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Competitive pressures on China: Income inequality and migration

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Abstract

How would perfect competition affect the distribution of income in China? To answer this question, we integrate the two main streams of income distribution theory, namely the functional and the personal income approaches. First, using a general equilibrium model of China comprising 30 sectors and 27 provinces, marginal productivities are used as competitive commodity prices and factor rewards. Second, the rewards are imputed to households using their compositions in terms of persons and factor endowment entitlements. The ensuing distribution is contrasted with the status quo. Less skilled labor would stand to lose and, therefore, inequality would mount. Skilled workers, managers and technicians would move from Western and Central China to Eastern China. These flows would be more than offset by a flow of unskilled labor from Eastern China to Central China. Our finding that Eastern China has too many unskilled workers, relative to the competitive benchmark, suggests that the Harris–Todaro mechanism operates in China. Competition would change the predominant nature of inequality from the rural–urban divide to differences between the social classes. Moreover, the existing negative relationship between development and inequality would evaporate.

JEL classification: D13; D33; O15; O18; J61; R11; R23; O53
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1. Introduction

There are two strands in the theory and measurement of income distribution. Economists focus on the *functional* distribution of income, using the concept of factor productivity. Their standard model features a macro-economic production function that maps factor inputs, such as labor and capital, into national income. The factors are rewarded according to their marginal products. Scarce factors fetch a high price. Inequality issues are implicit. Basically, when labor is abundant, relative to capital, the wage rate will be low and, therefore, inequality is expected to be high. In the other "camp," statisticians focus on the *personal* distribution of income, with emphasis on the measurement of income and inequality. They consider personal income as given and analyze it directly, without the need of a production function.

In this paper, however, we are not only interested in the actual distribution of income in an economy that becomes more market oriented, but also in the distribution that would ensue under the benchmark of perfect competition. This issue suggests a two-step program. In the first step we find the marginal productivities of the factor inputs, since they determine the factor incomes under perfect competition. In the second step we reset the factor components of household incomes and reevaluate the distribution of the latter. The first step requires a general equilibrium model to determine the shadow prices of the factor inputs, while the second step requires detailed statistical information to express the rewards of factor inputs, such as the different types of labor, in terms of personal and family incomes. This integration of the functional and personal income analytic approaches seems to be novel.

We extend the model of ten Raa and Mohnen (2001) to an economy of many regions; we refer to the references given there for a review of the applied general equilibrium literature. The model comprises 30 input–output sectors, grouped in agriculture, mining, manufacturing, construction and other services. The standard convexity assumptions are fulfilled, so that the welfare theorems hold and, therefore, a scan of the interprovincial utility frontier and an evaluation of the balance of payments can be used to determine equilibrium (Negishi, 1960). More precisely, we let each province generate a domestic final demand vector (with the observed commodity proportions, assuming Leontief preferences), but multiplied by a (provincial) expansion factor. We scan in each direction in the space of provincial expansion factors by maximizing domestic final demand subject to the national material balances for the tradable commodities, the provincial material balances for the non-tradable commodities, and the factor constraints for the various types of labor and capital. The shadow prices of the tradable commodities codetermine the provincial trade balances, which are used to adjust the relative weights of the provincial expansion factors, until a full balance of payments is achieved. We follow the usual assumption that agriculture, mining and manufacturing produce tradable commodities and that construction and the other services produce non-tradable commodities.

China is perhaps the most dramatic example of a transition to a market economy. Not only is central planning replaced by entrepreneurship, trade liberalized, and are millions of workers on the move, but what makes China particularly fascinating for a case study, is its starting point of egalitarianism. The opening up to free markets of a right-wing dictatorship, is interesting from the view point of efficiency gains, which overwhelm distributional issues. In China, however, there are serious equity stakes.

China is thought to be more egalitarian than other developing countries and features less urban income inequality than rural income inequality. How will competition alter the picture? There will be winners and losers, both in terms of factor claims and in terms of regions and provinces. Income gradients will press people to migrate. This mechanism will take some steam off the inequality problem that surrounds free markets in China. Our main finding is that inequality would multiply under competition, but the predominant nature of inequality would change from the rural–urban divide to differences between the social classes.

We measure inequality by the so-called Theil index, which admits a decomposition of inequality in within-group inequalities and between-group inequality. Normally there is one dimension of classification. Location, profession, or perhaps income itself, defines the subgroups. Our division of the population is three-way though, namely rural–urban, by province and by social class. There is a naughty methodological issue. We may, first, divide Chinese income in rural income and urban income and, second, break down further by province and social class, and then decompose inequality accordingly. Alternatively, we could first divide Chinese income in provincial incomes and then break down each in a rural and an urban component and further by social class. The problem is that the Theil decomposition is influenced by the order of classification. We shall present this slight theoretical problem formally and assess its magnitude.

The remainder of the paper is organized as follows. Section 2 discusses the general equilibrium model (an input–output model with a nonlinear adjustment mechanism for the weights of the provinces) and its main outcomes (the competitive allocation, the shadow prices, and the implied migrations). Section 3 reviews the income inequality literature, extends inequality decompositions to multiple dimensions (rural–urban and regional), implements it for China, and investigates how the general equilibrium valuations alter the results. Section 4 draws conclusions. The details of the model are in Appendix A. Appendices B and C describe the sources of the input–output data and the population/personal income statistics, respectively. The resulting population and income tables are reported in Appendices D and E, where also a map of China can be found. Appendix F explains how the functional rewards (generated by the model) have been transformed to personal incomes.

2. The general equilibrium model

We extend the model of ten Raa and Mohnen (2001) to many regions, dividing China into 30 input–output sectors and 27 provinces.[1] Each province generates domestic final demand plus net exports, which are both 30-dimensional commodity vectors. The provincial net exports sum to the national net exports (in the sense of vectors), because

[1] We miss Neimeng, Hainan, and Tibet because of input–output data problems. Fortunately, these are not populous provinces.

interprovincial deliveries cancel out. National net exports remain fixed in our analysis, so any efficiency gain is brought about by provincial specialization. However unrealistic, this conservative assumption steers the competitive allocation relatively close to the actual one. Introduction of a free world trade assumption would complicate the analysis–efficiency would have not only the domestic component captured in this paper, but also an international specialization component–and require even more data–the so-called Unit Value Ratios (ten Raa and Mohnen, 2002). For similar reasons we assume Leontief preferences, denoting the domestic final demand proportions of province i by vector f^i (obtained by scaling the provincial domestic final demand vector down to unity). The assumptions of the first and second welfare theorems are fulfilled, so we may determine the competitive allocation by maximizing the standard of living. The conflict of interest between provinces is handled using the equilibrium analytic technique of Negishi (1960).

We let each province generate a domestic final demand vector with the observed proportions (f^i), but multiplied by scalar d_iD where D represents the national domestic final use and d_i a provincial share. The provincial weights d_i will be determined by the balances of payments. For any vector of provincial weights, d, we maximize domestic final demand, D, preserving the commodity proportions in each province. More precisely, for any vector of provincial weights d, the linear program described in Appendix A maximizes D subject to the material balances and the factor constraints. The shadow prices to the constraints represent competitive commodity prices and factor rewards, respectively.

The determination of the provincial weights is as follows. For any vector of provincial weights d the linear program determines provincial gross output vectors. Subtraction of the intermediate demands (as determined by the input–output matrix) and the domestic final demands ($f^i d_i D$) yields the competitive provincial net exports vectors. Valuation by the competitive commodity prices yields the balance of payments of province i, for any vector of provincial weights d. We adjust the weights following Negishi (1960). If province i's balance of payments exceeds the balance of payments implied by the observed net exports vector, then the province under consideration exports too much and we give its domestic final demand share more weight by increasing the value of d_i, at the expense of the other provinces. In the limit we obtain an optimal domestic final use that observes not only the consumption patterns in the provinces, but also their mutual balances of payments.

We thus find the optimum pattern of specialization between the provinces, along with the supporting shadow prices of the commodities and the factor inputs. The implementation of this program demands an enormous input–output database, comprising input statistics by sector and province for the commodities, capital, and labor, stock statistics by province for capital and labor, and a breakdown of the latter by skill. Appendix B outlines the data collection procedure. The data are made available by the authors upon request.

