capitalists and self-employed are either technicians, managers, skilled or unskilled. We simply assume that all the capitalists and self-employed come from the skilled class. The final data are presented in appendix B.

The first step to build income data is to collect data on urban wages. Normally, the wage includes two parts: the money wage and the social insurance and welfare funds. The China Labour Statistical Yearbook (1993) provides data on money wage by province,[11] and the data on the social insurance and welfare funds of staff and workers.[12]

Urban wages represent overall data, which need to be further separated by occupation, as information authorities in China usually collect the wage data regarding sector rather than occupation. A special survey in the Yearbook of Labour Statistics of China (1993) provided a section regarding occupational wages. According to the information, the skilled wage matches the average wage, the unskilled wage equals 0.584 times the average wage, the manager's wage equals 1.035 times the average wage, and the technician's wage equals 1.052 times the average wage. [13] Assuming

[11]Table 1-65 "Number and Total Wage Bill of Staff and Workers by Province" in the China Labour Statistical Yearbook (1993).

[12]These are presented in four other separate tables, Table 9-20 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers in State-owned Units by Province", Table 9-31 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers in Urban Collectively-owned Units by Province", Table 9-34 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers in Units of Other Ownership by Province", and Table 9-36 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers in Foreign Funded Enterprises by Province". The average of these tables is the total social insurance and welfare funds of staff and workers by province.

[13]In the Yearbook of Labour Statistics of China (1993), Table 7-13 "Increase Rate of Wages of 14 Cities' and Counties' Staff and Workers" gives the average wages by occupation in October, 1992

these ratios are applicable to all provinces, we can then separate the provincial data on urban wage by occupation.

Most of the studies estimate that capitalist income could be around ten times, and self-employed income could be around four times, that of a skilled worker.[14] In this research, we borrow the two ratios to determine capitalist and self-employed incomes in the urban areas.

The data on retired income in urban areas are directly available from the Yearbook of Labour Statistics of China (1993).[15]

By assuming that dependants are spread equally among their families, and further by calculating a unique dependency ratio, which is the ratio of dependants to primary income earners,[16] this research obtains the dependant's income by dividing the average of the primary income earners' incomes over the dependency ratio. The primary income earners have the net income left after sharing their primary income with the family. At the stage after the family income distribution, the average of the net incomes of the primary earners is the same amount as the income received by the dependants.

The Yearbook of Survey on Rural Households (1992) includes the data on national rural households' income by education in the year 1991. We define the occupations of

as follows: unskilled 150.62 Yuan, skilled 257.87 Yuan, technician 271.22 Yuan, and manager 266.87 Yuan. In other words, the technician's wage is 1.016 over the manager's wage, 1.052 over the skilled, and 1.8 over the unskilled. Since the average of the wages is 257.89 Yuan, it can be seen that the unskilled worker's wage equals 0.584 of the average, the skilled worker's wage equals the average, the manager's wage equals 1.035 of the average, and the technician's wage equals 1.052 of the average.

[14]See, Zhong (1989), Yang and Shao (1989), Chu (1990), Li (1990), Luo (1989), and Zhao (1992).

[15]In the Yearbook of Labour Statistics of China (1993), there are four tables used: Table 9-25 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers under Termination, Retirement and Resignation in State-owned Units by Province", Table 9-32 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers under Termination, Retirement and Resignation in Urban Collectively owned Units by Province", Table 9-35 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers under Termination, Retirement and Resignation in Units of Other Ownership by Province", and Table 9-37 "Composition of Total Social Insurance and Welfare Funds of Staff and Workers under Termination, Retirement and Resignation in Foreign Funded Enterprises by Province". The weighted averages of the incomes in these tables are calculated to get the retired income in urban areas.

