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ACCOUNTING FOR LABOR INPUT IN CHINESE INDUSTRY, 1949-2005[*#]

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Following the user cost theory on measuring labour input, this study carefully scans through both published and unpublished information and constructs employment and compensation matrices for the Chinese industrial workforce over the period 1949-2005. Our measures capture individual and interactive effects of changes in gender, age, education, occupation, industry and ownership types of the industrial workforce, and decompose the growth of labour input in Chinese industry into quantity and quality changes. We find that the annual growth of the labor input in Chinese industry experienced a substantial decline from 7.9 percent in the pre-reform period to 1.9 percent in the post-reform period. Quality improvement accounted for 15 percent in the pre-reform period, but it made negative contribution during the post-reform period. Our results show that although changes in education and age (capturing seniority and experience effects) of the industrial workforce made a larger impact in the reform period than under central planning, they were more than offset by the negative impact of changes in gender, industrial structure and ownership type along with the market oriented reform. This could be explained by the labor-intensive nature and export-orientation of China's post-reform industrialization, as well as policy correction to various distortions under central planning, including over-manning and over-focusing on heavy industries.

Keywords: Labour quantity and quality; labour compensation; translog labour input indexing; iterative proportional fitting (IPF); economic transition.

JEL Classification: E24, C82, O47

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[#] The coverage of the present version is narrower than the original proposal due to data problems. It concentrates on the industrial sector for 1949-2005 rather than the total economy up to 2008.

1. Introduction

Economists have long been debating about whether and to what extent China's market-oriented, gradualist reform has improved China's productivity performance. However, serious data problems encountered in measuring input and output variables in growth accounting exercise or production function analysis for the Chinese economy have made the debate remain inconclusive. Attempting to seriously tackle major measurement problems for all input and output variables in one project is difficult if not impossible. This is because it requires researchers to work at industry or disaggregate level of the economy dealing with the differences between the Chinese statistical practices and the international norms or standards, reconciling historical inconsistencies in statistical concept, coverage and classification, as well as looking for useful information to help fill important gaps. In this study, we aim to solve one of the key measurement problems for Chinese industry, that is, the problem of measuring labour input that can be decomposed to quantity and quality.

The core issue in measuring labour input is how to hold the quality of hours worked constant when there are actually changes in the quality of workforce due to changes in the composition of the age, gender, education, occupation and industry of the workforce, or in other words, how to convert heterogeneous hours worked into homogenous volume of labour input. If failed to do so, for example, in the case of an increase of labour quality, the growth of total labour input will be understated and hence the growth of total factor productivity (TFP) will be exaggerated. The measure of natural numbers employed or hours worked is essential in that it provides a natural quantity base for the key task in the measurement. But, it alone does not conform to the theory of homogenous production function because only if every input is homogeneous in its components, the production function can be homothetically separable (Jorgenson, 1990, p.33). This core issue has been made theoretically sound with clear empirical evidence because of the studies by, for example, Denison (1962, 1974), Griliches (1960), Jorgenson and Griliches (1967), and Kendrick (1961, 1973), plus the later contributions by Chinloy (1980), Gollop and Jorgenson (1980, 1983), and Jorgenson, Gollop and Fraumeni (1987).[1]

Labour input in the Chinese economy has never been properly measured, which is a major obstacle to an accurate understanding of the sources of growth in the

[1] See a comprehensive review of these studies by Jorgenson (1990, pp. 32-41).

economy. Most studies on the growth of the Chinese economy or its individual sectors (e.g. Borensztein and Ostry, 1996; Chan et al., 1988; Chow, 1993; Hu and Khan, 1997) have simply used the numbers employed as a proxy for labour input. Even if the measure of numbers employed is accurate, which is unfortunately untrue, this still implies two serious problems. Firstly, when there are changes in institutional working hours, the quantity base of labour input becomes inconsistent overtime. Secondly, when there are changes in the quality of labour, they will be counted as changes in the residual of the production function, whereby making the estimated TFP performance of the Chinese economy or its individual sectors ambiguous.

There have been few studies attempting to measure the labour input in the Chinese economy according to the standard concept, especially for the long run. Li et al (1993) made the first ever effort to construct labour input indices for 34 sectors of the economy for a short period 1981-87 using the Jorgenson approach (Jorgenson, 1990). However, they did not attempt to tackle any conceptual and inconsistency problems in the official labour statistics. By contrast, Young (2003) devoted a significant part of his study on China's post-reform productivity growth to identifying and reconciling inconsistencies in the employment data from the official surveys and censuses. However, he did not attempt to work at disaggregate level to solve the problems. There is certainly an important knowledge gap in the measuring of labour input and hence the understanding of the main factors that have determined the changes of labour quality over both the central planning and the reform periods of the Chinese economy.

In this study, we first make a pioneer attempt to construct labour employment and compensation matrices for Chinese industry, cross-classified by demographic, educational, occupational and sectoral attributes of the workforce for selected benchmark years over the period 1949-2005. The most challenging task to us is how to apply the standard methodology to the available data that are not only rather limited in terms of what the methodology requires, but also suffer from serious conceptual and inconsistency problems. Obviously, we have to make various assumptions in order to reconcile the inconsistencies and fill the gaps in the available data for constructing the matrices. In order to support the assumption making, we have to conduct thorough search for any relevant information, direct or indirect, through various historical official documents on labour regulation and administration,

employment planning, and policy studies on various labour issues, many of which were kept in the state archives until very recently. With so-constructed employment and compensation matrices, following Chinloy (1980) and Jorgenson, Gollop and Fraumeni (1987), we then are able to express changes in labour quality as the sum of main effects associated with these demographic, educational, occupational, sectoral and institutional factors and their interactive effects in various orders yielding a growth accounting equation for the labour input in Chinese industry at different stage of economic development associated with important changes in policy regime.

We find that the annual growth of the labor input in Chinese industry experienced a substantial decline from 7.9 percent in the pre-reform period to 1.9 percent in the post-reform period. Quality improvement accounted for 15 percent in the pre-reform period, but it made negative contribution during the post-reform period. Our results show that although changes in education and age (capturing seniority and experience effects) of the industrial workforce made a larger impact in the reform period than under central planning, they were more than offset by the negative impact of changes in gender, industrial structure and ownership type along with the market oriented reform. This could be explained by the labor-intensive nature and export-orientation of China's post-reform industrialization, as well as policy correction to various distortions under central planning, including over-manning and over-focusing on heavy industries.

This paper is structured as follows. In the next section, we review the main problems in measuring labour input in the Chinese economy. In Section 3, we introduce the methodology of labour input indexing and the decomposition of the contribution of individual human capital attributes to the change of labour quality. We devote Section 4 to dealing with the key data problems and procedures in the construction of marginal labour employment and compensation matrices. In Section 5, we describe the procedures of constructing full-dimension labour employment and compensation matrices. In Section 6, we report the results of labour input index and discuss the changes of labour input due to the main and interactive effects of different attributes of workforce against the background of economic development and policy regime shifts in China. Finally, we conclude this study in Section 7.

2. PROBLEMS IN MEASURING QUANTITY AND QUALITY OF THE CHINESE WORKFORCE

The basic problem in Chinese labour statistics is not only that the Chinese system was substantially influenced by the Soviet system since the early 1950s which is fundamentally different from what commonly adopted as today's international standard, but more importantly, it cannot reflect significant changes in China's labour employment system as the consequences of policy or institutional changes while maintaining historical consistency. Like other factors of production, the absence of the market system in the allocation of labour under central planning implies that data on prices (wage rates) are scant. As for data on the quantity of employment, frequent policy shifts have affected the official indicators with significant changes in the definition of employment, the standard of industrial classification, and the statistical coverage of ownership type, size and accounting status of establishment (Wu, 2002) but there is no sufficient information or an effective system for researchers to reconcile these inconsistencies by themselves.

The number one question in measuring sectoral or industry-level labour input is how to get the basic numbers right, that is, the number of workers employed and furthermore, the number of hours worked, which should be used as the control totals in the construction of the labour employment matrix. To answer this question, one encounters the following problems in the Chinese labour statistics.

Firstly, inconsistency in industrial classification has been a big hurdle to a proper measure of numbers employed at sector level over time. After China's implementation of the Soviet-style industrial classification standard to serve the administration of central planning, there were major changes in 1972, 1985, 1994 and 2002. These changes were to shift the standard of classification from one mainly facilitating the administrative and planning controls over individual sectors to one reflecting more about the technological nature of individual sectors in line with the international standard industrial classification (ISIC). However, there has been no official adjustment to the statistics of individual industries compiled under different standards. Available information is far from sufficient for the adjustment. In its largest ever data compilation entitled *Fifty Years of Chinese Industrial Development*, the Department of Industrial and Transportation Statistics (DITS, NBS), could only present discontinuous industry-level indicators in three separate tables for the periods

1949-84, 1985-92 and 1993-99, respectively. This means that at sectoral/industry level there are serious inconsistency problems in both input and output indicators that obstructed the construction of a conceptually compatible and integrated time series.

Secondly, as a long tradition in the central planning era, employees of an industrial establishment who provide services in education units, medical clinics, child care centres, commercial outlets, and social and political organisations, as long as they do not have independent accounting status, which is true in most state-owned enterprises, are included in the industrial employment statistics. [2] Systematic accounting for these "misallocated" employees simply does not exist (Szirmai and Ren, 2000). The only useful information at sector level can be found in two industrial censuses for 1985 and 1995 and recent economic census for 2004. However, any attempt for interpolation or extrapolation based on the census data has to first deal with the problem of inconsistent industrial classification. Chen et al. (1988) made a very crude correction for this factor in their productivity study on Chinese industry as a whole by assuming that the proportion of non-industrial employment in Chinese industry was equal to the ratio of residential housing stock to total fixed assets possessed by firms. Their approach is unlikely to produce a close proxy because it assumes that the non-industrial employment has the same fixed assets-labour ratio as that of the industrial employment and it ignores non-industrial employment engaged in services that are not related to residential housing. Besides, as this is largely a state sector phenomenon, the post-reform rapid development of the non-state sector implies that ignoring the difference between the state and non-state sectors is an inappropriate treatment to the problem.

Thirdly, in the Chinese labour statistics the quantity of employment has never been measured in its natural unit, that is, hours worked. Systematic data on hours worked simply do not exist. Almost all studies directly adopt the official indicator of numbers employed with little adjustment (e.g. Borensztein and Ostry, 1996; Chan et al., 1988; Chow, 1993; Hu and Khan, 1997), which implicitly assumes that there was no change in weekly working hour standard over time. However, as will be shown in the data section later, there have been several important reductions in weekly working

[2] For details about the categories of inappropriately included non-industrial employees in industrial labour statistics, see publications by statistical authorities, for example, NBS and MOL (1994, pp. 19-20) and DITS (1999, p. 52).

hour standard, which means that numbers employed would have overstated the actual hours worked. Besides, since the institutional working hours are never the same across industries since the 1950s (Zhu, 1999) and the practice in regular working time is different between the state and non-state sectors since the reform, changes in industrial and ownership structure have definitely affected the actual hours worked by an average industrial worker. Besides, retaining off-post workers in the payroll and hence employment statistics is a different but related problem (DPSSTS, 1998, pp.62-63). This practice has been abandoned since 1998, but there has been no consistency adjustment in the official statistics (Holz and Lin, 2001, p.48). This means that even if one can convert numbers employed to hours worked, the actual hours worked would have still been inflated due to the improper inclusion of off-post workers.

Our number two question is how to measure the quality of China's workforce. From the growth accounting perspective, the proper measure of the quality change of labour input is the difference between the user-cost-weighted index of labour input and the un-weighted or hours worked index (Chinloy, 1980; Denison, 1961; Gollop and Jorgenson, 1980 and 1983). This requires constructing both labour employment and compensation matrices at least for the benchmark years of the period under study. The construction of the employment matrix requires hours worked cross-classified by detailed demographic, educational and occupational attributes of China's workforce, whereas the construction of the compensation matrix requires exact element matching of the employment matrix with the compensation paid for per hour worked.

Unfortunately, compared with the information on the quantity of China's workforce, there is even scarcer information on the demographic, educational and occupational characteristics of China's workforce. Consequently, instead of searching alternative measure of labour quality, many growth accounting exercises or productivity studies on the Chinese economy have simply used numbers employed as a proxy for labour input, regardless the aforementioned problems in the official statistics on numbers employed. This implicitly assumes that workers embodied with different human capital stock are paid the same marginal product.