The factor inputs are capital plus four types of labor, namely technicians, managers, skilled and unskilled workers. This order is assumed to constitute a top down hierarchy. In other words, technicians are capable of fulfilling any of the labor tasks, managers can do their own job, skilled or unskilled work, skilled workers can do their own job or perform unskilled work, and unskilled workers can only do their own job. We assume free labor mobility.

l_1^i is the row vector of technicians' employment coefficients in province i, l_2^i the same, but of managers, l_3^i of skilled labor, and l_4^i of unskilled labor. The vector of outputs by sector in province i, x^i, is *feasible* with respect to the labor forces N_1^i, N_2^i, N_3^i, and N_4^i, if

$$\sum l_1^i x^i \leq \sum N_1^i,$$

$$\sum (l_1^i + l_2^i) x^i \leq \sum \left(N_1^i + N_2^i\right),$$

$$\sum (l_1^i + l_2^i + l_3^i) x^i \leq \sum \left(N_1^i + N_2^i + N_3^i\right),$$

$$\sum (l_1^i + l_2^i + l_3^i + l_4^i) x^i \leq \sum \left(N_1^i + N_2^i + N_3^i + N_4^i\right).$$

All summations are over provinces, i=1, …, 27. The first inequality constrains the demand for technicians. The second constraint can be rewritten as

$$\sum l_2^i x^i \leq \sum N_2^i + \sum \left(N_1^i - l_1^i x^i\right).$$

This rewrite indicates that managerial demand is constrained by the sum of the labor force of managers and the number of redundant technicians. Similarly, the third constraint binds demand for skilled labor by the sum of the force of skilled workers and the numbers of technicians or managers for whom there are no jobs at the two top levels.

The four constraints pick up shadow prices as the model determines the optimum allocation. The shadow price of the fourth constraint is the base wage. The shadow price of the third constraint is the skill premium, the shadow price of the second constraint is the managerial premium, and the shadow price of the first constraint is the technicians' premium. Technicians pick up shadow values from all four constraints and, therefore, the competitive wage of a technician will be the sum of the base wage and all three premiums. If, for example, the first constraint is not binding, meaning that there is excess supply of technicians, then the wage of a technician will be the base wage, plus the skill and managerial premiums, while the technician's premium is zero. The hierarchy of labor tasks' fulfillment guarantees that wages will increase by skill (or at least not decrease). Table 1 shows the baseline (observed) figures and the competitive results, not only for labor, but also for capital.

Although actual labor rewards already increase by skill, competition would have some dramatic effects. The unskilled workers would receive a minimal wage of a mere sixth of the actual one. The next type of workers, skilled labor, would do no better. Managers would earn a hundred-fold compensation and on top of that technicians would earn a big bonus. Unskilled and even (lowly) skilled labor are abundant while the two top skills are very scarce. The shadow prices reveal the potential returns to higher education in China. Indeed, China now admits students to business schools and polytechnic institutes in great numbers. Investments in such schools should pay off handsomely.

The effects on capital rewards would be less dramatic. Table 1 shows that the rates of return would even decline. Since capital is assumed to be spatially immobile, the rates continue to vary by region.

Table 1
Observed and competitive factor rewards (Yuan)

	Observed	Competitive
Base wage	150.62	25
Skilled wage	257.87	25
Managerial compensation	266.87	31,756
Technician's salary	271.22	59,361
Average rent (%)	0.79	0.44
Central	0.66	0.22
Western	0.53	0.17
Eastern	0.98	0.59

Sources: The observed wages are the October 1992 figures, Yearbook of Labor Statistics of China (1993), Table 7-13 "Increase Rate of Wages of 14 Cities' and Counties' Staff and Workers." The rent on capital is the sum of depreciation, net tax and profit (taken from the 1992 input–output tables, Dept. of National Economic Accounting, State Statistical Bureau of China, 1996) divided by the capital stock. The competitive rewards are our model results. Table 6 or the map in Appendix D shows the division of provinces in three regions.

Table 1 reveals that the comparative advantage of the Chinese economy rests in less skilled labor. If our assumption of fixed national exports were relaxed, the Chinese economy would export more skill extensive commodities and import more skill intensive commodities. As usual, international trade would be a valve for national scarcities and remove some of the competitive pressure on income distribution.

Table 2 shows how total income and inequality would shoot up under competition. (The Theil indices will be detailed in the next session.)

The first column of Table 1 indicates that Chinese domestic income is slightly over 80% of the level attainable under free labor mobility and efficient specialization.

Tables 1 and 2 reflect the so-called dual variables of the program that maximizes the standard of living in China. The underlying primal variables are the sectoral output levels by province and reveal the optimum pattern of specialization within China, see Table 3.

Agriculture remains active in a great number of provinces, but most other activities are best undertaken in specific provinces, except of course the ones producing non-tradable commodities, including the services.[2] Table 3 locates the comparative advantages of the Chinese provincial economies, revealing the threats and challenges they face.

The general equilibrium model reallocates economic activity as to maximize the standard of living in China and this affects the level and mix of labor demand by province. The new demand for labor requires immigration. We depict all labor motions in Table 4. Positive figures represent inflows of workers or immigration and negative figures denote outflows or emigration.

A clear pattern emerges from Table 4. Skilled workers, managers and technicians would move from Western and Central China to Eastern China. These flows would be more than

[2] The efficient allocation of sectoral activities features specialization. Notice that we use an idealized concept of free interprovincial trade, neglecting trade frictions such as transportation costs over and above the ones captured in the intersectoral input–output statistics. The availability and incorporation of data on such frictions would generate a more diversified competitive allocation, including for agriculture.

Table 2
China's income and Theil index

	Income (billion Yuan)	Theil index
Observed	244	0.087
Competitive	300	0.758

offset by a flow of unskilled labor from Eastern China to Central China. Demand for unskilled labor would be so big in Central China that even some workers of the next rank ("skilled labor") would have to perform unskilled labor tasks. Western China would stand to lose all types of workers, if efficiency were to prevail.

Our finding that there are too many unskilled workers in Eastern China, relative to the competitive benchmark, suggests that the Harris and Todaro (1970) mechanism operates in

Table 3
Sectoral activity in provinces[a]

Sectors		Active provinces
Agriculture	1	TJ, HB, SX, LN, JL, HLJ, JS, AH, FJ, JX, SD, HeN, HuB, HuN, GX, SC, YN, ShX, GS, QH
Coal mining and processing	2	SX, GZ
Petroleum and gas extraction	3	HLJ
Metal mining and processing	4	SH
Non-metals mining and processing	5	HB, FJ, NX
Food manufacturing	6	SH, GZ
Textile industry	7	HB, ZJ, XJ
Sewing and leather products	8	SH
Timer and furniture manufacturing	9	SH
Paper making and stationary goods	10	JS
Electrical power steaming	11	JS
Petroleum processing	12	JX
Coking gas and coal products	13	GZ
Chemical industry	14	JS, ZJ
Non-metals products	15	HB
Smelting and processing of metals	16	BJ, JS
Metal products	17	HB
Machinery and equipment manufacturing	18	GD
Transportation equipment manufacturing	19	TJ
Electric equipment and machinery	20	SD, GD
Electronics and telecommunications equipment	21	GD
Instrument and meters	22	HuN
Other manufacturing	23	AH
Construction	24	All
Transportation and telecommunications	25	All
Commerce	26	All
Social service	27	All
Culture, education and research	28	All
Banking and insurance	29	All
Public administration	30	All

[a] The sectors producing non-tradable commodities are denoted in italics. See Table 6 for province codes.

Table 4
Labor mobility in competitive markets (thousands of workers)[a]

Region	Unskilled	Skilled	Managers	Technicians	Total
Eastern	−29,211	10,566	1521	4444	−12,681
Central	43,829	−20,639	−1360	−3620	18,210
Western	−1116	−3428	−161	−824	−5529
China	13,501	−13,501	0	0	0

[a] The figures are differences between competitive and observed labor employments. Hence they represent inflows of workers or immigration. Figures need not add due to rounding.

China. The argument is that high wages in the cities attract workers beyond unemployment. The market failure underlying this distortion is wage rigidity. In view of the minimal competitive wages for the lowest types of labor, this wage rigidity has its virtue though.

Our investigation of the efficient reallocation of labor is extended to the dependants, to obtain people migration figures. Application of The dependency ratios are discussed in Appendix C and tabulated in Appendix D. Application to the labor motions of Table 4 yields the net migration figures by region shown in Table 5.

Across regions, the positive figures (denoting immigration) sum to the same total as the negative figures (denoting emigration). The figure is 33 million persons, suggesting that free markets would exercise limited migratory pressure between the three regions. There are numerous movements between provinces though.