[16]In this research, retirees are not supposed to afford any dependants.

rural labor by education as follows: those with educational years fewer than six belong to the unskilled, those have between 7-12 years belong to the skilled, and those having above 12 years belong to the manager and the technician. In this way, rural labor's income can be split by occupation, even though the data are still national macro data rather than provincial data. The survey gives labor composition by education, but it does not include data on the corresponding income.[17] However, the survey presents the data on household income by labor education.[18] Using this information roughly as labor income by education,[19] it can be derived that in rural areas the technician's and manager's income are the same, which is 1.37 times more than the average, 1.34 times more than the skilled, and 1.59 more than the unskilled. This estimation is consistent with the common recognition that in rural area the income differences between technician and manager and between skilled and unskilled are small, but income difference between the technician and manager and the skilled and unskilled is large. The reasons behind these are that rural technician and manager are paid still according to urban wage system, while unskilled and skilled take similar operation for production. By applying these macro ratios at national level to provinces, we break down the rural income by occupation or skill and by province.

The income of rural capitalist and self-employed are estimated by assuming that rural capitalist earns ten times over rural skilled and rural self-employed earns four times over rural skilled, following the way in estimating the incomes of urban capitalist and self-employed. The rural retiree receives as same income as urban retiree. The rural dependant income equals to the rural households' mean income, which is directly available from the China Statistical Yearbook (1993).[20] The final data are presented

[17]Table 3-2 "Rural Labours' Quality by province" in the survey.

[18]Table 2-5 "The Main Indicators of Rural Households by Labor's Education" in the survey.

[19]As a result, unskilled income is 611.67 Yuan, skilled 725.83 Yuan, and Manager's and Technician's 971.56 Yuan. The average income of rural households, moreover, is 708.55 Yuan in 1991. Assume that technician's and manager's income are the same, their income is thus 1.37 times more than the average, 1.34 times more than the skilled, and 1.59 more than the unskilled. The skilled income is 1.19 times more than the unskilled.

[20]Table 8-23 "Net Income of Peasant Household Per Capita by Province" in China Statistical

in appendix C.

Yearbook (1993).

Appendix B (continued)

1992 China Population (estimated)

The Middle Part

	Heilongjiang	Jilin	Sanxi	Neimeng	Jiangxi	Hunan	Hubei	Anhui	Henan	China
1 Rural unskilled	8178501	6975122	9270061	6707771	14856940	26863862	21130853	26467638	41049622	437155466
2 Rural skilled	511357	320164	557680	275091	956758	1195240	902474	914910	1025825	26647818
3 Rural manager	108726	58740	93304	61229	112621	154599	151391	159854	254606	3379362
4 Rural technician	351239	241584	338984	240144	445507	602401	528277	547337	993937	11472709
5 Rural self-employed	152295	162505	587676	193310	590272	782226	654851	773824	901166	17275375
6 Rural capitalist	380	1004	11717	1662	3256	5846	1387	3019	8231	167139
7 Rural retiree	165499	57175	144714	60748	202132	335698	168436	194696	320295	5043517
8 Rural dependant	9307183	6803037	10197038	6510231	13998329	21429096	16221241	18869465	30558240	359829850
Rural population	18775180	14619331	21201174	14050186	31165815	51368968	39758910	47930743	75111922	860971236
1 Urban unskilled	1975755	1100966	1084208	1024358	1271044	2024164	2897862	1750715	2401093	50493026
2 Urban skilled	4361251	2854180	2376805	1954824	1875904	2801376	4361328	2680352	3497060	80823483
3 Urban manager	524770	295529	278229	201952	193682	323793	438279	283010	417715	8352688
4 Urban technician	1240598	858205	729725	617411	592710	926929	1288475	758248	1074305	23914704
5 Urban self-employed	464219	336786	154958	230212	312093	367627	279548	409499	368858	7402016
6 Urban capitalist	9230	4778	4615	4117	3754	6902	4995	3326	3943	331993
7 Urban retiree	982098	616772	324393	346321	384179	620861	785556	494470	566840	17088007
8 Urban dependant	7746814	4633456	3635792	3640621	3330819	4229392	5985025	4029636	5168228	116322296
Urban population	17304735	10700672	8588725	8019816	7964185	11301044	16041068	10409256	13498042	304728213
Dependency ratio	0.90	0.82	0.87	0.85	0.79	0.69	0.66	0.65	0.68	0.69
1992 Total population	36080000	25320000	29790000	22070000	39130000	62670000	55800000	58340000	88610000	1.166E+09