The only time series data source for measuring human capital contribution is the official statistics on the number of annual graduates with different levels of education attainment. But this time series is national aggregate only and comes without matching information on any characteristic of workforce. Following Barro and Lee

(1997; 2000), some growth accounting studies (e.g. Wang and Yao, 2002) apply the perpetual inventory method (PIM) to such data to measure the stock of human capital in the Chinese economy. The so-estimated human capital stock cannot be a reliable proxy for the actual human capital service in the Chinese economy because education in China has been heavily controlled by the state regulations and national plans which have little concern about the (underlying) market needs. In such a context, it is also difficult to justify the (underlying) function of the depreciation of human capital. Even if this approach can be used as an useful alternative, it is inappropriate for the current study as there is no such data available at sectoral or industry level.

There are also some relevant data from occasional censuses and surveys. But, of China's five population censuses and three industrial censuses,[3] only the 1990 and 2000 population censuses and the 1985 and 1995 industrial censuses are somewhat useful. However, the design of both types of the censuses does not allow full cross-classification of different demographic, educational and occupational attributes of the workforce. Besides, the two censuses are incompatible not only with each other, but also with the official labour statistics based on the regular annual reporting system. The quality of the census data has been seriously questioned by researchers. Young has empirically shown that the age-education profiles of the population censuses to some extent exaggerate the actual education attainment due to the improper inclusion of the data on adult education (2003, pp. 1240-44).

Compared with labour employment data, there are even much less information on labour compensation. The only available time series data are annual wage bills and average wage per employee by (broader) sector without any cross-classification by human capital attributes. To obtain relative wage estimates for weighting the changing composition of labour force, Li et al had to rely on their own labour compensation survey of less than 50,000 effective samples for the estimation of 34 sectors, but they give no detailed information about the time and the location of the survey (1993, p.163). Young (2003, pp. 1245-46) was able to access to personal income data from the NBS household surveys in 1986-92,[4] supplemented by the CASS household

[3] The five population censuses were conducted for 1953, 1964, 1982, 1990 and 2000 and the three industrial censuses were conducted for 1951, 1985 and 1995.

[4] The NBS conducts annual rural and urban household surveys that include some income data of household members. However, there has been no public access to the full survey data except for

surveys in 1988 and 1995,[5] arriving at a final sample size of 222,281. He relied on regression approach to capture the effects of human capital attributes of individuals. He found out that these household surveys have been heavily biased towards better-educated households (p. 1245). However, Young's data do not allow similar work at disaggregate level.

Another difficulty in constructing the compensation matrix is how to estimate the non-wage/salary income or income in kind paid to employees as part of labour compensation. For example, employees of the state sector enjoyed heavily subsidized housing (up to the end of 1990s) and other welfare payments in kind, which may vary greatly across industries and regions. NBS has made some efforts to improve its measure on labor compensation along with its development of SNA-type of input-output tables (Xu, 2000). Nevertheless, these efforts have not been taken into account in the previous studies on labour input.

3. LABOUR INPUT INDEXING

Labour input indexing should be discussed coherently with a production function aggregating the services provided by different types of labour and capital. The essential idea of constructing labour input index roots in the heterogeneity of labour in the sense that different types of labour have different marginal products in a given period. For example, an increase in the share of hours worked by skilled labour or by labour with better human capital will increase labour input even if the total hours worked remain unchanged (Denison, 1962; Jorgenson and Griliches, 1967). Directly using the numbers employed as a proxy for labour input in a production function implicitly assumes that labour is homogenous and the same hours worked by different types of labour will provide identical volume of services, which will certainly affect the reliability of the estimated residual.

Suppose that we have the following production function at time t, separable between labour and capital inputs, with a Hick's neutral shift parameter A:

$$Y_t = A_t f(L_t, K_{1t}, ..., K_{jt}) \quad (1)$$

regularly published national and regional averages based on the survey results. In the early 1990s, part of the original survey data became commercially available in Hong Kong.

[5] **More information to be provided here…**

where Y_t represents output, L_t labour input, and $K_{1t},...,K_{jt}$ the services of different capital inputs. Now let us define the labour aggregate as a function of hours worked by different types of labour:

$$L_t = \phi(H_{1t},...,H_{nt}) \tag{2}$$

where H_{it}, $i = 1, \ldots, n$, represents hours worked by type i labour. Following Chinloy (1980) and Jorgenson, Gollop and Fraumeni (1987), if assume efficient labour market and linear homogeneity of ϕ, then we have:

$$\frac{\partial \ln L_t}{\partial t} = \sum_{i=1}^{n} s_{it} \frac{\partial \ln H_{it}}{\partial t} \tag{3}$$

where s_{it} is the share of the ith type of labour in total labour compensation, which is equal to its logarithmic marginal output under the efficiency assumption:

$$s_{it} = \frac{w_{it} H_{it}}{\sum_{i=1}^{n} w_{it} H_{it}} = \frac{\partial \ln \phi}{\partial \ln H_{it}} \tag{4}$$

In Equation (4), the hourly wage of the ith type of labour is w_{it} and its compensation is $w_{it} H_{it}$. The growth rate of labour input is a convex combination of growth rates of total hours for each type of labour, with compensation shares as weights. Equation (4) also indicates that the necessary condition for producer equilibrium is given by equality between the share of the ith type of labour in the labour aggregate and the elasticity of the aggregate with respect to the ith type of labour.

Let total hours worked by all types of labour be $H_t = \sum_{i=1}^{n} H_{it}$. Then, the growth rate of H_t is the sum of the weighted growth rates of hours worked by each type of labour:

$$\frac{\partial \ln H_t}{\partial t} = \sum_{i=1}^{n} b_{it} \frac{\partial \ln H_{it}}{\partial t} \tag{5}$$

with $b_{it} = H_{it} / \sum_{i=1}^{n} H_{it}$ the weight of the ith labour type. Therefore, average labour quality per hour can be defined as labour input divided by hours worked:

$$Q_t = L_t / H_t \tag{6}$$

and its growth rate is:

$$\frac{\partial \ln Q_t}{\partial t} = \sum_{i=1}^{n} (s_{it} - b_{it}) \frac{\partial \ln H_{it}}{\partial t} \tag{7}$$

which is the sum of growth rates of hours worked by each type of labour, weighted by the *difference* between the shares in labour compensation and hours worked.

Now following Christensen, Jorgenson and Lau (1973), we specify the labour aggregate in the translog form:

$$\ln L_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln H_{it} + 1/2 \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln H_{it} \ln H_{jt} , \tag{8}$$

where α_0, α_i, $i = 1, \ldots, n$, and β_{ij}, $i, j = 1, \ldots, n$, are parameters and where $\beta_{ij} = \beta_{ji}$ to satisfy the required symmetry conditions. Under linear homogeneity, we have $\sum_{i=1}^{n} \alpha_i = 1$ and $\sum_{j=1}^{n} \beta_{ij} = 0, \quad i = 1, \ldots, n$.

With the efficiency assumption, the relative share of the *i*th type of labour equals its logarithmic marginal product:

$$s_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \ln H_{jt} \tag{9}$$

where s_{it} is defined the same as in equation (4).

Equations (8) and (9) as well as the symmetry conditions $\beta_{ij} = \beta_{ji}$ imply that the growth rate of the translog index of labour input l_t is:

$$l_t \equiv \Delta \ln L_t = \sum_{i=1}^{n} v_{it} \Delta \ln H_{it} \tag{10}$$

where $v_{it} = (s_{it} + s_{it-1})/2$ and Δ demotes the first difference operator.

From equation (6), the growth rate of quality q_t is defined as:

$$q_t \equiv \Delta \ln Q_t = \Delta \ln L_t - \Delta \ln H_t = l_t - h_t \tag{11}$$

where h_t represents the growth rate of total hours worked by all types of labour. Clearly, the growth rate of quality will be positive if hours worked by relatively high wage labour increase more rapidly than total hours worked.

Next, the contribution of each attribute of labour to quality change can be decomposed into two types of effects: the main effect of the attribute and the interactive effects of the attribute with each of the rest attributes. The main effect of the *i*th attribute is defined as the difference between the growth rates of labour input due to the *i*th attribute and total hours worked, regardless the time subscript:

$$q_i = l_i - h \tag{12}$$

where h is exactly the same as h_t defined in equation (11) and l_i is growth rate of labour input due to the *i*th attribute or the factor *i*. In the case of $q_i > 0$, as noted in Jorgenson and Griliches (1967), labour input measured as total hours worked is biased downward and hence TFP is biased upward.

Suppose that there are two attributes of labour, *i* and *k*, as a proper subset from *n* factors, a first-order interactive effect is derived from the partial index growth rate l_{ik} for the two factors and the single factor indices l_i and l_k:

$$q_{ik} = (l_{ik} - h) - (l_i - h) - (l_k - h) = l_{ik} - h - q_i - q_k \tag{13}$$

that is, the joint effect of *i* and *k* or $(l_{ik} - h)$ less the main effect of each. If there are only two factors, *i* and *k*, the growth rate of labour quality is defined as the summation of the main effects of two factors and their first-order interactive effect:

$$q = l_{ik} - h = q_i + q_k + q_{ik}\,. \tag{14}$$

As for labour input with *j* factors, $l_{1,\ldots,j}$, interactive effects up to (*j* – 1)th order are obtainable following the same principle (Chinloy, 1980, p.111).

4. CONSTRUCTION OF THE BASIC DATA FOR MARGINAL MATRICES

The procedures explained in the previous section are a very data-demanding exercise that can encounter many problems even in the US case where better labour survey and census data are available than in many other countries (see Jorgenson, Gollop and Fraumeni, 1987). Given the data problems in the Chinese official labour statistics as discussed in Section 2, the challenges that we face in this study are difficult to exaggerate. Only the size of the labour employment and compensation matrices that are to be constructed implies a big challenge. The number of factors that is considered affecting labour quality determines the number of dimensions of the matrices. As

listed in Table 1, in this study we aim to construct compatible labour employment and compensation matrices that are cross-classified by two genders (*g*), seven age groups (*a*), five education attainment levels (*e*), three types of job or occupation (*j*), three types of ownership status (*o*) and 24 industrial sectors (*s*). That is, each of the fully constructed matrices is a six-dimension matrix with 15,120 cells for each time point of the period 1949-2005.

TABLE 1
CLASSIFICATION FOR SECTORAL AND HUMAN CAPITAL ATTRIBUTES OF LABOUR INPUTS

Industrial Sector (*s*)	Human Capital Attribute
1. Coal mining	Gender: (*g*)
2. Oil and gas extraction	1. Male
3. Metallic mineral mining	2. Female
4. Non-metallic minerals mining	Age Group: (*a*)
5. Food & kindred products	1. 15-19
6. Tobacco products	2. 20-24
7. Textiles	3. 25-29
8. Apparel	4. 30-39
9. Leather & leather products	5. 40-49
10. Saw mill products & furniture	6. 50-54
11. Paper products, printing & publishing	7. >54
12. Petroleum & coal products	Education Attainment: (*e*)
13. Chemicals & allied products	1. Illiteracy or semi-illiteracy
14. Rubber & plastics products	2. Primary school
15. Stone, clay & glass products	3. Junior high school
16. Metals smelting, pressing & rolling	4. Senior high school
17. Metal products	5. Tertiary education
18. Industrial machinery & equipment	Occupation: (*j*)
19. Transportation equipment	1. Managerial & administrative staff
20. Electrical equipment	2. Technicians & engineers
21. Electronic & telecommunication equip.	3. Production workers
22. Instruments and office equipment	Ownership Type: (*o*)
23. Miscellaneous manufacturing	1. State-owned enterprises (SOEs)
24. Power, steam, gas and tap water supply	2. Non-SOEs at/above township level
	3. Other status below township (village level and household/self-employed)

In what follows, firstly, based on the available official data, we will construct the total numbers of employment by sector, cross-classified by occupation and ownership status for the period 1949-2000 (i.e. $s \times j \times o$). Our major tasks at this stage include the clarification of officially used concepts of industrial employment, the reconciliation of the official data under different industrial classification standards, and the adjustment for coverage problems. The results of these exercises will be converted to hours worked. Secondly, using available survey and census data we will construct the six-

or full-dimension labour employment and compensation matrices (*s*×*g*×*a*×*e*×*j*×*o*), as given in Table 1, for benchmark years. Data problems in constructing the benchmark matrices and techniques adopted to fix the problems will be discussed in details. Finally, we will complete the time series of the two full-dimension matrices for the entire period by interpolation using the benchmark matrices and the constructed three-dimension time series (*s*×*j*×*o*) as control totals.