For many decades, the Chinese government has conducted a special system of residence registration, the so-called “Hukou,” but the economic reform has granted more freedom to labor markets. In recent years tens of millions of farmers moved around the country in search for work. Wang et al. (1995) estimated that China counted 130 million surplus farmers and that the number will increase to 230 million in the next 10 years.

Table 4, the last column, reveals that over 18 million workers would cross the borders between the regions. Inclusion of family members increases the figure to nearly 32 million; see Table 5. At the provincial level there are many more migrations. In Eastern China, the provinces Tianjin, Liaoning, Shanghai and Fujian would absorb 52 million migrants, while the other seven provinces would see 74.5 million emigrants leaving. The net figure for Eastern China is 22.5 million emigrants. In Central China, only the provinces Shanxi and Jiangxi would have emigrants, namely 1.3 million, and the other provinces

Table 5
Population migration in competitive markets (thousands of persons)[a]

Region	Migration
Eastern	−22,565
Central	31,799
Western	−9939
China	0
Emigration	−32,505
Immigration	31,799
Numerical error	−705

[a] Figures need not add due to rounding.

would attract 33 million migrants, including 31.8 millions from Eastern and Western China. In Western China, 47.6 million migrants would leave the provinces Guizhou, Yunnan, Nixia and Xinjiang, while the other provinces would absorb only 37.7 million persons, with the remaining 10 millions leaving the West.[3]

3. Inequality

China is thought to be more egalitarian than other developing countries. The State Statistical Bureau found a Gini coefficient for China in 1979 of 0.33. Griffin et al. (1994) gave an estimate of 0.38 for China in 1988 and found this low in comparison to other Asian developing countries. Also, China was found to feature less urban income inequality than rural income inequality. Zhu and Wen (1990) found a Gini coefficient for rural areas of 0.3 and Griffin et al. (1994) confirmed it to be 0.33, but only 0.23 for urban areas, all for the year 1988. Wang et al. (1995) found that the 1993 rural and urban Gini coefficients were 0.33 and 0.24, respectively. The rural inequality derives from farmers' non-production income, whereas staff and workers earn wages similar to the ones that prevail in urban areas, according to Griffin et al. (1994).

Wang et al. (1995) ascribed the rural–urban inequality gap to unbalanced development–with rural economic reform in the period 1978–1985 and urban economic reform in the period 1985–1994–but few studies have explicit results on the relationship between inequality and development. Griffin et al. (1994) compared the rural incomes between all provinces and urban incomes between 10 provinces (again for the year 1988), but were unable to ascribe provincial differences to the rural–urban gap. Wang et al. (1995) found a 2.58:1.16:1 ratio for rural income levels in Eastern, Central and Western China, respectively, and found that the Eastern provinces show great income variation, unlike the Central and Western provinces.[4] Similarly, a 2.13:0.89:1 ratio for urban income levels in the respective regions extended their finding, but their analysis was crude, featuring a "representative" province for each region. Yang (1992) and Wei (1992) calculated the relative mean deviations from per capita GNP in 1989 for the Eastern, Central and Western regions (and the constituent provinces) with findings similar to those of Wang et al. (1995).

Inequalities within provinces have been widely investigated. Zhu and Wen (1990) and Griffin et al. (1994) calculated all provincial Gini coefficients for rural income, but found no relationship between inequality and the level of economic development. For comparison, we include their results in Table 6 below.

Our own analysis is based on the *Theil index*. We believe that there is good reason to measure inequality in this way. Shorrocks (1980) examines the generalized entropy family of inequality indices, of which the Theil index is the main representative. A deep theorem of Shorrocks (1988) shows that subgroup consistency leads inexorably

[3] Because Neimeng, Hainan and Tibet do not participate in the competitive market, their populations will remain constant in this research.

[4] See the map in Appendix D or Table 6 for the division of provinces.

Table 6
Income inequalities in rural China

Province	Code	Rank by next column	1988 Per capita farmers' income	1988 Gini coefficient (Griffin et al., 1994)	1988 Gini coefficient (Zhu and Wen, 1990)	1992 Gini coefficient (this study)	1992 Theil index (this study)
Eastern							
Beijing	BJ	2	1063	0.305	0.233	0.271	0.0553
Tianjin	TJ	4	891	**0.394**	0.256	0.259	0.0521
Hebei	HB	13	547	0.293	0.289	0.228	0.0459
Liaoning	LN	7	700	0.330	0.300	0.254	0.0333
Shanghai	SH	1	1301	0.222	0.215	**0.312**	0.0323
Jiangsu	JS	6	797	0.383	0.299	0.282	0.0294
Zhejiang	ZJ	3	902	0.286	0.298	0.266	**0.0555**
Fujian	FJ	9	613	0.290	0.218	0.256	0.0245
Shandong	SD	10	584	0.285	0.267	0.225	0.0484
Guangdong	GD	5	809	0.306	0.305	0.249	0.0392
Central							
Shanxi	SX	23	439	0.320	0.275	0.240	0.0431
Neimeng	NM	15	500	0.339	0.293	0.245	0.0233
Jilin	JL	8	628	0.354	0.264	0.247	0.0184
Heilongjiang	HLJ	12	553	0.368	0.294	0.251	0.0157
Anhui	AH	20	486	0.249	0.207	0.238	0.0267
Jiangxi	JX	19	488	0.230	0.201	0.247	0.0280
Henan	HeN	27	401	0.299	0.250	0.238	0.0230
Hubei	HuB	16	498	0.231	0.229	0.242	0.0252
Hunan	HuN	14	515	0.255	0.212	0.242	0.0257
Western							
Guangxi	GX	25	424	0.291	0.279	0.234	0.0231
Hainan	HN	11	567	0.276	0.283	0.253	0.0267
Sichuan	SC	22	449	0.265	0.241	0.226	0.0276
Guizhou	GZ	28	398	0.295	0.234	0.234	0.0167
Yunnan	YN	24	428	0.287	0.259	0.236	0.0249
Tibet	TB	29	374		0.279	0.248	0.0181
Shaanxi	ShX	26	404	0.289	0.263	0.238	0.0275
Gansu	GS	30	340	0.263	0.248	0.230	0.0262
Qinghai	QH	18	493	0.313	**0.325**	0.251	0.0232
Ningxia	NX	21	473	0.273	0.315	0.237	0.0240
Xinjiang	XJ	17	497		0.323	0.243	0.0325

towards the generalized entropy family. An inequality measure is *subgroup consistent* if it fulfils an intuitive condition: a redistribution of income within any subgroup that increases subgroup inequality, however defined, must increase overall inequality when all other incomes are preserved, according to the same definition. This monotonicity condition requires no additivity. Strictly speaking, subgroup consistency yields any monotonic transformation of a generalized entropy index, but this freedom is superficial; a weak adding-up requirement eliminates it, namely condition (19) of Shorrocks (1988).

Let total income of a partitioned population be unity (so that 'incomes' are shares). The income of g-group member j is denoted y_{gj}, where g=1, ..., G, the number of groups, and j=1, ..., N_g, the size of group g. Denoting the total income of group g by Y_g, the Theil (1967) index of inequality can be written as

$$\sum_{g=1}^{G} Y_g \log \frac{Y_g}{N_g/N} + \sum_{g=1}^{G} Y_g \sum_{j=1}^{N_g} \frac{y_{gj}}{Y_g} \log \frac{y_{gj}/Y_g}{1/N_g}.$$

The first term is between-group inequality and the second term is average within-group inequality. The classical division is between rural and urban income (g=1 and 2, respectively). Now refine each group in subgroups of sizes N_{gh}, where h=1, ..., H, the common number of subgroups, think of provinces. Denoting individual incomes by y_{ghj}, j=1, ..., N_{gh}, and subgroup incomes shares by Y_{gh}, inequality can be rewritten as

$$\sum_{g=1}^{G} Y_g \log \frac{Y_g}{N_g/N} + \sum_{g=1}^{G} Y_g \sum_{h=1}^{H} \frac{y_{gh}}{Y_g} \log \frac{y_{gh}/Y_g}{N_{gh}/N_g} + \sum_{g=1}^{G} Y_g + \sum_{h=1}^{H} \frac{Y_{gh}}{Y_g} \times \sum_{j=1}^{N_{gh}} \frac{y_{ghj}}{Y_{gh}} \log \frac{y_{ghj}/Y_{gh}}{1/N_{gh}}.$$

The first term represents between-group inequality, the second term between-subgroup inequality, and the third term the average within-subgroup inequality. Now we decompose inequality in rural–urban inequality, provincial inequality, and social inequality. We face a nasty nesting issue. Had we divided China in provinces first and refined them in rural and urban areas, inequality would still be the sum of provincial inequality, rural–urban inequality, and social inequality, but the numbers could be different. Total inequality would still be the same, as would be the third terms, representing average within-subgroup or social inequality. The leading terms, representing rural–urban inequality and provincial inequality, would have the same sum, but the division might differ.