Appendix B

1992 China Population (estimated)

The Eastern Part

	Shanghai	Beijing	Tianjin	Guangdong	Zhejiang	Liaoning	Jiangsu	Fujian	Hebei	Sandong
1 Rural unskilled	1053773	866858	1107746	17959349	11576084	9326260	24566410	9612977	25642777	34129906
2 Rural skilled	1575239	407383	222743	2010768	3667196	845708	6859832	1524030	42559	52544
3 Rural manager	78436	50628	26029	129161	148838	130956	574097	80137	147691	225585
4 Rural technician	164136	84921	53553	412357	398194	376870	998949	363176	565004	835486
5 Rural self-employed	104140	160865	95743	1173421	1456627	439673	1101917	400015	1653653	2373151
6 Rural capitalist	4389	599	6649	27492	16911	6364	6507	7085	14784	13390
7 Rural retiree	148256	33114	17375	281656	178704	167245	483125	140144	273196	341026
8 Rural dependant	1410663	1323908	1270754	19272202	11713375	8333590	19620942	12378061	22353882	24584733
Rural population	4539032	2928276	2800592	41266406	29155929	19626666	54211779	24505625	50693546	62555821
1 Urban unskilled	584655	823183	720507	4256586	2503955	2645268	1927493	947115	1973178	6645257
2 Urban skilled	3298110	2460982	2156565	6199681	3870447	6220334	4975721	1654209	3419409	5251203
3 Urban manager	282544	376242	191158	471232	262927	696926	636791	130018	358758	457677
4 Urban technician	887702	976299	594502	1474986	915195	1597977	1275515	492557	1024697	1502633
5 Urban self-employed	79090	117804	46516	763701	283895	472894	210288	242530	183928	296721
6 Urban capitalist	11601	15360	9342	73095	17086	19782	16385	54533	6093	16080
7 Urban retiree	1350286	724366	510376	1049934	655528	1592882	1110513	329770	542809	731107
8 Urban dependant	2416981	2597535	2170440	9692481	4695051	7288136	4745513	2803633	4548201	8643502
Urban population	8910969	8091771	6399406	23981696	13204084	20534199	14898219	6654365	12057073	23544180
Dependency ratio	0.40	0.55	0.60	0.80	0.63	0.64	0.54	0.95	0.75	0.63
1992 Total population	13450000	11020000	9200000	65250000	42360000	40160000	69110000	31160000	62750000	86100000

Appendix B (continued)

1992 China Population (estimated)

The Western Part

	Hainan	Xinjiang	Tibet	Qinghai	Ningxia	Guangxi	Shanxi	Yunnan	Sichuan	Gansu	Guizhou
1 Rural unskilled	2314405	4781473	894046	1651373	1719946	19173645	13474257	17370544	53560310	10219588	14653369
2 Rural skilled	203049	221014	43601	100307	29967	147022	344610	354377	1116132	59693	160545
3 Rural manager	16845	48400	12863	14611	12556	90158	74904	84298	172154	54628	51317
4 Rural technician	78775	195241	49155	79054	48059	397080	345036	376764	925725	198365	237399
5 Rural self-employed	66887	174221	14862	28951	48185	545070	407374	397675	1374038	264199	196583
6 Rural capitalist	894	1479	1	361	469	3660	4333	1394	7410	2280	4186
7 Rural retiree	108280	125893	8249	13518	11665	121342	124473	162615	543396	37435	73417
8 Rural dependant	2428165	5123878	994629	1515380	1732716	16810368	11942893	13859138	30286707	7213054	11766952
Rural population	5217300	10671599	2017406	3403555	3603563	37288345	26717880	32606805	87985872	18049242	27143768
1 Urban unskilled	256836	538664	33059	112351	138315	889196	1023015	1145500	5394754	908238	1495736
2 Urban skilled	282638	1156415	43655	323520	333784	1485203	1946758	1309144	5281343	1248429	1142853
3 Urban manager	37609	145341	8748	37075	38742	191802	233267	132736	426881	149210	130045
4 Urban technician	125216	431536	25424	106240	121541	524734	708435	499168	1702855	413525	427361
5 Urban self-employed	91127	185482	25863	40952	27034	313935	179326	142059	483389	105429	186253
6 Urban capitalist	14529	2900	16	563	1376	8002	3030	1331	7721	2844	4664
7 Urban retiree	62107	328993	10706	53891	56073	325262	387123	306219	1385758	194864	257950
8 Urban dependant	772638	2349076	115124	531853	549764	2773536	2851035	2176994	7311433	2068218	2821369
Urban population	1642700	5138407	262595	1206445	1266629	6511670	7331989	5713151	21994134	5090757	6466231
Dependency ratio	0.87	0.90	0.95	0.80	0.88	0.81	0.77	0.72	0.52	0.67	0.77
1992 Total population	6860000	15810000	2280000	4610000	4870000	43800000	34050000	38320000	1.1E+08	23140000	33610000