4.1 Construction of Employment Data (Marginal Matrices)

Official data on numbers employed

To prepare for the basic data work we first have to understand the available official data on numbers employed. Let us begin with a discussion of conceptual problems in the official data. However, when dealing with conceptual problems, it is important to separate state firms from non-state firms because compared with the available data for non-state firms, the available data for state firms tend to be more detailed and reliable, which can serve as the "hard core" in our data construction. Such a separation can also help deal with ownership-specific data problems such as converting numbers employed to hours worked, and identifying and removing the employment by social or residential service units operated by state industrial firms for their employees.

There are two key concepts in the Chinese official labour statistics, namely "staff and workers" (*zhigong*) and "persons engaged in employment" (*congye renyuan*). The latter is also known as "social labourers" (*shehui laodongzhe*) that ceased using in 1993. By definition, as a long tradition developed under central planning, the former refers to the employees who were administered by the state labour employment system, although they did not necessarily work in the state-owned enterprises or units, while the latter covers all wage earners including those who are not classified as "staff and workers". "Staff and workers" are employed by enterprises that are registered as legal entities (legal persons) with independent accounting status (officially defined as independent accounting units or IAUs which are required to maintain accounting books and make regular financial reports), whereas those who are not classified as "staff and workers" usually work in small (largely rural) factories attached to IAUs (i.e. making sideline products in addition to the main business of IAUs), in household or joint household-run (largely seasonal) business, or simply as

self-employed. However, the official employment indicators based on these concepts are by no means clear.

Under China's National Bureau of Statistics (NBS) there are two departments that regularly publish employment statistics, namely, the Department of Industrial and Transportation Statistics (DITS) and the Department of Population and Employment Statistics (DPES), [6] both reporting data for "staff and workers" and "persons employed" and their sub-categories. However, users often find that for the same indicator the two official sources may report different data. This requires a good understanding of the definition used by the different authorities. Of all available indicators, the most compatible indicator from the two sources is the *state* "staff and workers". From 1952 to 1997, DITS and DPES reported almost identical data for the state "staff and workers", except for the period 1980-84 and 1994-97 in which there was a slight difference between the two sources. But, there were two major changes in 1998 which created a break in the indicator.

The first change relates to how to statistically treat "staff and workers" in the state units who were supposed to be permanently employed by the state under central planning. Prior to 1998, off-post staff and workers were still kept in the payroll and hence in the employment list of state firms, which was a phenomenon that emerged along with the industrial reform in mid 1980s, especially since the 1990s, when the marketisation became intensified. In 1998 the statistical authorities decided to remove the off-post staff and workers, which have created a break in the existing series that is difficult to adjust because there are not available data on off-post staff and workers either prior to or after the change. Both DPES and DITS adopted this change. However, at the same time DITS renamed its indicator "staff and workers" to "persons engaged".[7] This confuses users because there is already a DPES indicator with the same name. For convenience, we will still use the original name of "staff and workers" for the DITS data since 1998.

[6] DPES was previously named as Department of Social Statistics (DSS) and renamed recently as Department of Population, Social and Science and Technology Statistics (DPSSTS). However, these changes do not affect DPES indicators. Since conceptually using DPES can avoid confusion due to the name change, we will use DPES throughout this study when it refers to any DPES employment concept. References will still be handled in the standard way.

[7] Strictly speaking, DITS did not simply "rename" its indicator. Following the change in 1998 DITS decided to include "others" in its series. This category includes those who are either re-employed retirees or foreigners (DITS, 2000, p.296). We assume that this inclusion has no significant effect on the DITS series.

The second change relates to how to define the "state economy". Traditionally, the "state economy" means completely state-owned. While DPES has followed this definition, DITS changed it to "state-dominated in share holdings" in 1998 (see DITS, 1999, p.57). Mainly because of this change, in 1998 the number of state industrial employment reported by DITS is 9.6% bigger than the number reported by DPES. In 2000, the difference jumped to 42.9%.

Now, let us enlarge the scope of our investigation from *state* to *total* "staff and workers". The biggest discrepancy between the two official sources is found with the indicator of *total* "staff and workers" since 1978 when the DITS series began to diverge from the DPES series surpassing the latter by 11.2% in 1978 and 35.5% in 2000, which deserves a closer examination of the definition used by the two authorities. We find a significant definitional incompatibility between the two sources. The DITS definition refers to the employment at or above the rural township level, while the DPES definition refers to the employment located in cities including the so-called "industrial areas" that are administratively treated as urban areas. Obviously, both definitions are administrative level-based, but the DITS definition has a wider coverage than that of the DPES because it includes employment outside cities. However, there was also a change in 1998 when DITS redefined its total "staff and workers" as all state enterprises and non-state enterprises with at least 5 million yuan of annual sales (DITS, 2000, p.16, footnote), shifting from administrative level-based to ownership and enterprise size-mixed criterion. This again created a break that has to be tackled in our exercise.

As for the indicator of "persons engaged", i.e. the indicator that includes both "staff and workers" and those not defined as "staff and workers", DPES provides a long time series back to 1949 that largely maintains conceptual consistency. By contrast, DITS has never published the same indicator with the same definition (bear in mind that DITS confusingly renamed its "staff and workers" to "persons engaged" in 1998, but we have decided to stick to its original name). In this study, we use the DPES series of "persons engaged" as the control totals.

Our exercise requires these indicators with industry breakdown at least at the two digit level of the Chinese standard industrial classification (CSIC) that is consistent over time. For the state "staff and workers" both DPES and DITS provide industry level data based on their own definitions but there are significant gaps in some years

and inconsistencies in industrial classifications over time. In addition, there have been two DITS industrial censuses in 1985 and 1995 that provide much more detailed industry breakdowns as well as other information that can help us check and adjust the historical series.

TABLE 2
AVAILABLE OFFICIAL DATA ON INDUSTRIAL EMPLOYMENT AND THE REQUIRED DATA WORK IN THIS STUDY

Available Data	Required Data Work
DPES "Persons Engaged": • Industrial aggregate, 1949-2000 (CSIC inconsistency problem; coverage problem) • Mining, manufacturing, utilities, 1978-2005	• Used as the overall control totals that help derive persons engaged in industries outside the DITS "S&W", i.e. employment within the "outer layer" • Used as broad sectoral control totals that also help the work above
DPES "Staff & Workers": • State, 2-digit level industries, 1952-92, 1998-2005 (CSIC-inconsistent) • Total, state, urban collectives, industrial aggregate, 1949-77 • Total, urban collectives, other ownership types (including FDI); mining, manufacturing, utilities, 1978-2005	• Used as the "hard core"; correct for CSIC inconsistency; crosscheck with the DITS state "staff and workers", and fill gaps • Together with DITS data, estimate DITS non-state "staff and workers" at the 2-digit level • Same as the previous point; in addition, information on employment of other ownership types helps work on estimating labour compensation
DITS "Staff & Workers":[a] • State, 2-digit level industries, 1952-79, 1995-2005 (CSIC-inconsistent) • Total, 2-digit level industries, 1985-2005 (CSIC-inconsistent)	• Adjust to definitional changes of state "staff and workers"; reconcile with DPES data; correct for CSIC inconsistency • Used for deriving the "township layer" at the 2-digit level; reconcile data using different CSICs, and fill gaps
Other Sources: • The 1985 Industrial Census,[b] ownership types, 3/4-digit level, some indicators back to 1980 • The 1995 Industrial Census,[b] 3/4-digit level industries • The 2004 National Economic Census,[b] 3/4-digit level industries • MoA[c] rural township and village enterprises, 2-digit level, 1987-97	• Both censuses can be used as much more detailed benchmark that help reconcile different CSICs and decompose non-state aggregates (including aggregates of the "outer layer"), as well as check and adjust annual data • Used for decomposing the "township layer" and "outer layer" aggregates to the 2-digit level

Notes:
a) Renamed to "Persons engaged" in 1998, see text for explanation.
b) DITS is the main authority of these censuses.
c) Data are published by the Bureau of Township and Village Enterprises, Ministry of Agriculture (MoA).

Table 2 summarises the features of the basic available data and required tasks in our data construction. Our exercise aims to construct a data set with three layers that are conceptually and CSIC-consistent: 1) the state employment as the "hard core", 2)

the employment in the "township-layer" that consists of all the non-state employment qualified as at or above the rural township level (mixed with the size criterion since 1998 as previously discussed), including employment in collective-owned enterprises, foreign invested enterprises and private enterprises, and 3) the "outer layer" that contains all other people who also engaged in industrial activities. The first two layers cover all the "staff and workers" according to the DITS (wider) definition (including the "staff and workers" as defined by the DPES narrower definition), plus employment in the category of "others" as in the practice of DITS.

Reconciliation of different standards of industrial classification

As indicated in Table 2, the available sectoral-level data are inconsistent overtime because of changes in China's standard industrial classification (CSIC) system. China implemented its first CSIC in 1972, which in fact only institutionalised its practice in industrial classification following the Soviet classification system adopted in early 1950s. Subsequently it has made two major changes, that is, a shift from the 1972 CSIC to the 1985 CSIC and then from the 1985 to the 1994 CSIC, aiming to change the industrial classification from one facilitating administrative and planning controls over industries to one that more reflects the production or technological nature of individual industries.

The Soviet industrial classification system was designed to serve the need of central planning. It intends to facilitate administrative controls by different ministries over resource allocation for the production of the key capital and consumer goods. Individual industries were therefore classified into "groups" according to their vertical links in input-output chains rather than their technological natures. Such "groups" are typically reflected by the classification of two-digit level industries in the 1972 CSIC. For example, since all metal ore mining, smelting and processing activities were administered by the Ministry of Metallurgy, they were grouped together as the metal industry (01, referring to the first two digits under the 1972 CSIC in Table 3). The economic reform began in the end of the 1970s induced a need for a significant change in the standard industrial classification, which was reflected in the 1985 CSIC. The 1985 CSIC, implemented in the DITS 1985 Industrial Census, is considered a major effort to move towards the international standard industrial classification (ISIC). In the current study, we use the 1994 CSIC for industrial

classification, which is the revision of the 1985 CSIC and is in principle equivalent to the ISIC 1988 Revision (NBS, 1998, pp. 25-26).[8]

However, there has been no official adjustment to convert the data under the different versions of CSIC to the prevailing 1994 standards, which is a major problem for us. As the examples demonstrated in Table 3, since the change in CSIC involved separating or merging existing two-digit level industries, any reconciliation of the historical data using different versions of CSIC requires more detailed (higher-digit level) statistics. However, the published information is at most the aggregates of two-digit level industries if not broader industrial groups.

TABLE 3
EXAMPLES ON RECONCILIATION OF DIFFERENT CHINESE STANDARDS OF INDUSTRIAL CLASSIFICATION

Wu-Yue Code[a]	1994 CISC		1985 CSIC		1972 CSIC	
	Code	Industry	Code	Industry	Code	Industry
02	⇦07	Oil and natural gas extraction	⇦0900	Oil and natural gas extraction	⇦0401 ⇦0402	Oil extraction Gas extraction
12	⇦25	Petroleum refinery and coking	⇦3400	Petroleum refinery	⇦0403	Petroleum refinery
			⇦3510 ⇦3520	Coking Coal gas	⇦0321 ⇦0322	Coking Coal gas
24[b]	⇦45	Coal gas			⇦0310	Coal mining
01	⇦06	Coal mining	⇦0800	Coal mining		
…	…	…	…	…	…	
03	⇦08	Ferrous metal ore mining	⇦1000	Ferrous metal ore mining	⇦0111	Ferrous metal ore mining
	⇦09	Non-ferrous metal ore mining	⇦1100	Non-ferrous metal ore mining	⇦0121	Non-ferrous metal ore mining
16	⇦32	Ferrous metal smelting and pressing	⇦4800	Ferrous metal smelting and pressing	⇦0112	Ferrous metal smelting and pressing
	⇦33	Non-ferrous metal smelting and pressing	⇦4900	Non-ferrous metal smelting and pressing	⇦0122	Non-ferrous metal smelting and pressing

a) See Table 1 for the name of the industry in the coding system of this study.
b) In this study, the coal gas industry is included in "utilities" (24).