Let us discuss the data requirements of these inequality measures. We need personal incomes by (rural or urban) area, province, and social class, both for the observed economy and for the hypothetical, purely competitive economy. Appendix C describes our collection of the population and personal income statistics; for the respective tables see Appendices D and E. The incomes under perfect competition are derived from the factor input prices obtained in Section 2. We allocate these earnings to eight social classes, namely four types of labor (unskilled, skilled, managers, and technicians), the self-employed, the capitalists, the retirees, and, last but not the least, the dependants. The imputation of labor income is straightforward, but the imputation of capital income is not. Moreover, factor incomes must be distributed to persons, taking into account family sizes. We assume that the population division between rural and urban remains constant in each province, because we have no bridge table between input–output sectors and the rural–urban classification.[5] The details of the transformation of the functional to the personal distribution of income are collected in Appendix F.

[5] Rural China has many industries other than agriculture.

The inequality measures in the literature (provincial Gini coefficients for rural income) are presented in Table 6, along with our own calculation for comparison. The first two columns give the province names and codes. The third and fourth columns display the levels and ranks of the provincial farmers' incomes. The fifth, sixth and seventh columns provide the Gini coefficients of Griffin et al. (1994), Zhu and Wen (1990), and this study, respectively. The eighth column provides the Theil indices of this study. It is noteworthy that all measures locate the most unequal distribution of income in different provinces (the bold figures). Income inequality measurement is no easy job!

In Table 7, the first column reproduces the rural income inequalities (from Table 6, last column) and the second column presents the urban inequalities. A weighted average of the two yields the inequality within areas, given in column 3. The inequality between the rural and urban economies is given in column 4. Columns 3 and 4 are reproduced as percentages of provincial inequality in columns 5 and 6, respectively, while the sum of respective elements is reported in column 7, the Theil index of any province. For example, in Beijing the rural–urban divide contributes only 13% to inequality, but in Tibet the share is 63%.

The discussion of the national Theil indices at the bottom of Table 7 is quite similar. The first column displays rural inequality. A weighted average of all the provincial Theil indices yields the inequality within the provinces, 0.0324. The inequality between the provinces is 0.0243. The two terms are reproduced as percentages at the bottom, and they sum to 0.0567, the Theil index for rural inequality in China. The explanations of urban inequality (column 2) and the weighted average of rural and urban inequality (within-area inequality, column 3) are similar. A weighted average of the rural–urban divides (column 4) yields the Theil index for this inequality, namely 0.0284.[6] Provincial inequality, be it rural, urban, or the divide, is given by the right hand side column, column 7. Here the weighted average yields a Theil index of 0.0664, which is well above the figures of the developed provinces, such as Beijing and Shanghai. Addition of the inequality between the provinces, 0.0208, yields the Theil index in bold on the right bottom of the table: 0.0872. This figure represents the *overall personal income inequality* in China for the year 1992. Once more, the two contributing terms are reproduced as percentages at the bottom (in columns 5 and 6).

Reading the row of Theil's inequality measure, overall personal income inequality (0.0872) is shown as the sum of rural–urban inequality (0.0284) and within-area inequality (0.0588), where the latter has been obtained by vertical summation of the between-provinces (0.0208) and the within-province or social inequality (0.0380) measures. Reading the column of provincial inequality, overall personal income inequality (0.0872) is shown as the sum of the between-province inequality (0.0208) and the within-province inequality (0.0664) measures, where the latter has been obtained by horizontal summation of rural–urban inequality (0.0284) and within-area or social inequality (0.0380). Either way overall inequality consists of 33% rural–urban inequality,

[6] Notice that the variation of this statistic between provinces is meaningless; this is why Table 2 has an empty cell in column 4.

Table 7
Income inequalities in the observed Chinese economy

Province	Code	Rural inequality	Urban inequality	Within areas	Between areas	Within areas	Between areas	Provincial inequality
Eastern								
Beijing	BJ	0.0553	0.0328	0.0372	0.0058	87%	13%	0.0430
Tianjin	TJ	0.0521	0.0256	0.0321	0.0039	89%	11%	0.0360
Hebei	HB	0.0459	0.0327	0.0411	0.0342	55%	45%	0.0753
Liaoning	LN	0.0333	0.0401	0.0378	0.0187	67%	33%	0.0565
Shanghai	SH	0.0323	0.0209	0.0239	0.0062	79%	21%	0.0301
Jiangsu	JS	0.0294	0.0297	0.0295	0.0221	57%	43%	0.0516
Zhejiang	ZJ	0.0555	0.0515	0.0543	0.0005	99%	1%	0.0548
Fujian	FJ	0.0245	0.0905	0.0471	0.0189	71%	29%	0.0660
Shandong	SD	0.0484	0.0445	0.0472	0.0016	97%	3%	0.0488
Guangdong	GD	0.0392	0.0662	0.0512	0.0054	90%	10%	0.0566
Central								
Shanxi	SX	0.0431	0.0326	0.0379	0.0422	47%	53%	0.0801
Neimeng	NM	0.0233	0.0461	0.0357	0.0296	55%	45%	0.0653
Jilin	JL	0.0184	0.0455	0.0343	0.0235	59%	41%	0.0578
Heilongjiang	HLJ	0.0157	0.0436	0.0323	0.0114	74%	26%	0.0437
Anhui	AH	0.0267	0.0580	0.0379	0.0391	49%	51%	0.0770
Jiangxi	JX	0.0280	0.0585	0.0377	0.0160	70%	30%	0.0537
Henan	HeN	0.0230	0.0455	0.0303	0.0398	43%	57%	0.0701
Hubei	HuB	0.0252	0.0355	0.0297	0.0218	58%	42%	0.0515
Hunan	HuN	0.0257	0.0523	0.0346	0.0297	54%	46%	0.0643
Western								
Guangxi	GX	0.0231	0.0682	0.0371	0.0363	51%	49%	0.0734
Hainan	HN	0.0267	0.1082	0.0668	0.0648	51%	49%	0.1316
Shichuan	SC	0.0276	0.0467	0.0343	0.0257	57%	43%	0.0600
Guizhou	GZ	0.0167	0.0628	0.0323	0.0259	55%	45%	0.0582
Yunnan	YN	0.0249	0.0448	0.0316	0.0488	39%	61%	0.0804
Tibet	TB	0.0181	0.1045	0.0484	0.0821	37%	63%	0.1305
Shaanxi	ShX	0.0275	0.0393	0.0328	0.0587	36%	64%	0.0915
Gansu	GS	0.0262	0.0407	0.0334	0.0804	29%	71%	0.1138
Qinghai	QH	0.0232	0.0461	0.0365	0.0977	27%	73%	0.1342
Ningxia	NX	0.0240	0.0372	0.0312	0.0771	29%	71%	0.1083
Xinjiang	XJ	0.0325	0.0496	0.0424	0.0601	41%	59%	0.1025
Within provinces		0.0324	0.0455	0.0380	0.0284	57%	43%	0.0664
Between provinces		0.0243	0.0163	0.0208		100%	0%	0.0208
Theil's inequality		0.0567	0.0618	0.0588	0.0284	67%	33%	*0.0872*
Within provinces		57%	74%	65%	100%	44%		76%
Between provinces		43%	26%	35%	0%			24%

24% provincial inequality, and a remainder of 43% social inequality. How sensitive is the decomposition of inequality with respect to the naughty nesting issue? In the above analysis we first divided between the rural and urban areas and then subdivided between provinces. If we reverse the order, the overall inequality would still be the same, 0.0872, but the rural–urban inequality would be only 28% (instead of 33%) and the provincial inequality 29% (instead of 24%); the residual social inequality would remain the same (43%), by construction. Roughly speaking, without any pretense to settle this methodological problem at the level of theory, it is safe to conclude that of Chinese inequality three/tenth is rural–urban, three/tenth provincial, and four/tenth social.