Appendix C

Chinese Income in 1992

The Eastern Part

	Shanghai	Beijing	Tianjin	Guangdong	Zhejiang	Liaoning	Jiangsu	Fujian	Hebei	Sandong
1 Rural unskilled	1914	1352	1126	1125	1169	856	912	846	587	691
2 Rural skilled	2279	1610	1340	1339	1392	1019	1086	1008	698	822
3 Rural manager	3050	2154	1793	1792	1862	1363	1454	1348	934	1100
4 Rural technician	3050	2154	1793	1792	1862	1363	1454	1348	934	1100
5 Rural self-employed	9118	6439	5362	5358	5566	4076	4346	4030	2793	3289
6 Rural capitalist	22794	16097	13404	13394	13916	10189	10865	10076	6984	8223
7 Rural retiree	3416	3128	2816	3105	2858	2675	2662	2403	2878	2635
8 Rural dependant	2226	1572	1309	1308	1359	995	1061	984	682	803
Rural mean income	2433	1827	1429	1372	1524	1026	1090	998	720	853
1 Urban unskilled	2071	1562	1125	1084	801	1071	1290	1029	1039	672
2 Urban skilled	3545	2675	1927	1856	1372	1834	2208	1762	1778	1151
3 Urban manager	3669	2769	1994	1921	1420	1898	2285	1824	1840	1191
4 Urban technician	3729	2814	2027	1953	1443	1930	2323	1854	1870	1211
5 Urban self-employed	14174	10729	7716	7418	5494	7320	8830	7032	7115	4598
6 Urban capitalist	35434	26822	19289	18546	13735	18299	22074	17580	17787	11496
7 Urban retiree	3416	3128	2816	3105	2858	2675	2662	2403	2878	2635
8 Urban dependant	3369	2464	1776	1562	1166	1618	1993	1502	1545	916
Urban mean income	3539	2719	1935	1890	1375	1876	2183	1910	1718	1031
1992 overall mean income	3166	2482	1781	1562	1477	1461	1326	1193	912	901

Appendix C (continued)

Chinese Income in 1992

The Middle Part

	Heilongjiang	Jilin	Sanxi	Neimeng	Jiangxi	Hunan	Hubei	Anhui	Henan	China
1 Rural unskilled	816	694	539	578	660	636	583	494	506	649
2 Rural skilled	972	826	642	688	786	757	694	588	602	1082
3 Rural manager	1300	1106	859	921	1052	1012	929	786	806	1197
4 Rural technician	1300	1106	859	921	1052	1012	929	786	806	1110
5 Rural self-employed	3887	3305	2568	2753	3146	3027	2777	2351	2408	3461
6 Rural capitalist	9718	8264	6420	6881	7864	7567	6943	5878	6021	9778
7 Rural retiree	2462	2399	2602	2403	2130	2391	2179	2290	2439	2578
8 Rural dependant	949	807	627	672	768	739	678	574	588	780
Rural mean income	938	794	664	670	777	736	673	569	577	795
1 Urban unskilled	851	863	964	814	825	990	787	838	922	934
2 Urban skilled	1457	1478	1651	1394	1413	1696	1348	1434	1578	1737
3 Urban manager	1508	1529	1709	1443	1462	1756	1395	1484	1633	1819
4 Urban technician	1532	1555	1737	1466	1486	1784	1418	1509	1660	1827
5 Urban self-employed	5822	5908	6585	5564	5664	6786	5388	5738	6316	6648
6 Urban capitalist	14556	14770	16463	13910	14161	16965	13470	14346	15789	18459
7 Urban retiree	2462	2399	2602	2403	2130	2391	2179	2290	2439	2661
8 Urban dependant	1260	1288	1466	1195	1157	1410	1150	1178	1322	1432
Urban mean income	1488	1538	1628	1406	1426	1685	1295	1456	1541	1686
1992 overall mean income	1201	1109	942	937	909	907	852	727	724	1028