For example, in the 1972 CSIC, metallic, coal and petroleum are all two-digit-level industries, identified by the *first two digits* "01", "03" and "04", respectively. In

[8] Note that the 1994 CSIC, coded as GB/T4754-1994 in China's national standard system, was further revised in 2003 (NBS, 2003, pp. 23-25). We ignore this new revision because thcurrent study covers only up to 2000.

the central planning period, these industries were accordingly administered by three ministries with the same names. As the examples show, at the two-digit level, mining or extraction activities are mixed with manufacturing activities, which do not comfort to the homogeneity principle underlying the standard of industrial classification. However, if data on higher-digit level or subordinate industries were available, our reconciliation job would have not been too difficult. For instance, if the time series data for the 0310, 0321 and 0322 industries are available, employment in coal mining, coking and coal gas production could be easily separated and then converted to the two-digit industries in the 1994 CSIC. But, such data simply do not exist in the official publication.

To solve this problem, we mainly rely on the NBS annual bulletins (*nian bao*) published by various NBS departments for internal use.[9] Data for individual industries reported in these bulletins are national aggregates that are compiled through intermediate aggregations by NBS local offices based on regular enterprise-level statistical reports. Prior to the 1980s, the bulletins mainly focus on state enterprises. Subsequently, they have included non-state firms at or above the rural township level. For higher-digit level industries, the annual bulletins are by no means complete. For example, for some two-digit level industries, if the two-digit level aggregation was conducted in local offices, information on the industry's subordinate sectors would not be sent to the NBS headquarters and hence not be included in the bulletins. Furthermore, many annual bulletins were unfortunately lost in the Cultural Revolution (1966-1976) during which NBS was abolished for five years (1968-72). Lastly, most of the information on intermediate aggregations kept in local offices was also lost and the rest, given various constraints, cannot be easily retrieved.

We attempt to exhaust all available employment data for individual industries, as detailed as possible. However, for some periods we have to deal with those "industry groups" without any breakdown of subordinate industries. In case of a partial breakdown of a group, the targeted unknown industry may be derived as a residual. For example, as shown in Table 3, the unavailable employment data for crude oil and gas extraction (0401 and 0402) can be obtained by subtracting the number of employment in petroleum refinery (0403) from the number of employment of the

[9] We are very much indebted to our NBS colleagues who made the achieved historical data available to the authors.

petroleum industry (04). In the case of no breakdown at all for an industry in a period, we use the intra-industry weights of the nearest periods by the mid-point interpolation approach.[10] We try to avoid using output weights when filling the gaps in employment because it unrealistically assumes constant labour-output relationship.

At the end of this stage of our data work, we were able to construct the 1994 CSIC-consistent, two-digit level time series for the numbers employed by the state enterprises (the "hard core") for the period 1952-92 and 1995-2000, leaving gaps in the periods 1949-51 and 1993-94. We were also able to construct the 1994 CSIC-consistent numbers employed by all enterprises at or above the township level (the "township layer", i.e. the DITS concept of non-state "staff and workers") for the period 1980-2000, leaving the pre-1980 period uncovered. Strictly speaking, we need to adjust the 1998-2000 part of the series for the shift from "township" to "designated size" to maintain consistency. In what follows, we explain how all these gaps are filled and how the "outer layer" with the same industry breakdown is constructed.

Filling the gaps in the basic data

Our first task is to complete the state "hard core" series by filling the gaps in 1949-51 and 1993-94. Since it is unreasonable to expect any significant structural change over such short periods, if data on the state total are available, we can simply allocate the total into individual industries according the industrial structure at the time right before or/and after the gaps. With the readily available state totals for 1993 and 1994, we can fill this gap by using the average of the industrial structures in 1991 and 1995 (to decompose the state total of 1993) and the average of the industrial structures in 1993 (estimated) and 1995 (to decompose the state total of 1994). However, the state totals for 1949-51 deserve more work. Some historical data from a NBS publication (DSS, 1987, p. 83) suggest that they are incompatible with the series of the state "staff and workers" since 1952. In fact, what make up the difference are those non-state firms that were transformed into state-private joint ownership in the campaign of "socialist transformation" during 1956-57. Since these firms, together with other cooperatives, were further converted into complete state ownership after 1957, they are counted as the state "staff and workers" in all NBS series since 1952. We follow

[10] We believe that the mid-point interpolation for structure has some advantage over the straight line interpolation because it does not affect the control totals. Besides, structural changes reflect not only an industry's own growth but also its relative growth to other industries within a group.

the same approach by adding the employment in such a case to the state sector, which gives a plausible result for the period 1949-51.[11] The so-estimated state totals are distributed to individual industries based on the industrial structure in 1952.

Our next task is to extend the 1980-2000 township-layer "staff and workers" or the non-state part of the DITS "staff and workers" back to 1949. For this purpose, we need information that is sufficient for constructing annual aggregates at this level and estimating industrial structure of employment at least for some benchmark years anchoring the required industry level interpolations. The township layer consists of two components: 1) "staff and workers" in urban non-state enterprises such as collective firms, cooperatives, and foreign invested enterprises, except for self-employed and people working in private firms, and 2) "staff and workers" in rural township enterprises. As given by the definition, the first component is in line with the DPES concept of "staff and workers" for which data on annual aggregates are already available (see Table 2). Our exercise then mainly focuses on the second component, that is, constructing annual aggregates of rural industrial employment for the period 1949-79 that are compatible with the DITS concept of township "staff and workers".

In official statistics, rural enterprises mainly consist of township and village enterprises (TVEs) which were transformed from factories run by people's communes or their production brigades during the decollectivization in early 1980s which abandoned people's communes. In terms of the administrative hierarchy in rural China, post-reform townships are fully compatible with pre-reform communes. Back in history, the commune-run factories originated from rural industrial or handicraft cooperatives emerged in the cooperative movement in 1954-57. During the Maoist feverish Great Leap Forward (GLF) campaign in 1958-60, people's communes replaced all types of farmers' cooperatives as a more radical form of collective farming. Meanwhile, rural industrial and handicraft cooperatives were transformed into bigger commune factories. However, the collapse of the GLF was a dead blow to most of the commune factories which were closed down as required by the government retreat policy and did not recover until mid to late 1970s.

[11] This approach is actually the same as what used in DSS, which can be seen in other two tables in DSS (1987, pp. 13 and 26) that perhaps give the only estimates for state total and industrial employment back to 1949, though they are seldom shown in other NBS publications.

Historical data on rural enterprises are extremely scant. Thanks to NBS, we fortunately obtained some unpublished data including NBS surveys on China's traditional and handicraft industries in 1954-55, internal statistical report of commune factories in 1959, DITS *Annual Bulletin* on commune factories in 1978-83 (1979 missing) and DITS *Annual Bulletin* on township enterprises in 1984-85. After carefully processing these data and checking through total numbers employed and their industrial distribution, together with other scattered information from the government, we can set up three compatible benchmarks: 1956 (cooperatives), 1962 (early commune factory period) and 1978 (late commune factory period), which can be used to extend the non-state component of the DITS 1985-2000 township level series.

The 1954-55 survey on handicraft industries covered both urban and rural areas and distinguished labourers engaged in different industries from those who could not be identified by type of industrial activity. We assume that the majority of the former located in cities already worked in factories and, as we have pointed out, they should have been already included in the urban part of the non-state component of the series (covered by DPES, see Table 2). We argue that before the cooperative movement in 1955, those located in rural areas were largely self-employed or worked in family-based workshops which are incompatible with the DITS series. A NBS publication has lent some support to our hypothesis. It reported that the number of employment of handicraft-making cooperatives increased from 0.60 million in 1954 to 0.98 million in 1955, and further jumped to 4.85 million in 1956 when "advanced cooperatives" were promoted.[12] Subtracting the urban part of 3.34 million in 1956, we obtain 1.51 million that is used as the starting point of the rural part of the series.

A large number of "advanced cooperatives" were transformed into commune factories during the Great Leap Forward campaign in 1958-60. It is not clear about the size of employment during that period. The only official statistical publication in the central planning period, *The Great Ten Years*, reported there were 700,000 commune factories by the mid-1959 (NBS, 1959, p.37), but did not give any data on the employment of these factories. Driven by GLF, 740,000 rural cooperatives were merged into 26,000 much larger communes (NBS, 1959, p.27). It is therefore not

[12] See a table reporting changes of status of persons engaged in handicraft industries by DSS (1987, p.86).

exaggerating to assume that on average each factory hired at least 20 workers. This means that there would be 14 million or more industrial workers at the commune (township) level or equivalent to nearly 60 percent of the urban employment in industry (24 million, as given by the DPES concept "staff and workers"), which may be unrealistic. This suggests that either the number of commune factories or the actual factory size was exaggerated. Other sources suggest either of these could be true.[13] One of the government circulars for the post-GLF policy retreat in 1962 disclosed that by the end of 1961 there were only 1.26 millions worked in the rural commune factories.[14] We take this information more seriously than other data in the context of the harsh policy retreat. Using the trend-deviation approach, we interpolate the commune factory employment between 1957 and 1961 with the growth of commune industrial output as an "indicator variable" (which gives the deviations over this period). The result is plausible showing that the number of commune factory employment reached the record high peak in 1960 during this period (3.38 million). If following the change of the industrial output of communes, the commune factory employment would drop to about 500,000 in 1962 and 270,000 in 1963 or the lowest since 1956 that is consistent with the situation in the overall economy. Also based on the industrial output of communes, we assume that the employment of commune factories recovered to the 1962 level by 1965.

The next benchmark is 1978. The published DITS "staff and workers" data cover the period 1985 to 2000 (DITS, 2000, pp.84-93 and 111-117). Based on its *Annual Bulletin* and the 1985 industrial census, DITS statisticians helped us extend the series back to 1980. Instead of fully disclosing the approach that they used to construct the data for 1980-84, they provided us with the *Annual Bulletin* for 1978 and 1980-85. Crosschecking DITS estimates with these internal data, we have discovered that DITS estimates were smaller than what were directly available from the *Annual Bulletins*. This means that DITS must have conducted a screening exercise to make the numbers

[13] One source is newly discovered NBS internal report, which gives the number of employment in commune factories in 1959 as 5.8 million (NBS, 1960). Another source is one of the DITS annual publications, which reports the number of commune factories in 1960 as 117,000 (DITS, 1989, p.21). Since the government only began its retreat policy in the industrial sector in the mid-1961 (Wang and Dong, 1995, pp.98-102), this suggests that the number of commune factories, 700,000, by the mid-1959 as given in *The Great Ten Years* (NBS, 1959, p.37) is very implausible.

[14] This circular was jointly issued by the CCP Central Committee and the State Council on 27 May, 1962, aiming to support agricultural production and reduce demand for foodstuff after the collapse of GLF (SC/DRC, 2000, V.4 (II), pp. 537-540).

employed qualified for their concept of "staff and workers". For 1985, the number of township employment is 10.48 million, which is 79 percent of the *Annual Bulletin*-reported figure of 13.28 million. For 1980, as estimated by DITS upon our request, the estimated number is 5 million or 55 percent of the *Annual Bulletin*-reported 9.09 million. It seems that DITS considered the reported number of employment for commune factories being less "qualified" than that of township enterprises. We apply this "qualification assumption" to 1978 and obtain an estimate of 4.22 million for the number of commune factory employment for that year instead of accepting 7.67 million in the 1978 *Annual Bulletin*. The gap between 1965 and 1978 is filled with the trend-deviation interpolation approach. We should not forget that in 1998 the DITS definition for non-state "staff and workers" changed from "township" to "designated size", which created a significant break (down from 18.04 million in 1997 to 11.10 million in 1998 and further to 3.86 million in 1999). Thus, to maintain consistency of the whole series, the DITS data for 1998-2000 are adjusted back to the township definition based on the existing 1997 employment in the DITS series and the growth rate of rural enterprises derived from the DPES system.[15]

To complete out data work for the "township layer", we need to distribute annual aggregates to the industrial sectors as defined in Table 1. Conceptually, we can derive employment for two-digit industries by subtracting the state "staff and workers" from the DITS "staff and workers". The difference is the non-state "staff and workers" located in both urban (collectives, joint ownerships, foreign invested firms) and rural (commune/township) enterprises. With the available data, after correcting for CSIC inconsistency, we can obtain such results for the period 1985-2000.[16] For the period 1949-84, we rely on four industrial structure benchmarks, namely 1955, 1959, 1978 and 1985, to anchor the two-digit level interpolations. The 1955 benchmark of industrial structure is obtained from the 1955 handicraft survey. We calculate the industrial structure for 1995 using the number of employment engaged in urban and rural industrial cooperatives with identifiable industries. For the 1959 and 1978

[15] DPES reports national employment data with ownership type break down for 16 (large) sectors (e.g. industrial data are available for mining, manufacturing and utilities), which can be used to derive rural collective enterprises by subtracting persons engaged in urban enterprises, private firms and the self employed. However, since the so-derived contains rural village enterprises, we assume that the growth rate of township is the same as that of village enterprises. The result is given in Table A1.