We now turn to the crucial question what competition would do to inequality. Table 8 presents our findings as relative departures from the empirical inequality statistics of Table 2 (ignoring the two columns with percentages, 5 and 6). For example, the first inequality

Table 8
Inequality changes from the observed to the competitive economy

Province	Code	Rural inequality	Urban inequality	Within areas	Between areas	Provincial inequality
Eastern						
Beijing	BJ	5.95	8.05	7.23	5.12	6.94
Tianjin	TJ	9.50	14.33	11.77	12.33	11.83
Hebei	HB	4.24	17.85	10.90	0.85	6.34
Liaoning	LN	35.67	9.52	13.74	10.13	12.54
Shanghai	SH	19.06	17.13	16.62	4.92	14.21
Jiangsu	JS	20.74	13.23	16.42	3.49	10.88
Zhejiang	ZJ	8.71	8.95	8.62	118.40	9.62
Fujian	FJ	35.90	3.77	11.75	10.92	11.51
Shandong	SD	21.39	12.56	15.37	96.88	18.05
Guangdong	GD	7.15	7.00	8.26	9.93	8.42
Central						
Shanxi	SX	16.72	11.18	12.42	3.85	7.90
Neimeng	NM	1.00	1.00	1.00	1.00	1.00
Jilin	JL	55.56	5.44	11.54	9.28	10.62
Heilongjiang	HLJ	55.64	6.44	12.22	13.18	12.47
Anhui	AH	36.76	7.17	16.88	5.30	11.00
Jiangxi	JX	30.36	5.73	14.38	11.62	13.55
Henan	HeN	49.93	8.02	23.71	6.34	13.85
Hubei	HuB	44.22	10.77	19.58	11.52	16.17
Hunan	HuN	37.70	6.83	16.79	8.52	12.97
Western						
Guangxi	GX	41.60	4.16	14.83	7.83	11.37
Hainan	HN	1.00	1.00	1.00	1.00	1.00
Shichuan	SC	45.99	10.03	21.41	11.27	17.07
Guizhou	GZ	7.76	8.98	12.81	0.70	7.42
Yunnan	YN	20.90	3.94	8.89	4.86	6.44
Tibet	TB	1.00	1.00	1.00	1.00	1.00
Shaanxi	ShX	39.41	7.62	16.24	5.58	9.40
Gansu	GS	44.74	8.60	18.03	3.69	7.90
Qinghai	QH	37.12	5.34	13.28	1.69	4.84
Ningxia	NX	4.56	10.14	9.73	0.63	3.26
Xinjiang	XJ	4.97	8.06	7.72	0.44	3.45
Within provinces		19.23	9.14	12.57	6.28	9.88
Between provinces		8.94	3.24	4.90		4.90
Theil's inequality		14.82	7.59	9.86	6.28	**8.69**

figure of Table 7 (rural inequality in Beijing, 0.0553) is increased by a factor 5.95. The last ratio of Table 8 (in bold) is the most interesting one; overall inequality is increased by a factor 8.69. The rural–urban inequality goes up by a relatively modest factor of 6.28. The inequality between provinces is increased by a factor 4.90 and the inequality within provinces by a dramatic factor 9.88. What accounts for this is the hefty increase in subgroup or social inequality by a factor 7.52.

In short, *competition would breed inequality but the share of the rural–urban divide would diminish*.

The emergence of inequality should come as no surprise. The Chinese income distribution in the base year 1992 is egalitarian; Appendix E shows the small income differences between persons. In rural areas, the highest/lowest income ratio (representing the capitalists versus the unskilled) is only 15. In urban areas it is still only 20. Each social class earns more in urban than in rural areas and urban mean income is about double rural mean income. Shanghai and Guizhou are the richest and poorest provinces, respectively, but the mean income ratio is a modest 5.

The finding of the literature that China has less urban inequality than rural inequality is *not* confirmed. The rural and urban Theil indices are about the same (0.0567 and 0.0618, respectively, see Table 7). Within the two areas inequality varies quite a bit, essentially by stage of development.[7] In the less and under-developed provinces most inequality is in fact urban and, indeed, in the developed Chinese provinces there is less urban inequality than rural. One might say that the literature's finding pertains to developed China.

Under perfect competition, however, urban inequality would be less than rural inequality. (The expansion factors of rural and urban inequality are 14.82 and 7.59 according to Table 8, bottom line.)

So far we have discussed the inequalities within rural and urban China. Now we turn to their differences. The literature stressed the difference between urban and regional income levels as a result of urban economic reform. We confirm this; the rural–urban divide is substantive (0.0284, that is 33% of overall inequality, 0.0872, see Table 2). Appendix E shows that urban income is more than double of rural income (all per person) and that all provinces except Zhejiang show higher levels of urban than of rural income.

The rural–urban divide would multiply under competition (by a factor 6.28), but at a lower rate than overall inequality (8.69, see also Table 8). Our analysis confirms the finding of the literature that Eastern China stands out in terms of income and that Central and Western China are not too far apart. The contribution of provincial variation to overall inequality is significant. Table 7 ascribed 24% to

[7] In 1994, the Eastern provinces (see Table 6 for the classification) were home to 36.5% of China's population but 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. The Central provinces were home to 35.6% of China's population and contributed 27.6% to national GDP. Per capita GDP in the Central part was 2913 Yuan. The Western provinces were home to 27.9% of China's population but contributed 16.8% to national GDP. Per capita GDP in the Western part was 260 Yuan. The Eastern, Central and Western parts are referred to as developed, less-developed and under-developed zones, respectively.

provincial inequality (0.0208 out of 0.0872). Competition would increase provincial inequality by a factor 4.90 (see Table 8), which is less than the rural–urban inequality increase (factor 6.28). China's income inequality between provinces will be relatively modest when they fully reap their locational advantages under perfect competition.

Contrary to Griffin et al. (1999), Table 6 reveals a negative relationship between income inequality and economic development. The figures in columns 3 and 4 of Table 7 indicate that income inequality between the social classes exceeds that between the rural and urban areas in all developed provinces, in 6 of the 9 less developed provinces, and in 4 of the 11 least developed provinces. Rural–urban inequality and economic development are negatively related, while rural–urban inequality correlates positively with overall inequality. Social inequality varies little with the level of development. Since under competition the rural–urban divide would become relatively less important, this explains why the negative relationship between inequality and development would be dissolved. Inequality would be determined by differences in factor rewards that, at least for labor, would be independent of the province or the stage of development.

4. Conclusion

In this paper we have presented an input–output model to reveal the potential of the Chinese economy, including the supporting shadow prices. The drawback of this approach is that a number of unrealistic assumptions have to be made. Commodities are classified in 30 categories, assuming perfect substitutability within categories and perfect complementarities between them, declaring each either perfectly tradable or not at all. A similar caveat applies to the classification of factor inputs. Trade with the rest of the world is not changed at all. Neither is technology. Subject to the limitations, the model indicates that perfect competition would restructure the Chinese economy severely along the following lines. If factor rewards would reflect provincial or national scarcities, the less skilled labor types would stand to lose and, therefore, inequality would mount. The flipside of this change is the potential for improvement of the average standard of living. Optimal specialization between provinces alone, may add about 23% to the level of domestic final consumption in China. Skilled workers, managers and technicians would move from Western and Central China to Eastern China. These flows would be more than offset by a flow of unskilled labor from Eastern China to Central China. Our finding indicates that Eastern China accommodates too many unskilled workers, relative to the competitive benchmark, and thus suggests that the Harris–Todaro mechanism operates in China.

We have offered two three-way decompositions of Chinese income inequality in rural–urban, provincial, and social components, one pertaining to the observed data and the other to the income levels that would prevail under perfect competition. Competition would reduce the rural–urban divide (at least in relative terms) and dissolve the negative relationship between the level of development and income inequality. However, competition would skew factor rewards dramatically and thus create tension between the social classes. Compared to the competitive benchmark, Chinese policy is quite successful in checking inequality. As its economy is reorganized along competitive lines, skilled labor will prove scarce. It should be mentioned that this result is a consequence of our assumption of a fixed trade position and technology. Stimulating higher education and free world trade can alleviate the pressure.