Appendix C (continued)

Chinese Income in 1992

The Western Part

	Hainan	Xinjiang	Tibet	Qinghai	Ningxia	Guangxi	Shanxi	Yunnan	Sichuan	Gansu	Guizhou
1 Rural unskilled	725	636	714	519	508	630	481	531	545	421	435
2 Rural skilled	863	758	850	617	605	750	572	633	649	501	518
3 Rural manager	1155	1014	1137	826	810	1003	766	847	869	670	693
4 Rural technician	1155	1014	1137	826	810	1003	766	847	869	670	693
5 Rural self-employed	3453	3031	3400	2470	2421	2998	2290	2531	2597	2003	2073
6 Rural capitalist	8632	7578	8499	6175	6052	7496	5724	6328	6492	5007	5181
7 Rural retiree	2279	2760	3956	3533	2741	2519	2422	2825	2300	2905	2394
8 Rural dependant	843	740	830	603	591	732	559	618	634	489	506
Rural mean income	862	762	820	597	587	723	559	610	624	481	487
1 Urban unskilled	1382	1253	1734	1301	1143	1038	972	1091	821	1026	642
2 Urban skilled	2367	2145	2969	2228	1957	1778	1663	1868	1405	1756	1100
3 Urban manager	2450	2220	3072	2305	2026	1840	1721	1934	1455	1818	1139
4 Urban technician	2490	2256	3123	2343	2059	1870	1750	1965	1478	1848	1157
5 Urban self-employed	9467	8550	11894	8885	7831	7130	6641	7482	5624	7033	4403
6 Urban capitalist	23667	21375	29735	22213	19578	17825	16604	18704	14060	17583	11008
7 Urban retiree	2279	2760	3956	3533	2741	2519	2422	2825	2300	2905	2394
8 Urban dependant	2042	1830	2159	1957	1756	1460	1445	1536	1135	1488	861
Urban mean income	2650	2200	3398	2328	1972	1866	1660	1791	1332	1688	1048
1992 overall mean income	1290	1230	1117	1050	947	893	796	786	766	746	595

D The data for the general equilibrium model

National and Provincial input-output tables

This research considers 27 Chinese provinces in competition, whereas 30 administrative provinces exist formally in China. The remaining three provinces that are not included in the competition, due to data problems, are Hainan, Tibet and Neimeng. Among them, Hainan and Tibet did not produce their input-output tables, and Neimeng's input-output table was too particular in its sector classification, and hence was incompatible with the input-output tables of other provinces. For this reason, the three provinces have been discarded from the model. The other 27 provinces have produced their 1992 input-output tables in square-matrix form. Most of them have three versions, namely 6×6, 33×33 and 118×118 sectors or commodities. The model chooses to use the 33×33 version, for the sake of simplicity. The 33 sectors' table has been adjusted, to accommodate this research, into a 30 sectors' table, where maintenance, repair and other industries, commerce and restaurants, freight and passenger transports are combined. The tables can provide a number of data sets such as intermediate input, value added, domestic final use, interprovincial and international trade, and gross output.