[16] Since we have adjusted the annual aggregates of the rural component for 1998-2000, we use the existing industrial structure of this period to distribute the adjusted aggregates.

benchmarks, we directly used the industrial structure of commune factories, assuming urban non-state firms to have the same structure, as there is no other information available. The 1985 benchmark is set up with data from the 1985 *Annual Bulletin* for township enterprises and the 1985 industrial census.

Our last task is to construct annual aggregates of the "outer layer" and then distribute them to the same industrial sectors. The annual aggregates can be derived by subtracting the sum of the state and "township layer" employment from the DPES control totals (a concept that has been discussed).[17] For the pre-reform period, we rely on two benchmarks to control the sectoral distribution of the aggregates, 1955 and 1985. The 1955 benchmark is constructed based on the number of people engaged in the rural handicrafts attached to agriculture with identifiable industrial classification as found in the 1955 handicraft survey. The 1985 benchmark is constructed using industrial structure of the employment in village enterprises from the 1985 industrial census. We use the mid-point interpolation approach to estimate the employment structure between the two benchmarks. For the period 1949-54, we use the 1955 benchmark assuming the employment structure at this level did not change over that period. Considering the level of economic development and technology in rural China during that period, this assumption is not too difficult to accept.

For the period after 1985, there are more data available. Over the period 1987-97, the Ministry of Agriculture (MoA) regularly published employment data on both township and village level of enterprises by industry (Table 2). Although the data provide more industry details than the NBS statistics but they cannot be reconciled with the latter. The MoA source suggests much larger size of employment by rural enterprises. It is needless to mention that NBS is more specialized than MoA in data collection and compilation. On the other hand, the MoA system (its regional offices and local agencies) is very likely to exaggerate the employment of rural enterprise because promoting rural industrialization was one of the main tasks of MoA assigned by the central government. Considering this, we use the employment structure derived from the data rather than accepting its numbers employed, and for 1995 we replace the MoA data by the 1995 industrial census data on the employment structure

[17] However, China's population census data have shown that the DPES control totals may be wrong (Yue, 2005). Since any adjustment will affect the whole system, we do not attempt to do so in the present study.

of village enterprises. For the period 1998-2000, we simply accept the structure of 1997. Finally, for people who were not engaged in village enterprises but worked in family business or simply as self-employed, we assume their industrial distribution to be the same as that of village enterprises.

After this gap-filling exercise, we have constructed the basic data for the entire period in 24 industrial sectors with the consistent standard of industrial classification (grouped based on the 1994 CSIC), and distinguished by three groups of ownership types or three layers, namely, the state layer ("hard core"), the "township layer" covering all non-state employment at the township or above level, and the "outer layer" containing all other ownership types. The so-constructed data are adjusted to mid-year (average) and reported in Appendix Table A1, which are ready for the adjustment for the coverage problems.

Adjustment for coverage problems

As discussed in Section 2, China's industrial employment statistics are exaggerated because they inappropriately includes employees engaged in non-industrial activities, classified in industrial labour statistics as "employees engaged in services" and "other employees". The first category includes people engaged in services provided by enterprise-run education units, medical clinics, child care centres and commercial outlets, as well as social or political organisations attached to enterprises. The second category includes various types of staff and workers who are attached to but not working for the factor/enterprise that hire them.[18] We label all these people as "non-industrial workers" who should be removed from the current industrial employment statistics. Since these problems are typically a state-enterprise phenomenon, and to less extent observed in urban collective enterprises and some township government-involved or controlled enterprises, our adjustment for the coverage problem should be ownership-specific.

For this purpose, we need data on employment by occupation at the CSIC two-digit level of industrial details, cross-classified by ownership type (referring to each

[18] As explained in various NBS documents, the category of "other employees" includes workers and staff who are on a factory's payroll but have stopped working for the enterprise, including those engaged in farming activities (attached to a factory), in long-term study leave, in government assignment (outside the routine work of the factory), and on industrial injury or long sick leave, and those off-post workers (*de facto* unemployed) (see NBS and MoL, 1994, p.20; DPSSTS, 1998, p.66).

of the three layers). Strictly speaking, only comprehensive labour survey or census can satisfy such a data need. Fortunately, time series is not a basic data requirement. This is because institutional factors, which cause the Chinese industrial enterprises to run community, social and personal services, to accommodate the organs of political organizations, and to keep off-post employees in payrolls, do not change in the short term. Given the institutional settings, in any industry production technology should be the major factor determining the occupation structure of employment because it affects factor intensity, firm size and hence managerial structure. Since major technological change does not take place in the short term, one should not expect frequent changes of occupation structure in any industry. This means that we only need a few benchmarks that can reflect the change of occupation structure in individual industries over the entire period, and hence help anchor the interpolations between the benchmarks.

China's 1985 and 1995 industrial censuses can approximately meet our data requirement. The two benchmarks should be sufficient for the reform period. For the pre-reform period, we rely on some newly found information from the DPES *Annual Bulletins* for 1955 and 1959-64 that were survived from the Cultural Revolution (1966-76). Constrained to the level of industrial details of the available occupation data, we can only use four broad occupation categories, namely, "workers", "technicians", "managerial and administrative staff", and "non-industrial employees". Note that the last category includes the "employees engaged in services" and the employees defined as "others" by DPES.

We set up five benchmarks for the state sector (the "hard core"), that is, 1955, 1963, 1985, 1995 and 2000. The two census-based benchmarks, 1985 and 1995, are reconciled for classification consistency. In fact, the only approximately compatible benchmark for the period prior to 1985 is 1963. We find that compared with earlier statistics (data for 1955 as an example), the available 1959-64 issues of the DPES *Annual Bulletin* report increasingly more details of occupation. This is largely because during the policy retreat after the collapse of the GLF campaign, the government wanted to identify "non-productive workers" in cities and repatriate them to the countryside (Wang and Dong, 1995, pp.113-116). Of the 1959-64 issues, the 1963 issue (DPES, 1963, pp.38-49) gives the most industry details than other issues and then serves as a compatible benchmark with 1985. The gap between 1963 and

1985 should not be a big problem because there was no radical industrial policy change before the market oriented industrial reform in 1984 and, especially, during the ten years of Cultural Revolution.

However, the 1955 issue of the *Annual Bulletin* (DPES, 1955, pp.133-135) gives much less industry details of occupation than what this study requires (10 versus 24 as given in Table 1). We estimate the occupation structure for 1955 with the information available from the 1963 benchmark as the reference. In the estimation, we first re-group the 1963 data into the ten (larger) sectors to match the 1955 data and calculate the ratio of sub-sector to sector total for each sector. We then use the ratio to estimate the sub-sector occupation structure for 1955 assuming that the "relationship" between sector and its sub-sectors in occupation structure in 1955 was the same as that in 1963.

TABLE 4 (A)
OCCUPATION STRUCTURE IN STATE INDUSTRIAL EMPLOYMENT (THE "HARD CORE"), 1963, 1985 AND 1995, BY INDUSTRIAL SECTOR
(Total employment = 100)

	1963				1985				1995			
	W	T	A	N	W	T	A	N	W	T	A	N
	A: The State "Staff and Workers" (the "Hard Core")											
All	75.3	4.4	9.6	10.6	70.3	4.1	10.7	14.9	62.0	6.0	10.2	21.8
1	76.2	3.1	7.8	12.8	69.1	1.6	7.5	21.8	56.1	2.4	6.8	34.8
2	68.7	8.0	12.1	11.2	61.5	4.1	12.9	21.5	52.0	8.5	11.8	27.8
3	70.2	4.3	8.8	16.8	67.3	3.1	10.2	19.3	59.6	4.7	10.1	25.6
4	72.6	3.1	10.1	14.2	70.2	1.9	11.9	15.9	64.9	4.4	11.3	19.5
5	79.0	1.3	11.8	7.9	79.8	1.9	9.9	8.4	66.2	5.5	11.2	17.1
6	82.7	1.4	7.6	8.3	80.8	1.2	9.2	8.8	68.5	6.2	11.1	14.2
7	81.3	2.6	6.6	9.4	80.6	1.7	7.4	10.3	68.7	3.1	6.5	21.7
8	82.4	1.7	8.1	7.8	78.8	1.6	7.7	11.9	69.6	3.3	9.4	17.7
9	83.4	1.6	8.5	6.5	78.8	1.5	10.0	9.7	66.7	3.0	8.6	21.7
10	79.3	1.7	10.1	8.9	74.3	2.3	11.1	12.3	62.1	4.1	11.2	22.6
11	78.5	3.0	9.0	9.6	76.4	2.2	10.4	11.0	68.2	4.3	10.6	16.9
12	70.4	6.1	8.9	14.5	61.5	6.1	12.1	20.3	54.9	11.1	12.5	21.6
13	73.8	5.0	10.4	10.8	69.2	5.0	11.9	14.0	63.3	7.9	11.1	17.7
14	78.4	3.5	9.4	8.7	74.6	3.2	11.6	10.6	62.5	5.0	9.9	22.6
15	78.4	2.0	9.9	9.6	74.6	2.7	10.6	12.0	68.0	4.9	10.8	16.3
16	71.8	5.1	8.3	14.8	69.4	3.8	10.4	16.4	64.3	5.6	9.6	20.5
17	77.3	4.1	10.7	7.9	71.8	3.8	13.0	11.4	59.7	5.3	11.8	23.2
18	70.8	9.1	10.8	9.2	68.8	5.8	12.2	13.2	58.5	7.1	11.7	22.6
19	74.2	8.0	9.1	8.7	65.4	6.9	12.9	14.8	58.4	8.8	11.8	21.1
20	70.8	9.1	10.8	9.2	69.4	6.0	12.8	11.8	60.6	7.6	11.8	20.0
21	70.8	9.1	10.8	9.2	65.3	10.1	12.8	11.8	51.7	12.5	10.8	25.1
22	70.7	9.8	11.8	7.7	64.0	10.0	13.6	12.4	50.9	9.5	11.7	27.9
23	81.4	1.3	10.2	7.0	76.2	2.6	12.0	9.2	63.3	6.8	10.6	19.3
24	72.2	6.4	12.3	9.2	67.7	5.3	13.0	14.0	64.7	10.0	12.4	12.9

Sources: Authors' calculation based on data from DPES (1963, pp. 38-49), NICLG (1988, V.3, pp. 546-561) and NICO (1997, Ownership Volume, pp. 168-203; Sector Volume, pp. 201-233). See the text for the details of the calculation.

Notes: Refer to Table 1 for the code of industrial sectors. W: workers, T: technicians, A: administrative staff, N: Non-industrial employees. See text for the details of N.

As for the 2000 benchmark, there is even less information available. The official labour statistics only report the number of technicians in three broad sectors, i.e. mining, manufacturing and utilities (DPSSTS, 2001, p.160). However, there is slightly more information available for 1997 when all four occupation categories of employment were reported for the same three sectors (DPSSTS, 1998, pp.211-219). To estimate the occupation structure for 2000 we use the same approach as we did for 1955 but have to work on much broader sectors. More precisely, our reference for the ratio of "technicians" to each of the other occupation categories is based on the 1997 DPSSTS data (3 sectors) and our reference for the ratio of sub-sector to sector total is based on data from the 1995 industrial census (24 sectors), assuming all these ratios were held true for 2000.