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Appendix A. The general equilibrium model

We maximize scalar D, the overall value of national final uses, the sum of the values of final uses in all sectors and all provinces. The variables exogenous to the linear program are:

A^i	a square matrix of intermediate input coefficients, 30 by 30, of province i
f^i	a 30-dimensional column vector of the proportions of province i's final uses
e^i	a 30-dimensional column vector of province i's net foreign exports
d^I	the share of province i's overall final uses in domestic final uses

The provincial shares d^i will be endogenized after the presentation of the linear program. At this stage, the endogenous variables are:

x^I	a column vector of province i's 30 outputs (nonnegative)
D	a scalar of overall domestic final uses

The first constraints are the material balances:

$$\sum \left(I - A^i\right)x^i \sum f^i d^i D + \sum e^i.$$

Notice that the material balances are pooled across provinces, meaning that the commodities are assumed to be tradable. There are a few exceptions. The commodities listed at the bottom of Table 3 in italics are *non-tradable*. For these components the inequality must hold for each term i *separately*. The labor constraints have been described in Section 3. In addition, there are 27 capital constraints, presuming that capital is province specific, but mobile between sectors:

$$\sum K^i x^i \leq M^i,$$

where K^i is a 30-dimensional row vector of fixed capital coefficients for province i and M^i is the stock of fixed capital in province i.

For each vector of provincial shares of domestic final demand, d, the linear program determines an optimal allocation of gross outputs and shadow prices. Denoting p as the shadow prices of commodities, the overall value of the net exports to the rest of China is for each province:

$$S^i(d) = p\left[\left(I - A^i\right)x^i - f^i d^i D - e^i\right], \qquad i = 1,\ldots,27.$$

Compare this to the observed balance of payments,

$$S_0^i(d) = (1,\ldots,1)\left[\left(I - A^i\right)x_0^i - f^i d_0^i D_0 - e^i\right], \qquad i = 1,\ldots,27.$$

The equilibrium provincial shares will be determined by the condition that the two expressions match. The combination of the linear program and the non-linear budget constraints constitutes the general equilibrium model. We solve the model by the method of the Mixed Complementarity Problem (MCP), which combines the linear programming with the Newton algorithm; see Brooke et al. (1998). MCP solves the model effectively if a solution to the model exists *and* the initial values are selected near the solution.

Appendix B. The input–output data

B.1. National and provincial input–output tables

Most Chinese provinces have produced square input–output tables in three versions, with 6, 33, and 118 commodities. We consolidate the 33 sector table into one with 30 sectors by aggregating maintenance, repair and other industries, commerce and restaurants, and freight and passenger transports. The tables provide intermediate inputs, value added, domestic final use, some interprovincial and international trade, and gross outputs. To pinpoint the provincial final consumption vectors, we must determine their exports to not only the rest of the world, but also to the rest of China.

Now 12 provinces provide separate information on interprovincial and international trade. Their exports to the rest of China sum to 829,782 million Yuan, their imports to 898,960 million Yuan, hence their domestic net exports amount to −69,178 million Yuan. Net domestic exports in the 15 provinces without separate information on interprovincial and international trade must therefore be 69,178 million Yuan. We assume that the ratio of overall exports (829,782 million Yuan) to gross output (3,766,102 million Yuan) in the 12 provinces, which is 0.22, equals the ratio of overall import (58,596 million Yuan) to gross output (2,663,441 million Yuan) in the 15 provinces. Then overall import from the rest of China in the 15 provinces is 585,957 million Yuan (and the overall export is 585,957+69,178= 655,135 million Yuan). The overall export is allocated to the 30 sectors by their shares of net exports. The material balances then determine the imports from the rest of China.

The trade data need to be further separated in the 15 provinces. We calculate their shares in exports to the rest of China or the world and assume that these match the shares of exports to the rest of China. This procedure disaggregates exports to the rest of China by origin. The same procedure is applied to the imports from the rest of China.

Domestic trade in the 15 provinces is disaggregated by sector by means of the RAS method.[8] For 15 provinces the exports are not separated between domestic and foreign. The provincial budget constraint (see Appendix A) requires separation though. For this purpose we have constructed a commodity by province table. Column 28, which is the sum of columns 1–27, shows the overall exports at the sectoral level, whereas 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.

B.2. Capital stocks

The State Statistical Bureau has made available to us the unpublished data on capital stocks in the year 1992 for 40 industrial sectors by province. We aggregate these data into 23 industrial sectors according to the sector classifications in the input–output table. The data for non-industrial sectors are estimated from the information on investment in the China Statistical Yearbook (1993).[9] Here the classification is as follows: (1) agriculture, (2) industry, (3) geological prospecting, (4) construction, (5) transportation and telecommunications, (6) commerce, food services 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. Sectors (3)–(13) are simply aggregated into seven non-industrial sectors. We calculate the proportions of the investment in industry to the investment in these non-industrial sectors and use these for the proportions of capital stocks. This determines the capital stocks in the non-industrial sectors. The data on the capital stocks in the agricultural sectors are obtained in a different way. The Rural Statistical Yearbook of China in 1993 provides data on the number of rural households by province and on the capital stocks per rural household.[10] The two

[8] For the RAS method, see Bacharach (1970).

[9] See Tables 5-23 "Investment in Capital Construction by Sector of National Economy and Province in 1992" and 5-43 "Investment in Technical Updating and Transformation by Sector of National Economy and Province in 1992."

[10] See Table 4-3 "Rural Households and Population by Province in 1992" for the data on the number of rural households by province, and Table 3-24 "Original Value of Fixed Assets for Production Per Rural Household by Province" for the information on capital stocks per rural household.

sources are combined to derive the capital stocks in the agricultural sector by province.

B.3. Employment and labor resources

Information on employment and labor resources is 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; we aggregate them into 30 sectors and four types of occupations.

Appendix C. Data on population and personal income

The population data in terms of the eight social classes (unskilled worker, skilled worker, manager, technician, self-employed, capitalist, retiree and dependant), the rural and urban areas, and the provinces, are directly available from the China Population Census (1990), except for the number of capitalists and self-employed. The data for the labor classes (unskilled, skilled, manager and technician) are obtained from the China Population Census Vol. 2 (1990),[11] where there are 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).[12] The first two pertain to urban data and the third to rural data. The data on family-income dependants is obtained by subtracting the number of workers and retirees from the total population. Because the population census data are in the year 1990, they are updated to 1992 using the 1992 population figures from the Statistical Yearbook of China (1993).[13] The data on the number of capitalists and self-employed are collected separately from the China Labor Statistical Yearbook (1993).[14] Instead of presenting the data on capitalist and self-employed directly, the China Population Census (1990) has them included in the labor categories. Therefore, to make the data consistent, a number of workers corresponding to the number of capitalists and self-employed are subtracted from the labor categories. Neither the China Population Census (1990) nor the China Labor Statistical Yearbook (1993) provides information on the occupation of capitalists and

[11] 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, and the third is for rural data.

[12] 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).

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

[14] 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 Labor Statistical Yearbook (1993).

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 D.

The first step to construct income data is the collection of data on urban wages. Normally, this wage includes two parts: the money wage and the social insurance and welfare funds. The China Labor Statistical Yearbook (1993) provides data on money wage by province and the data on the social insurance and welfare funds of staff and workers.[15] The urban wages must be further separated by occupation, as Chinese information authorities usually collect the wage data by sector rather than occupation. A special survey in the Yearbook of Labor Statistics of China (1993) provides a section regarding occupational wages. According to this source, the skilled wage matches the average wage, the unskilled wage amounts 0.584 of the average wage, the manager's wage 1.035 of the average wage, and the technician's wage 1.052 times of the average wage.[16] Applying these ratios to all provinces, we can disaggregate the provincial urban wage data by occupation.

Most studies estimate that capitalist income could be 10-fold the wage of a skilled worker, and self-employed income 4-fold.[17] 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 Labor Statistics of China (1993).[18]

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[15] In the China Labor Statistical Yearbook (1993) see Table 1-65 "Number and Total Wage Bill of Staff and Workers by Province." The social insurance and welfare funds 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.

[16] In the Yearbook of Labor 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 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.

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

[18] In the Yearbook of Labor 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.

Spreading income uniformly within families and using a constant ratio of dependants to primary income earners, we obtain dependants' income by dividing the average of the primary income earners' incomes over the dependency ratio.[19] The primary income earners have the same net income left (after sharing their primary income with the family).