First, because twelve provinces have separate information on interprovincial and international trade, the export to and import from the rest of China in each of the 12 provinces are available. The sum of exports to the rest of China in those provinces is 829,782 million Yuan, the imports are 898,960 million Yuan, and the sum of the net export is therefore -69,178 million Yuan. Because the overall provincial net export is zero, it can be expected that the sum of the net exports to the rest of China in the 15 provinces that do not have separate information on interprovincial and international trade must be 69,178 million Yuan. It is, however, impossible to directly derive the export and import to the rest of China in these 15 provinces. They have to be estimated by assuming that the ratio of the overall exports (829,782 million Yuan) to gross output (3,766,102 million Yuan) in the 12 provinces, which is 0.22, is equivalent to the ratio of the overall import (58,596 million Yuan) to gross output (2,663,441 million Yuan) in the 15 provinces. Such an assumption makes it possible to estimate the overall import from the rest of China in the 15 provinces as 585,957 million Yuan (the overall export is 655,135 (585,957+69,178) million Yuan). The overall export is further distributed to each of the 30 sectors according to the shares of the net exports in each sector in the overall net export. Once exports to the rest of China in the 15 provinces are estimated on the sectoral level, imports from the rest of China are the sum of the exports and the net exports of the other 12 provinces, according to material balance.

While data on the export to and import from the rest of China in the 15 provinces are separated into 30 sectors, the data need to be further separated with respect to the 15 provinces. The mixed data on interprovincial and international trade in these 15 provinces are known. Therefore, we can calculate the shares of the mixed export to the rest of China and to the rest of the world in each province to the overall export in the 15 provinces. Assume that these shares are equivalent to the shares of the export to the rest of China in each of the 15 provinces. Then, in the overall export to rest of China in the 15 provinces, the overall export to the rest of China in the 15 provinces to each of the 15 provinces can be separated. The same procedure is applied to the imports from the rest of China.

The overall export to and the overall import from the rest of China in the 15 provinces need to be separated with respect to sectors and provinces. This is a complicated procedure. Here, the RAS method[21] is employed. There is a table (in which columns 1-27 and rows 1-30 show the data of exports) that is a mixture of the exports to the rest of China and the rest of the world, in the 15 provinces. Column

[21] For a detailed introduction to the RAS method, see Bacharach (1970).

28. which is the sum of columns 1-27, shows the overall exports at the sectoral level; row 31, which is the sum of rows 1-30, indicates the overall exports at the provincial level. Columns 1-28 and rows 1-31 are the original data, while column 29 and row 32 are the data estimated above. The former are the overall exports to the rest of China at the sectoral level; the latter are the overall exports to the rest of China at the provincial level. The data in columns 1-27 and rows 1-30 need to be adjusted such that the sum of columns 1-27 equals column 29, and the sum of rows 1-30 equals row 32 by the RAS method. The same procedure is also applied to the import from the rest of China. Once the exports to and the imports from the rest of China are separated, the exports to and the imports from the rest of the world can be obtained by extracting the exports to and the imports from the rest of China from the total mixture of exports and imports.

Capital usage and stocks

Detailed information on capital stocks in industrial sectors, however, has recently become available, which was collected by the department of industry in the State Statistical Bureau (SSB) through an industrial census. The SSB has made available to us the unpublished data on capital stocks in the year 1992 for 40 industrial sectors by province. We adjust these data to suit this research by aggregating them into 23 industrial sectors according to the sector classifications in the input-output table.

The data for non-industrial sectors are not available; they are estimated from the information on investment in the China Statistical Yearbook (1993).[22] Total investment on capital construction and technical updating and transformation, with respect to 13 sectors, are as follows: (1)agriculture, (2)industry, (3)geological prospecting, (4)construction, (5)transportation and telecommunications, (6)commerce, food ser-

[22]In the Yearbook, Table 5-23 "Investment in Capital Construction by Sector of National Economy and Province in 1992" and Table 5-43 "Investment in Technical Updating and Transformation by Sector of National Economy and Province in 1992".