There is additional information that can be used for the interpolation between the benchmarks, that is, the number of employment for each occupation (as defined in this study) of the state industry as a whole in 1952-87 (DSS, 1987, p. 39; 1989, p. 49). This information is important because it gives the actual annual changes in different occupations over this period, even if it has no sectoral details. To incorporate it in the interpolation, we first interpolate the share of each occupation category by sector between the benchmarks, based on which we can calculate the ratio of sector to the industrial total for each occupation. Then, assuming the ratio is held for the actual industrial total as reported by DSS, we replace the interpolated share of each occupation category in the total industry by the same share obtained from the DSS annual aggregates to estimate the actual total-adjusted occupation structure for each sector.[19] Note that to fully use the DSS annual aggregates, we extend the 1955 benchmark back to 1952 by assuming that the share of "workers" was 80 percent rather than 73 percent in 1955 and adjusting other occupation shares accordingly. For

[19] We denote the share of the *j*th occupation in the total employment of a benchmark year *T* (in our case, T = 1955, 63, 85) that is obtained from the census/survey data as φ_j^T and the same share but obtained from other source without sector details as $\tilde{\varphi}_j^T$ (in our case the DSS 1952-87 series of the total state industry). Assuming that the relationship $\varphi_{jk}^T / \varphi_j^T = \tilde{\varphi}_{jk}^T / \tilde{\varphi}_j^T$ is held for the *j*th occupation of the *k*th industrial sector, then $\tilde{\varphi}_{jk}^T = \tilde{\varphi}_j^T (\varphi_{jk}^T / \varphi_j^T)$ must also be held. To estimate the share of the *j*th occupation in the *k*th sector between the benchmark years, we conduct interpolation between the benchmarks using the available census/survey data and obtain φ_{jk}^τ, where the superscript τ stands for any time point between the benchmark *T*. Then we adjust the results by the share of the *j*th occupation in the total employment from the other source (the DSS series) by $\tilde{\varphi}_{jk}^\tau = \tilde{\varphi}_j^\tau (\varphi_{jk}^\tau / \varphi_j^\tau)$.

the period 1949-51, we simply adopt the estimated occupation shares for 1952. For the period 1988-2000, we conduct interpolation between the benchmarks and then adjust the results for 1988-91 because there is additional information available on the number of technicians by sector.[20]

TABLE 4 (B)
OCCUPATION STRUCTURE IN NON-STATE INDUSTRIAL EMPLOYMENT (THE "TOWNSHIP LAYER"), 1963, 1985 AND 1995, BY INDUSTRIAL SECTOR
(Total employment = 100)

	1963				1985				1995			
	W	T	A	N	W	T	A	N	W	T	A	N
	B: The Non-state "Staff and Workers" (the "Township Layer")											
All	90.0	0.9	5.2	3.9	79.6	1.6	10.8	8.0	73.4	5.4	10.0	11.2
1	89.4	0.6	4.1	6.0	79.1	1.2	8.0	11.7	77.8	3.6	7.2	11.4
2	77.0	2.0	8.6	12.4	68.1	2.8	11.9	17.2	56.9	17.9	15.2	10.0
3	89.7	0.9	4.6	4.9	79.3	1.8	9.2	9.7	77.0	4.8	8.6	9.6
4	93.8	0.2	3.2	2.9	83.0	0.5	8.7	7.8	79.6	4.3	8.7	7.4
5	89.3	0.5	6.3	3.9	79.0	1.0	12.4	7.6	71.5	6.4	12.3	9.8
6	93.6	0.3	3.7	2.4	82.8	0.8	9.9	6.5	72.1	5.4	12.5	10.0
7	93.3	0.4	3.3	3.0	82.6	1.0	8.6	7.7	77.3	4.0	7.8	10.9
8	96.6	0.1	2.1	1.2	85.5	0.4	8.9	5.1	79.8	3.4	8.2	8.5
9	94.2	0.2	3.5	2.1	83.3	0.7	10.1	5.9	78.8	3.3	8.7	9.2
10	91.5	0.3	4.8	3.4	81.0	0.7	10.8	7.6	74.1	4.8	9.9	11.2
11	91.9	0.4	5.0	2.7	81.3	0.9	11.5	6.3	73.8	4.9	10.8	10.5
12	86.7	1.4	6.4	5.5	76.7	2.4	11.3	9.6	70.2	6.7	12.0	11.2
13	85.4	1.7	7.3	5.6	75.6	2.8	12.3	9.3	68.3	7.3	12.2	12.2
14	90.8	0.6	5.4	3.3	80.3	1.3	11.5	7.0	72.1	4.6	10.6	12.7
15	94.9	0.3	3.0	1.8	84.0	0.9	9.5	5.6	77.6	5.3	8.9	8.1
16	87.3	1.3	5.8	5.6	77.2	2.3	10.4	10.1	73.5	5.2	9.9	11.4
17	86.8	0.7	6.4	6.1	76.8	1.3	11.2	10.7	70.6	5.6	10.8	13.1
18	86.1	1.7	7.2	5.0	76.2	2.9	12.4	8.5	68.1	6.8	11.5	13.5
19	85.9	1.5	7.4	5.2	76.0	2.6	12.6	8.8	68.0	6.8	11.8	13.4
20	86.9	1.5	7.1	4.5	76.9	2.6	12.5	8.0	67.2	6.7	11.6	14.5
21	81.5	3.8	8.4	6.3	72.1	5.7	12.6	9.5	67.9	9.2	10.1	12.7
22	79.6	3.9	9.6	7.0	70.4	5.6	13.8	10.1	62.3	7.7	11.5	18.5
23	95.3	0.2	2.9	1.5	84.3	0.8	9.7	5.1	76.0	3.8	8.3	11.9
24	81.1	2.0	10.1	6.8	71.7	3.0	15.0	10.2	66.4	11.1	13.6	8.8

Sources and *Notes*: See Table 4 (A).

For the township layer that includes all non-state "staff and workers" (the DITS concept), only the 1985 and 1995 industrial censuses can provide the required data. To construct the time series for the entire period, we need at least one benchmark at the early time and one at the end of the period. For the earlier benchmark, we also choose 1963. We estimate the 1963 benchmark by assuming that the share of "workers" in the total employment increased to 90 percent from 80 percent in 1985 and adjusting the other occupation shares in the total and at sector level accordingly. This assumption is based on two observations: first, there was a rising trend in the share of service staff between by the two censuses, and second, the authorities

[20] Various issues of CLSY from 1989 onwards (check pp.#).

launched a campaign in 1962-63 to cut "non-productive" staff and workers (see for example (SC/DRC, 2000, V.4 (II), pp. 537-540).

For the period prior to 1963, firstly we assume that the occupation structure in the period 1953-62 were the same as that in 1963. There was no fundamental institutional change during this period. In technical terms, we however implicitly assume that the underlying capital-labour ratio remained unchanged over the period. This is not a very strong assumption given that industries at this level did not undergo significant technical advance. Secondly, for the period 1949-52, we assume that industrial firms did not hire "non-industrial employees" because there was no state control at this level and China had not yet adopted the central planning system. We then adjust the share of other occupations accordingly.

For the period between the 1985 and 1995 census-based benchmarks, we conduct simple interpolation to fill the gap. As for the period after 1995, we first estimate the 2000 benchmark using the same approach as we did for the state sector because the same sources also provide occupation information for collective firms (DPSSTS, 2001, p.160; DPSSTS, 1998, pp.211-219), and then interpolate the data between the so-estimated 2000 benchmark and the 1995 census-based benchmark.

So far, with the available information and assumptions, we have constructed the occupation structure by sector for both the state industry and the non-state industry at or above the township level for the entire period 1949-2000. This result is used to remove the inappropriately included "non-industrial employees" in both the "hard core" and the "township layer".

As we pointed out earlier, since the coverage problem discussed in this section is typically a state-enterprise phenomenon and to less extent observed in some urban collective enterprises and township enterprises, there is no need to adjust the rest of the employment (within the "outer layer") for this problem. We feel justified to assume that industries in this layer are highly labour intensive. We thus assume, though arbitrarily, that all sectors in this layer have the same occupation structure as that of the sector in the township layer which has the highest share of "workers", adjusted by dropping the "non-industrial employees" in that sector. To match the

other layers, we also set up three benchmarks, i.e. 1963, 1985, 1995 and 2004.[21] The occupation structures between 1985 and 1995 are interpolated, and the occupational structures for the period 1949-62 and 1996-2005 are assumed the same as that of 1963 and 1995, respectively. Based on the so-constructed occupation structure for each industrial sector of the state enterprises and the non-state enterprise at the township layer, we can remove the "non-industrial employees" from the employment data.

If we use **N** to denote the employment matrices, we now have a time series of marginal employment matrices $\mathbf{N}^{M}$ with numbers employed cross-classified by 3 occupations (j), 3 ownership types (o) and 24 industrial sectors (s), which can be defined as $\mathbf{N}^{M}_{s+++jot} = \sum_{g=1}^{2}\sum_{a=1}^{7}\sum_{e=1}^{5}\mathbf{N}_{sgaejot}$, where the symbol + in the subscript stands for the missing dimension that is implicitly summed up. Therefore, the total number of cells for the period 1949-2005 is $\mathbf{N}^{M}_{s+++jot} = 24\times3\times3\times57 = 12312$, and for each year ($t$) is 216.

The so constructed employment data are now ready for the last step, that is, converting the numbers employed to the hours worked.

Numbers employed converted to hours worked

In the absence of systematic records of any kind on standard working hours across industries and over time, one may think that the exercise of converting numbers employed into hours worked is inevitably arbitrary. However, official documents and studies do suggest that not only has the standard of working hours by law changed overtime, but also different standards were adopted by industries at the same time. Besides, instead of following the official standard of working hours, non-state firms and self-employed people tend to adjust their working hours in response to current demand and supply conditions. In this section, our work will focus on how to set up different standards in the hour-number conversion exercise for different industries, ownership types and periods.

[21] Our assumption is based on observations of the most labour intensive industries, typically the apparel industry, in the "township layer", assuming without "non-industrial employees". We set the shares of "workers", "technicians" and "administrative staff" as 92.5, 0.5 and 7.0 percent, respectively, for 1963, 91.0, 0.5 and 8.5 percent for 1985, and 90.0, 2.5 and 7.5 percent for 1995.

It is important to treat state and non-state industries differently in this exercise. It is a long tradition since the central planning period that state enterprises and government sectors are integrated in human resource management. Institutionally, enterprise managers, administrative personnel, technicians and staff who represent political and social organizations receive equivalent ranks to those working in government offices. Regulations on labour compensation and welfare including working hours are strictly implemented in state enterprises as in the government sector. In fact, information on working hours disclosed in studies and official documents only refers to state enterprises.

Let's begin with the state sector. To set up the standard number of working weeks per year for state enterprises, we need to subtract the number of public holidays from a calendar year. China maintained a seven-day public holiday system from 1949 to September 1999 and afterwards increased the number of public holidays to ten. If using 365 calendar days as a standard, the non-public holiday calendar contains 51.1 weeks for the period from 1949 up to September 1999 and 50.7 weeks afterwards. In this study, we adopt a standard of 51 working weeks per calendar year.

It is commonly believed that the People's Republic implemented the 8-hour working day system from the right beginning of the new regime. This is true in principle. But, in reality, this was not strictly followed until China's first constitution passed in 1954. Prior to 1954, as required by Article 32 of the *Common Guiding Principles of the Chinese People's Political Consultative Conference* (CPPCC), which was a provisional constitution and inaugurated by the CPPCC's First Plenary Meeting in September 1949, all state and private enterprises should in general limit their working time to 8-10 hours per day (Zhu, 1999, p. 391). We therefore assume that the number of average working hours per day was 9 and the number of working hours per week was 54 in 1949-53. The 8-hour working day or 48-hour working week system was legally implemented in 1954 and had since been maintained till May 1994 when the number of weekly working hours was reduced to 44, equivalent to 5.5 working days. One year later, in May 1995 a new standard of 40 hours per week was adopted, equivalent to 5 working days (DPSSTS, 1998, p. 332; Bai, 2002, p. 409). This standard defines China's institutional working hours and will be used as our *baseline* (Table 5) for measuring working hours across different industrial sectors as explained below.

However, individual industries are allowed to adopt different working-hour standards that are less than what defined by the baseline. Technically, the production process of some industries such as steel, chemical, and power generation must not be interrupted. Therefore, their workers have to work shifts to ensure the continuation of production. But some industries adopt the shift system for non-technical reason. For example, when resources are in short supply mining industries work shifts to meet the high and increasing demand by manufacturing industries. In the central planning period pursuing heavy industrialization, industries engaged in the manufacturing of consumer goods such as textiles suffered from insufficient investment. To meet the demand, they had to adopt the shift system so that the existing equipment could be fully used.