The Yearbook of Survey on Rural Households (1992) includes data on national rural households' income by education in the year 1991. We define the occupations of rural labor by education as follows: those with educational years fewer than 6 belong to the unskilled, those with 7–12 years belong to the skilled, and those having over 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 national macro data rather than provincial data. The survey breaks down labor by education, but not in terms of income.[20] However, the survey has data on household income by labor education.[21] Using this information as a proxy for labor income by education, it can be derived that in rural areas the technicians' and managers' incomes are the same, namely 1.37 times the average, 1.34 times the skilled, and 1.59 times the unskilled labor wage.[22] (This estimate is consistent with the common recognition that in rural areas technicians and managers earn a high income, common to both, and that skilled and unskilled labor wages are low, also at a common level. Technicians and managers are paid urban wages, while the unskilled and skilled workers are residual claimants.) By applying these ratios to the provinces, we break down rural income by occupation or skill, as well as by province.

We estimate the income of rural capitalists and self-employed by assuming that rural capitalists and rural self-employed earn 10, respectively, four times the rural skilled wage, as we did for the urban incomes. Rural retirees receive the same income as urban retirees. The rural dependant income equals to the rural households' mean income, which is directly available from the China Statistical Yearbook (1993).[23] The final data are presented in Appendix E.

[19] We assume that retirees cannot afford dependants.

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

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

[22] 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. Assuming that technician and manager's incomes are equal, their income is 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.

[23] Table 8-23 "Net Income of Peasant Household Per Capita by Province" in China Statistical Yearbook (1993).

Appendix D. 1992 Population in China[24]

Eastern	BJ	TJ	HB	LN	SH	JS	ZJ	FJ	SD	GD
Rural unskilled	866,858	1,107,746	25,642,777	9,326,260	1,053,773	24,566,410	11,576,084	9,612,977	34,129,906	17,959,349
Rural skilled	407,383	222,743	42,559	845,708	1,575,239	6,859,832	3,667,196	1,524,030	52,544	2,010,768
Rural manager	50,628	26,029	147,691	130,956	78,436	574,097	148,838	80,137	225,585	129,161
Rural technician	84,921	53,553	565,004	376,870	164,136	998,949	398,194	363,176	835,486	412,357
Rural self-employed	160,865	95,743	1,653,653	439,673	104,140	1,101,917	1,456,627	400,015	2,373,151	1,173,421
Rural capitalist	599	6649	14,784	6364	4389	6507	16,911	7085	13,390	27,492
Rural retiree	33,114	17,375	273,196	167,245	148,256	483,125	178,704	140,144	341,026	281,656
Rural dependant	1,323,908	1,270,754	22,353,882	8,333,590	1,410,663	19,620,942	11,713,375	12,378,061	24,584,733	19,272,202
Rural population	2,928,276	2,800,592	50,693,546	19,626,666	4,539,032	54,211,779	29,155,929	24,505,625	62,555,821	41,266,406
Urban unskilled	823,183	720,507	1,973,178	2,645,268	584,655	1,927,493	2,503,955	947,115	6,645,257	4,256,586
Urban skilled	2,460,982	2,156,565	3,419,409	6,220,334	3,298,110	4,975,721	3,870,447	1,654,209	5,251,203	6,199,681
Urban manager	376,242	191,158	358,758	696,926	282,544	636,791	262,927	130,018	457,677	471,232
Urban technician	976,299	594,502	1,024,697	1,597,977	887,702	1,275,515	915,195	492,557	1,502,633	1,474,986
Urban self-employed	117,804	46,516	183,928	472,894	79,090	210,288	283,895	242,530	296,721	763,701
Urban capitalist	15,360	9342	6093	19,782	11,601	16,385	17,086	54,533	16,080	73,095
Urban retiree	724,366	510,376	542,809	1,592,882	1,350,286	1,110,513	655,528	329,770	731,107	1,049,934
Urban dependant	2,597,535	2,170,440	4,548,201	7,288,136	2,416,981	4,745,513	4,695,051	2,803,633	8,643,502	9,692,481
Urban population	8,091,771	6,399,406	12,057,073	20,534,199	8,910,969	14,898,219	13,204,084	6,654,365	23,544,180	23,981,696
Dependency ratio	0.473	0.513	0.606	0.55	0.372	0.467	0.552	0.728	0.58	0.678
Total population	11,020,047	9,199,998	62,750,619	40,160,865	13,450,001	69,109,998	42,360,013	31,159,990	86,100,001	65,248102

(continued on next page)

[24] See Table 6 for province codes.

Appendix D (*continued*)

Central	SX	NM	JL	HLJ	AH	JX	Hen	Hub	Hun
Rural unskilled	9,270,061	6,707,771	6,975,122	8,178,501	26,467,638	14,856,940	41,049,622	21,130,853	26,863,862
Rural skilled	557,680	275,091	320,164	511,357	914,910	956,758	1,025,825	902,474	1,195,240
Rural manager	93,304	61,229	58,740	108,726	159,854	112,621	254,606	151,391	154,599
Rural technician	338,984	240,144	241,584	351,239	547,337	445,507	993,937	528,277	602,401
Rural self-employed	587,676	193,310	162,505	152,295	773,824	590,272	901,166	654,851	782,226
Rural capitalist	11,717	1662	1004	380	3019	3256	8231	1387	5846
Rural retiree	144,714	60,748	57,175	165,499	194,696	202,132	320,295	168,436	335,698
Rural dependant	10,197,038	6,510,231	6,803,037	9,307,183	18,869,465	13,998,329	30,558,240	16,221,241	21,429,096
Rural population	21,201,174	14,050,186	14,619,331	18,775,180	47,930,743	31,165,815	75,111,922	39,758,910	51,368,968
Urban unskilled	1,084,208	1,024,358	1,100,966	1,975,755	1,750,715	1,271,044	2,401,093	2,897,862	2,024,164
Urban skilled	2,376,805	1,954,824	2,854,180	4,361,251	2,680,352	1,875,904	3,497,060	4,361,328	2,801,376
Urban manager	278,229	201,952	295,529	524,770	283,010	193,682	417,715	438,279	323,793
Urban technician	729,725	617,411	858,205	1,240,598	758,248	592,710	1,074,305	1,288,475	926,929
Urban self-employed	154,958	230,212	336,786	464,219	409,499	312,093	368,858	279,548	367,627
Urban capitalist	4615	4117	4778	9230	3326	3754	3943	4995	6902
Urban retiree	324,393	346,321	616,772	982,098	494,470	384,179	566,840	785,556	620,861
Urban dependant	3,635,792	3,640,621	4,633,456	7,746,814	4,029,636	3,330,819	5,168,228	5,985,025	4,229,392

Urban population	8,588,725	8,019,816	10,700,672	17,304,735	10,409,256	7,964,185	13,498,042	16,041,068	11,301,044
Dependency ratio	0.734	0.831	0.764	0.811	0.632	0.719	0.62	0.595	0.598
Total population	29,789,899	22,070,002	25,320,003	36,079,915	58,339,999	39,130,000	88,609,964	55,799,978	62,670,012

Western	GX	HN	SC	GZ	YN	TB	Six	GS	QH	NX	XJ
Rural unskilled	19,173,645	2,314,405	53,560,310	14,653,369	17,370,544	894,046	13,474,257	10,219,588	1,651,373	1,719,946	4,781,473
Rural skilled	147,022	203,049	1,116,132	160,545	354,377	43,601	344,610	59,693	100,307	29,967	221,014
Rural manager	90,158	16,845	172,154	51,317	84,298	12,863	74,904	54,628	14,611	12,556	48,400
Rural technician	397,080	78,775	925,725	237,399	376,764	49,155	345,036	198,365	79,054	48,059	195,241
Rural self-employed	545,070	66,887	1,374,038	196,583	397,675	14,862	407,374	264,199	28,951	48,185	174,221
Rural capitalist	3660	894	7410	4186	1394	1	4333	2280	361	469	1479
Rural retiree	121,342	108,280	543,396	73,417	162,615	8249	124,473	37,435	13,518	11,665	125,893
Rural dependant	16,810,368	2,428,165	30,286,707	11,766,952	13,859,138	994,629	11,942,893	7,213,054	1,515,380	1,732,716	5,123,878
Rural population	37,288,345	5,217,300	87,985,872	27,143,768	32,606,805	2,017,406	26,717,880	18,049,242	3,403,555	3,603,563	10,671,599
Urban unskilled	889,196	256,836	5,394,754	1,495,736	1,145,500	33,059	1,023,015	908,238	112,351	138,315	538,664
Urban skilled	1,485,203	282,638	5,281,343	1,142,853	1,309,144	43,655	1,946,758	1,248,429	323,520	333,784	1,156,415
Urban manager	191,802	37,609	426,881	130,045	132,736	8748	233,267	149,210	37,075	38,742	145,341
Urban technician	524,734	125,216	1,702,855	427,361	499,168	25,424	708,435	413,525	106,240	121,541	431,536
Urban self-employed	313,935	91,127	483,389	186,253	142,059	25,863	179,326	105,429	40,952	27,034	185,482
Urban capitalist	8002	14,529	7721	4664	1331	16	3030	2844	563	1376	2900
Urban retiree	325,262	62,107	1,385,758	257,950	306,219	10,706	387,123	194,864	53,891	56,073	328,993
Urban dependant	2,773,536	772,638	7,311,433	2,821,369	2,176,994	115,124	2,851,035	2,068,218	531,853	549,764	2,349,076
Urban population	6,511,670	1,642,700	21,994,134	6,466,231	5,713,151	262,595	7,331,989	5,090,757	1,206,445	1,266,629	5,138,407
Dependency ratio	0.742	0.882	0.498	0.774	0.616	0.781	0.636	0.684	0.788	0.767	0.842
Total population	43,800,015	6,860,000	10,998,000	33,609,999	38,319,956	2,280,001	34,049,869	23,139,999	4,610,000	4,870,192	15,810,006