vices and storage, (7)real estate and public services, (8)health care, sports and social welfare, (9)education and culture, (10)scientific research, (11)banking and insurance, (12)administration, (13)others. Here, sectors (3)-(13) can be simply aggregated into seven non-industrial sectors. Then we can calculate the proportions of the investment in industry to the investment in these non-industrial sectors. Furthermore, assuming that the proportions of capital stocks are the same as the proportions of investment (because the fixed capital stocks in industry are obtained previously), it then becomes possible to estimate capital stocks in non-industrial sectors. The data on the capital stocks in the agricultural sector are obtained in a different way. The Rural Statistical Yearbook of China in 1993[23] provides data on the number of rural households by province and on the capital stocks per rural household; the two sources are used to derive the capital stocks in the agricultural sector by province. Data on capital usage in agricultural and non-industrial sectors do not exist, and deriving them is impossible, because no data exists on the capital for production in these sectors. Therefore, the usage rates in agricultural and non-industrial sectors use industrial data as a reference. As the estimated utilization rates in industries are around 0.8, we assume that the utilization rate is applicable to agricultural and non-industrial sectors in all provinces.

Employment and labor resources

Information on employment and labor resources can be obtained from the provincial "Population Census in 1990". The original data in each province for employment and labor are broken down into 55 sectors and eight types of occupation, which are aggregated into 30 sectors, and into four types of occupations.

[23]In the Rural Statistical Yearbook of China 1993, the Table 3-3 "Rural Households and Population by Province in 1992" has the data on the number of rural households by province, and the Table 3-24 "Original Value of Fixed Assets for Production Per Rural Household by Province" provides the information on capital stocks per rural household.

E Transformation of functional to personal incomes in competitive economy

Let IK_s^j denote capital income, where $j = 1, ..., 27$ represents provinces and $s = 1, ..., 30$ represents sectors. Let K and γ denote employed capital and rental rates, as in the previous chapter. Let a represent the agricultural sector, b the sectors of industry, construction, transports and communications, and commerce, and c the sectors of public service, culture and education, finance and insurance, and administration. Then, the results on capital income are obtained through the calculations below.

Capital income in the agricultural sector is

$$IK_a^j = \sum_{s=1}^{1} K_s^j \gamma_s^j.$$

Capital income in the sectors of industry, construction, transports and communications, and commerce is

$$IK_b^j = \sum_{s=2}^{26} K_s^j \gamma_s^j.$$

Capital income in the sectors of public service, culture and education, finance and insurance, and administration is

$$IK_c^j = \sum_{s=27}^{30} K_s^j \gamma_s^j.$$

After the model is solved, the results directly include the unskilled wage and the wage premiums of the technician, the manager and the skilled.

In the agricultural sector, all capital is owned privately by farmers, who, however, are not capitalists. The rural capitalists, in fact, are those who hold their capital in sectors such as industry, commerce and construction (but not in the agricultural sector). Capital income in the agricultural sector is distributed to all farmers who hold own capital, whereas the rural capitalist receives rents from other non-agricultural sectors. At present, it is observed that both state and private capital exist mainly in the sectors of industry, commerce and construction. According to the data on capital ownership in industrial sectors by province from The Third National Industrial Census of China in 1995, we calculate the proportions of private capital in total capital, and apply them to the data in 1992 to get the amounts of private capital in industrial sectors in 1992. Since the data on capital ownership in commerce and construction sectors are unavailable, we assume that the proportions of private capital in total capital are the same as in the industrial sector. The capital income in these sectors is distributed between the state and private holders. The sectors of public service, education and culture, finance and banking, and administration are dominated by state capital. Capital income in these sectors is collected by the government only.

Capital holders earn rents. But, there is a small group of people who have capital, and only a few of them hold a significant amount of capital and rely on the capital income. For this reason, we simply assume that the people who own significant amounts of capital are capitalists, and that the capitalist is the sole earner of private capital income. The capitalist's income is separated from total capital income, which includes both government and private capital incomes, according to the proportions of private capital in total capital in the sector. Denote

α – the share of private capital income in total capital income,

I – capitalists' average income,

N – the number of capitalists,

then

$$I^j = \frac{\alpha^j I K_b^j}{N^j}.$$

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