In the absence of (sufficient) compensation for the negative physical impact of the shift system on workers, especially in industries with unfavourable working conditions, the government adopted variations of the shift system in different industries to reduce the number of working hours while maintaining the full utilization of equipment. Typically, in industries such as textiles, the old system of "three shifts" was replaced by a system of "three shifts by four groups" in the early 1960s, under which workers work 6 hours less per week than the baseline standard. In industries with harsher conditions such as mining and oil extraction, a "four shifts" system was implemented under which workers only worked for 6 hours per day or 36 hours per week (Zhang 1984, pp. 539-540; Zhu, 1999, pp. 438-444). Consequently, as given in Table 5 there are three types of industries adopting different standards of weekly working hours, namely, the A type following the baseline, the B type with 6 hours less than the baseline and the C type with 12 hours less than the baseline. Whenever there was an institutional change in the baseline, we adjust the standard of the B and C types accordingly. Besides, given the rising pressure on resource industries (the B* type), we impose some *ad hoc* upward adjustment by 4 hours a week to these industries for the period since 1993. However, we only apply the standards for the B-type (and B*-type) and C-type industries to "workers" and "technicians". In other words, we assume that "administrative staff" and "non-industrial employees" in these industries follow the baseline standard.

TABLE 5
"STANDARDS" OF WORKING HOURS PER WEEK FOR WORKERS AND TECHNICIANS BY OWNERSHIP TYPE

	1949-1953	1954-1957	1958-1993	1994	1995-2005
State: A (the baseline)	54	48	48	44	40
B	54	48	42	38	34
B*	54	48	42 (-1992)	46 (1993)	46 (1994-)
C	54	48	36 (-1992)	40 (1993)	40 (1994-)

	1949-1953	1954-1984	1985-1992	1993-2005
"Township Layer" (all industrial sectors)	54	48	52	56

	1949-1957	1958-1959	1960-1984	1985-1992	1993-2005
"Outer Layer" (all industrial sectors)	31.2 (65% of 48)	48	31.2 (65% of 48)	38.4 (80% of 48)	48

Sources: See the text for detailed information and adjustment.
Notes: Type of industries: A=5, 8, 9, 10, 17-23; B=6, 7, 11, 13, 14; B*=12, 15, 16, 24; C=1-4 (see Table 1 for the sector codes). See text for the details of the standards and adjustments.

Let us now turn to the case of the non-state employment in the "township layer". We have treated all the employment in this layer indifferently although they include various types of non-state enterprises such as urban collectives, joint ownerships, foreign invested firms and rural commune/township enterprises. A common feature of these enterprises is their heavy engagement in labour intensive industries. However, taking into account the changes in the policy regime and the composition of enterprises, we should treat the number-hour conversion in the pre-reform period, specifically, before the full-scale industrial reform began in 1985, and the post-reform period differently. During the central planning period, urban collective enterprises were integrated with the state industrial system. Therefore, it is reasonable to consider them as semi-state enterprises that followed the government's labour regulations. On the other hand, the rural commune/township factories which survived from the Great Leap Forward were also controlled by local governments because there was no market system for their inputs and outputs. We then assume that in the pre-reform period, they all followed the baseline standard of working hours and there were no difference between occupation groups and across industries (Table 5).

In the reform period, there were two important policy changes: one was the shift from planned to market-oriented industrial development that gave more room for non-state enterprises to grow and the other was the opening up to foreign direct investment, which resulted in rapid growth of export-oriented, labour-intensive industries. As widely observed (but not officially surveyed), driven by increasingly

fierce market competition in the situation of abundant labour supply, non-state enterprises tend to ignore working conditions and over use workers.[22] Therefore, we have two assumptions in setting up the working hour standard for the enterprises in this layer. Firstly, we assume that the non-state enterprises increased their working hours in response to the opportunities emerged following the industrial reform. Therefore, we upward adjust the weekly working hours by 4 or from 48 to 52 hours a week for the period 1985-92. Secondly, we assume that these enterprises did not follow the baseline standard to cut working hours in 1994 and 1995, instead, they further raised the weekly working hours since 1993 along with the government's more liberal measures towards foreign trade and direct investment in 1993.[23] We thus increase the number of working hours of "workers" by 4 to 56 for the period in 1993-2005. It should be noted that this assumption allows 5 percent more than the maximum number of working hours that is allowed by China's *Labour Law* in order to capture the effect of the over work of workers.[24] For other occupation categories, the standard remains the same as that used for the period 1985-1992.

For those classified as industrial labourers in the "outer layer", consisting of the employment in village (production brigade) factories, self-employed, and people in private firms, since many engage in farm sideline activities or activities that were to fill the idle season in farming, and gradually move to labour intensive activities, we assume that they generally do not work full time year round, but their working hours have increased since the 1990s in line with the change of the overall economy. We adopt a seasonal adjustment that discounts the baseline standard by 35 percent for the period 1949-84; that is, about four months of the year of the industrial labour force in this layer were spent on farm activities or just idle. The only exception is the time in 1958-59 for which we assume that all types of labourers were fully used driven by the rural industrialisation policy during the Great Leap Forward campaign. After the industrial reform, we assume that the idle time or the time spent on farming reduced

[22] Need a footnote on this with reference.

[23] Following Deng's call for bolder market-oriented reforms during his to the southern China from 18 January to 21 February, 1992, the 14th National Congress of the communist Party of China decided to promote "socialist market economy" (Bai, 2002, pp. 309 and 323-324).

[24] As required by the Labour Law inaugurated in 1995, the standard or the institutional working hours per week are 44 (Article 36) and the maximum additional working hours should not exceed 36 per month (Article 41). This means that the maximum working hours should be 53 per week. Need more (even anecdotal) information on extremely long working hours of migrant workers.

from 35 to 20 percent; therefore, we adjust the number of working hours to 80 percent of the baseline standard for the period 1985-92. For the period 1993-2005, because of the accelerated marketisation we assume 48 per week as given by the pre-1994 baseline standard. Table 5 also lists the standard of working hours for this layer.

Based on the working hour standards in Table 5, we convert the numbers employed cross classified by 3 occupations (*j*), 3 ownership type (*o*) and 24 industrial sector (*s*) into the hours worked, which can be defined as a time series of marginal employment matrices in hours as $\mathbf{H}^{M}_{s+++jot}$ for the period 1949-2005. The results will serve as the "control totals" in the construction of the full-dimension labour employment and compensation matrices.

4.2 Construction of Compensation Data (Marginal Matrices)

Official data on labour compensation and problems

The Construction of labour compensation data is even a bigger challenge to us. Most of the required data, especially compensation by human capital attribute, do not exist in Chinese official statistics. The available official data are aggregate wages paid to employees at sectoral level with ambiguous definition and insufficient coverage. It is necessary to begin with an understanding of the available data and related problems so that we can highlight the key tasks in our data work.

There are two basic indicators of labour compensation in the official labour statistics constructed by DPES, namely, "total wage bill" (*gongzi zonge*) and "total insurance and welfare payment" (*baoxian fuli feiyong zonge*), covering only the "staff and workers" in the urban/industrial sector as defined by DPES (see Section 4.1). Statistics for the two indicators are collected through the reporting system, supported increasingly by sample surveys since the reform, and internally reported in the DPES quarterly and annually bulletins, based on which the finalized statistics, especially for "total wage bill", are published in *China Labour Statistical Yearbook* from 1988.[25] A closer examination of the two indicators helps understand their origin and nature. Traditionally, "total wage bill" was one of a few key indicators used by the planning authorities to monitor and control state enterprises and urban collective firms (semi-state), so called "total wage bill management". The planning authorities assigned

[25] Historical data for 1949-1985 are published by the Department of Social Statistics (DSS), the predecessor of DPES, in 1987 and updated for 1978-87 also by DSS in 1989.

"total wage bill" to enterprises estimated based on their current-year performance and next-year production plans. Enterprises were not allowed to pay more than the assigned limit. On the top of the "total wage bill", enterprises were also allowed to make "total insurance and welfare payment" to their employees but it should be equivalent to a maximum 14 percent of its "total wage bill". Therefore, under the "total wage bill management" labour compensation was conceptually a planned spending quota on labour rather than actual payment to labour. Of course, during the central planning period plans were usually "fulfilled" and the planned payment was equal to the actual payment because there was no leeway for enterprises to pay more to their employees than the state set standard wages or to hire more workers that was not as planned. This is, however, no longer the case since the reform.

Along with the reform, income incentives have played an increasingly important role when enterprises have to respond to market competitions including competition for labour. In 1985, a reform to the existing wage system that began in 1955 was introduced to large and medium-sized state enterprises linking "total wage bill" with total enterprise tax payment (including turn over profits), under which the growth of the former was not allowed to be faster than that of the latter, usually 30 to 70 percent of the latter (State Council, 1985a). To effectively curb state enterprises' incentives of maximizing labour income—a typical problem with ambiguous property rights, the authorities resorted to tax incentives. As required in two subsequent regulations issued following the wage reform, an enterprise's total bonus payment (part of its wage bill) would be subject to a progressive tax from 30 to 300 percent if it exceeded an amount equivalent to four-month standard wage bill and its total wage payment would also be charged by a wage adjustment tax up to 300 percent if it exceeded the approved "total wage bill" by more than 7 percent (State Council, 1985b and 1985c).

The problem was two-folded. In cases that the assigned "total wage bill" was insufficient, enterprises had to hide some labour compensation as non-labour cost, whereas in cases that the assigned "total wage bill" was more than actually needed, enterprises were either encouraged to overpay employees or to make inappropriate expenses under the name of labour compensation. Coherently, "total insurance and welfare payment", which was still limited to an equivalent of 14 percent of the "total wage bill", gave the same distorted incentives to enterprises. Instead of abandoning the "total wage bill management", the statistical authorities focused on improving

statistics on actual wage paid aiming to align the "total wage bill" assignment with the reality. After various surveys by NBS since 1986, a revised version of the 1955 *Regulations on the Structure Total Wage Bill* was issued in 1990 (NBS, 1990, Decree No. 1), supplemented by another NBS regulation on the structure of total labour compensation including both wage and non-wage incomes in 1992 (NBS, 1992, Circular No. 257). These efforts were largely in vain because the planning authorities enhanced the "total wage bill management" in order to manage the unprecedented expansion of aggregate demand. Consequently, the taxable wage standard, which was a key variable in managing the "total wage bill", could not timely reflect changes in the cost of labour along with the marketisation of the economy.[26]

There are another two problems in the DPES labour statistics. First, data on "total wage bill" do not cover employees who are not classified as "staff and workers" in the urban sector (up to 2000)[27] and they also exclude rural enterprises completely. Second, data on "total insurance & welfare payment" do not have industry breakdowns that match the "total wage bill".

There are another two sources of labour compensation data provided by NBS, both with a full coverage. They are industrial censuses and national input-output tables. The Department of Industrial and Transportation Statistics (DITS) is responsible for conducting the 1985 and 1995 National Industrial Censuses as well as the industrial part of the 2004 Economic Census. The censuses provide labour compensation data for all enterprises, both urban and rural, and family based or self-employed activities, but with more details on enterprises at or above the township level/designated size. However, the enterprise data still categorized under "total wage bill" and "total insurance & welfare payment" that are in line with their regular accounting and reporting practice with DPES. Therefore, while coming with a wider

[26] The tax threshold was raised to 550 yuan in 1996 after a 500 yuan standard introduced since the early 1990s. In 1999 it was further raised to 800 yuan with a local floating band up to 20 percent of the baseline. This standard however remained intact till 2006 when a further adjustment increased it to 1600 yuan with the termination of local floating adjustment (STA, 2006). Since this study covers up to 2005, the latest adjustment is beyond our analysis.

[27] In the 1994 *China Labour Statistical Yearbook* (p. 591), DPES for the first time introduced a wider concept "labour compensation to persons employed" (*congye renyuan laodong baochou*) that consists of two parts: 1) "total wage bills" paid to "staff and workers" and 2) "labour compensation" paid to others employed. This change also appeared in a publication by NBS and Ministry of Labour (NBS-MOL, 1994, p. 25). However, the first data related to this are published in *China Labour Statistical Yearbook* from the 2001 issue onwards without industry details.

coverage than the DPES annual data, the census data do not solve the conceptual problems in the DPES indicators.