Fig. 1. Location of Chinese provinces.

Appendix E. 1992 Income in China[25]

Eastern	BJ	TJ	HB	LN	SH	JS	ZJ	FJ	SD	GD
Rural unskilled	1352	1126	587	856	1914	912	1169	846	691	1125
Rural skilled	1610	1340	698	1019	2279	1086	1392	1008	822	1339
Rural manager	2154	1793	934	1363	3050	1454	1862	1348	1100	1792
Rural technician	2154	1793	934	1363	3050	1454	1862	1348	1100	1792
Rural self-employed	6439	5362	2793	4076	9118	4346	5566	4030	3289	5358
Rural capitalist	16,097	13,404	6984	10,189	22,794	10,865	13,916	10,076	8223	13,394
Rural retiree	3128	2816	2878	2675	3416	2662	2858	2403	2635	3105
Rural dependant	1572	1309	682	995	2226	1061	1359	984	803	1308
Rural mean	1827	1429	720	1026	2433	1090	1524	998	853	1372
Urban unskilled	1562	1125	1039	1071	2071	1290	801	1029	672	1084
Urban skilled	2675	1927	1778	1834	3545	2208	1372	1762	1151	1856
Urban manager	2769	1994	1840	1898	3669	2285	1420	1824	1191	1921
Urban technician	2814	2027	1870	1930	3729	2323	1443	1854	1211	1953
Urban self-employed	10,729	7716	7115	7320	14,174	8830	5494	7032	4598	7418
Urban capitalist	26,822	19,289	17,787	18,299	35,434	22,074	13,735	17,580	11,496	18,546
Urban retiree	3128	2816	2878	2675	3416	2662	2858	2403	2635	3105
Urban dependant	2464	1776	1545	1618	3369	1993	1166	1502	916	1562
Urban mean	2719	1935	1718	1876	3539	2183	1375	1910	1031	1890
Overall mean	2482	1781	912	1461	3166	1326	1477	1193	901	1562

[25] See Table 6 for province codes.

Appendix E (*continued*)

Central	SX	NM	JL	HLJ	AH	JX	Hen	Hub	Hun
Rural unskilled	539	578	694	816	494	660	506	583	636
Rural skilled	642	688	826	972	588	786	602	694	757
Rural manager	859	921	1106	1300	786	1052	806	929	1012
Rural technician	859	921	1106	1300	786	1052	806	929	1012
Rural self-employed	2568	2753	3305	3887	2351	3146	2408	2777	3027
Rural capitalist	6420	6881	8264	9718	5878	7864	6021	6943	7567
Rural retiree	2602	2403	2399	2462	2290	2130	2439	2179	2391
Rural dependant	627	672	807	949	574	768	588	678	739
Rural mean	664	670	794	938	569	777	577	673	736
Urban unskilled	964	814	863	851	838	825	922	787	990
Urban skilled	1651	1394	1478	1457	1434	1413	1578	1348	1696
Urban manager	1709	1443	1529	1508	1484	1462	1633	1395	1756
Urban technician	1737	1466	1555	1532	1509	1486	1660	1418	1784
Urban self-employed	6585	5564	5908	5822	5738	5664	6316	5388	6786
Urban capitalist	16,463	13,910	14,770	14,556	14,346	14,161	15,789	13,470	16,965
Urban retiree	2602	2403	2399	2462	2290	2130	2439	2179	2391
Urban dependant	1466	1195	1288	1260	1178	1157	1322	1150	1410
Urban mean	1628	1406	1538	1488	1456	1426	1541	1295	1685
Overall mean	942	937	1109	1201	727	909	724	852	907

Western	GX	HN	SC	GZ	YN	TB	Six	GS	QH	NX	XJ
Rural unskilled	630	725	545	435	531	714	481	421	519	508	636
Rural skilled	750	863	649	518	633	850	572	501	617	605	758
Rural manager	1003	1155	869	693	847	1137	766	670	826	810	1014
Rural technician	1003	1155	869	693	847	1137	766	670	826	810	1014
Rural self-employed	2998	3453	2597	2073	2531	3400	2290	2003	2470	2421	3031
Rural capitalist	7496	8632	6492	5181	6328	8499	5724	5007	6175	6052	7578
Rural retiree	2519	2279	2300	2394	2825	3956	2422	2905	3533	2741	2760
Rural dependant	732	843	634	506	618	830	559	489	603	591	740
Rural mean	723	862	624	487	610	820	559	481	597	587	762
Urban unskilled	1038	1382	821	642	1091	1734	972	1026	1301	1143	1253
Urban skilled	1778	2367	1405	1100	1868	2969	1663	1756	2228	1957	2145
Urban manager	1840	2450	1455	1139	1934	3072	1721	1818	2305	2026	2220
Urban technician	1870	2490	1478	1157	1965	3123	1750	1848	2343	2059	2256
Urban self-employed	7130	9467	5624	4403	7482	11,894	6641	7033	8885	7831	8550
Urban capitalist	17,825	23,667	14,060	11,008	18,704	29,735	16,604	17,583	22,213	19,578	21,375
Urban retiree	2519	2279	2300	2394	2825	3956	2422	2905	3533	2741	2760
Urban dependant	1460	2042	1135	861	1536	2159	1445	1488	1957	1756	1830
Urban mean	1866	2650	1332	1048	1791	3398	1660	1688	2328	1972	2200
Overall mean	893	1290	766	595	786	1117	796	746	1050	947	1230

Appendix F. Transforming competitive functional into personal incomes

Let IK_s^j denote capital income, where j=1, . . . , 27 represent provinces and s=1, . . . , 30 sectors. Let K and γ denote employed capital and rental rates. Capital income in the agricultural sector is

$$IK_{\mathrm{a}}^j = K_1^j \gamma_1^j.$$

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

$$IK_{\mathrm{b}}^{j} = \sum_{s=2}^{26} K_s^j \gamma_s^j.$$

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

$$IK_{\mathrm{c}}^{j} = \sum_{s=27}^{30} K_s^j \gamma_s^j.$$

The model determines directly the unskilled wage rate and the wage premiums for the technicians, the managers, and the skilled.

In the agricultural sector, all capital belongs to farmers, who, however, are not capitalists. The rural capitalists hold their capital in sectors such as industry, commerce and construction. Capital income in the agricultural sector is distributed to all farmers who hold own capital, whereas the rural capitalists receive rent in non-agricultural sectors.

State and private capital exist mainly in the sectors of industry, commerce, and construction. Using 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 for 1992. Since the data on capital ownership in commerce and construction sectors are unavailable, we assume that the private share of total capital is the same as in the industrial sector. Public service, education and culture, finance and banking, and administration are dominated by state capital. We assume that the government collects all capital income in these sectors.

Not many people own capital, let alone rely on it for income. We simply assume that all private capital income accrues to the people who own significant amounts of capital, the capitalists. The capitalists' income is separated from total capital income, which includes both government and private capital incomes, according to the private/total capital ratio. The final step is to put $I^j = \alpha^j IK_{\mathrm{b}}^j / N^j$ where α is the share of private capital income in total capital income, I the capitalists' average income, and N the number of capitalists, all indexed by province, j.

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