The Department of National Accounts (DNA) is responsible for constructing the national input-output tables with one full table in every five years since 1987 and one reduced table between two full tables. DNA in principle follows UN's System of National Accounts (SNA) and has an integrated view on statistics from all specialized NBS departments including DPES, which provides it a better position to find and fix problems. In addition to the data provided by the specialized departments, DNA conducts its own input-output surveys to fill data gaps and missing parameters required for constructing the full tables. One of the main tasks in the input-output survey is to repair the DPES labour compensation data. Through crosschecking the input-output survey results with the annual DPES statistics it attempts to identify labour compensation items that are reported or disguised as others and adjusts them for measuring labour compensation in the input-output tables. Given the shortcomings in the "total wage bill management" system and hence the distorted incentives of enterprises in reporting data, what DNA can do is still limited. However, their labour compensation data are the best available and should be used as our benchmark control totals in constructing labour compensation time series for the post reform period.

Table 6 summarizes the features of the available data and required data work in constructing the compensation time series that matches numbers employed by industry and by ownership types, that is, $\mathbf{N}^{M}_{s++++ot}$.

TABLE 6
AVAILABLE OFFICIAL DATA ON LABOUR COMPENSATION AND THE REQUIRED DATA WORK IN THIS STUDY

Available Data	Required Data Work
DNA/Input-Output Table "Labour Compensation": • 2-digit level industries, no ownership breakdown • One full table every five years and one reduced table in between, 1987-2005 (CSIC-inconsistent)	• Industry classification adjustment • Reconciliation and interpolation between full and reduced tables • Used as benchmark control totals at industry level for constructing the post-1987 series
DITS/Census "Total Wage Bill" and "Total Insurance & Welfare Payment": • The 1985 and 1995 Industrial Censuses, major ownership types, 3/4-digit level, some indicators back to 1980	• For "total wage bill", used as much more detailed benchmarks that help reconcile different CSICs and decompose non-state aggregates to 2-digit level as well as check and adjust annual data • The ratio of "total wage bill" to "total insurance & welfare payment" is used to estimate welfare

• The 2004 Economic Census, major ownership types, 3/4-digit level industries	payment at industry level by ownership types • Data on 1980 reported in the 1985 Census are used for industrial and ownership structures in central planning
DPES[a]: • State "Total Wage Bill", 2-digit level industries, 1952-84, 1978-87, 1988-2005 (CSIC-inconsistent) • State "Total Insurance & Welfare Payment", industrial aggregate, 1959-64, 1975-85; mining, manufacturing, utilities, 1993-99	• Industry classification adjustment • Together with census data, estimate industry level welfare payment for benchmarks and fill the gaps • Average wage used for making assumptions for industries in other ownership types
DPES[a] "Total Wage Bill": • Urban collectives, industrial aggregate, 1952-84, 1978-87, 1988-2005 • Other ownership types (including FDI) industrial aggregate 1984-87, 1988-2005	• Together with census data, especially ratios of state to non-state in census, estimate industry level wage and welfare payment for benchmarks • Interpolations between benchmarks

Sources: See the text for adjustments and references.
Notes: a) DSS as predecessor and DPSSTS as successor.

Data construction by sector and ownership type

Based on the available data presented in Table 6 and their problems discussed above, we take six steps to construct the sector (24) by ownership types (3) labour compensation marginal matrix for each year of the entire period. In what follows, we describe the procedures of the data construction for each step.

The state sector

Constructing the state sector component is crucial, especially for the central planning period or in the case of industrial reform for the period prior to 1985, because this is the only sector for which the best data available though still far from satisfaction. Since the available DPES compensation data refer to numbers employed and are classified in the 1972 CSIC, an industrial classification that is typically designed for vertical administrative control over resource allocation, to keep the compensation-number matching we need to re-classify the numbers employed in the state industry in 39 sectors into 11 two-digit sectors, with the "residual" further decomposed into 4 sectors. We then assume that sub-groups in each of these sectors have the same wage rate, which is not a strong assumption particularly for the central planning period, and allocate the two-digit level "total wage bills" into corresponding sub-sectors covering for the period 1952-87 (DSS, 1987, pp. 124-5; 1989, pp. 166-7). For 1949-51, we assume the "total wage bill" grew at the same rate of the total industrial employment

and the total wage is decomposed by the industrial structure of 1952. As for the rest of the state series, for the period 2001-05 (DPSSTS, 2006, pp….), direct data are available, which are crosschecked by the 2004 Census. For the period 1988-2000, except for the 1995 Census, when wage data are only available for three broad sectors (mining, manufacturing and utilities), we decompose the sectoral totals with the intra-industry structure of each of the three broad sectors for each year, obtained by interpolations between the structures of 1987 (crosschecked by the 1985 Census data), 1995 (the census) and 2001.

We now need to estimate "total insurance & welfare payment" in the state sector. Due to scant information we have to rely on the census data which give both welfare value and its industrial composition for four benchmarks, i.e. 1980, 1985, 1995 and 2004. We first construct an industry-specific welfare-wage ratio, calculated using the industrial compositions of wage and welfare,[28] for the benchmarks. Interpolations are used to derive the series of the ratio between 1980 and 2004. We assume that the 2004 ratio can be used for 2005. The welfare-wage ratio of 1980 is then used to derive the ratio for the period 1949-80. The underlying assumption for the pre-planning 1949-52 may be a bit strong, but we have no choice. Finally, adding the results of the "total insurance & welfare payment" to the estimated "total wage bill" we arrive at the total labour compensation for the state sector.

Urban collectives

In constructing labour compensation for enterprises in the "township layer", we work separately on three components, namely, urban collectives, foreign invested enterprises (FIEs) and the rest as a residual that includes mainly rural enterprises, domestic private enterprises as well as various types of joint ventures among domestic firms. This disaggregating is for two reasons. First, we need different assumptions for these components because financing, market and the institutions determining labour compensation are rather different among them. Second, while no

[28] This approach imposes the relationship between welfare (F) and wage payment (W) at a benchmark year (*) on other years. Let ω_i be the share of wage payment and ϕ_i be the share of welfare in the ith industry, i.e. $\omega_i = W_i / \sum_{i=1}^{n} W_i$ and $\phi_i = F_i / \sum_{i=1}^{n} F_i$. The welfare-wage ratio, λ, for a benchmark is defined as $\lambda_i^* = \phi_i^* / \omega_i^*$. To obtain the welfare share for the ith industry of any other year, we use the following approach, $\phi_{i,t} = \omega_{i,t}\lambda_i^* = \omega_{i,t}(\phi_i^* / \omega_i^*)$. (Consider a more general approach to deal with the same type of estimation – also see a similar approach in an earlier footnote.)

detailed compensation data by industry for any of the component for most of the period, there are data for each component that are further divided into mining, manufacturing and utilities, which should definitely be used in our estimation.

For urban collectives, while there are average wage data and total wage payment for three groups, i.e. mining, manufacturing and utilities, for every year, there are also detailed industry-specific average wage data by industry for seven years, 1989-92 and 2003-05. Our first take is to decompose the group data. To do so we calculate an industry-to-group ratio in average wage for each industry for each of the seven years, e.g. the textiles-to-manufacturing ratio. Assuming that the relationship (the ratio) for 1989 is held for the years prior to 1989, we use the 1989 ratio and the available average wage for the manufacturing as a whole in each year prior to 1989 to estimate the wage rate by industry, technically the same approach as explained in Footnote 28. Besides, we obtain average wage estimates for the period between 1992 and 2002 by interpolation.

Estimation of the welfare payment for urban collectives is based on information from the 1995 and 2004 Censuses. Like the above exercise for the state sector, we first calculate the welfare-wage ratio for each industry in urban collectives using the 1995 Census data. Since our calculation shows that the ratio for all collectives is 0.172 compared with 0.336 of the state sector for this benchmark, we then assume a welfare-wage ratio for urban collectives as a whole as half of that of state enterprises for the period prior to 1995. The so-derived annual aggregate ratios are then used to adjust the industry-to-total ratio in 1995 which gives us an estimation of the welfare-wage ratio by industry for each year before 1995. For the period between 1995 and 2004 we again use interpolation and for 2005 we assume the ratio for 2004 is held. Finally, the labour compensation by industry is obtained by multiplying the numbers employed in each industry by an industry-specific compensation rate that is the wage rate adjusted by the estimated welfare-wage ratio.

Foreign invested enterprises

The official statistics on foreign invested enterprises (FIEs) began in 1984. Our approach used to estimate labour compensation for FIEs is the same as we used for urban collectives. The only data with industry details available are average wage from the 1995 Census and from labour statistics in 2003-05. “Total wage bill” and average

wage for mining, manufacturing and utilities are available for each year. Based on the industry-to-group ratio in 1995, we estimate industry wage rate for each year prior to 1995 and then complete the series by interpolations between 1995 and 2003. To estimate the welfare-wage ratio, we rely on data the 1995 and 2004 censuses. The 1995 ratio is used to estimate annual ratios for 1984-94. We conduct interpolations between 1995 and 2004 to complete the series, assuming 2005 equal to 2004.

Rural enterprises

The last component of the "township layer", whose records began in 1956, is in fact the "residual" resulting from subtracting urban collectives and FIEs from all non-state enterprises in this layer. We use the same approach to estimate average wage by industry for each year prior to 1995 based on data from the 1995 Census and conduct interpolations between the 1995 and 2004 Census, assuming 2005 equal to 2004. For the welfare-wage ratio, since there is no information and welfare payment is not a standard practice in these enterprises, we assume that it is equivalent to half of that of urban collectives in 1956-92, and then rose to 60 percent in 1993-2000 and to 70 percent in 2001-05 along with the marketisation.

The outer layer

There is no information on labour compensation for this layer except for self-employed family business in the 2004 Census. From the census we know that labour compensation for the self-employed is in general less than that of rural enterprises, or about 65 to 80 percent of the latter (note that there is no distinction between wage and welfare payment for the self-employed). In the estimation, we assume that the relative compensation (i.e. the self-employed-to-rural enterprises ratio) in 2004 is held for the period 2001-05. For the period prior 1949-2000, we assume that labourers in this layer were even less paid but increased over time. Specifically, we assume that the labour compensation to the self-employed is 70 percent of the 2004 ratio over 1949-84 or before the industrial reform, 80 percent in 1985-92, and 90 percent in 1993-2000.

Reconciliation with input-output tables

The final step is to reconcile our results with the national input-output tables. As we argued in the previous discussion that in terms of both concept and practice in measuring labour compensation, the national input-output tables is the only

information that could bring us closer to the true labour compensation. DNA has constructed so far four full input-output tables, i.e. 1987, 1992, 1997 and 2002, and also four reduced input-output tables, i.e. 1990, 1995, 2000 and 2005. However, bearing in mind the input-output tables do not provide breakdowns for ownership types as we have been working on that are very important in the case of China.

Our procedures contain four steps. The first step is to make reclassifications among these tables to ensure consistence in industrial classifications in line with the 2002 CSIC. The second step is to make interpolations between the benchmarks to arrive at a time series for 1987-2005. Fortunately, this almost covers the entire period of industrial reform when inconsistence between the controlled and actual labour compensation was more likely to happen. The third step is therefore to calculate the differences between our estimates and the input-output table totals for each industry in each year at the national level. In the last step, we assume that the relative compensations between all five ownership types (instead of three that is finally used) are held and hence used to redistribute the input-output table identified differences based on the relative compensations. This finally gives us a marginal labour compensation matrix cross classified by sector ($s = 24$) and by ownership type ($o = 3$), which can be defined as $\mathbf{C}^{M}_{s++++ot} = \sum_{g=1}^{2}\sum_{a=1}^{7}\sum_{e=1}^{5}\sum_{j=1}^{3}\mathbf{C}^{M}_{sgaejot}$. Therefore, the total number of cells for each year (t) is $\mathbf{C}^{M}_{s++++ot} = 24\times 3 = 72$.

5. Construction of the Full-dimension Employment and Compensation Matrices

Our work so far has constructed three long time series of marginal matrices for the period 1949-2005, that is, 1) numbers employed cross-classified by sector (industry), occupation and ownership types, denoted as $\mathbf{N}^{M}_{s+++jot}$, 2) hours worked cross-classified by the same three attributes as in the numbers employed matrices, denoted as $\mathbf{H}^{M}_{s+++jot}$, and 3) labour compensation cross-classified by sector and ownership type, $\mathbf{C}^{M}_{s++++ot}$. These marginal matrices will be used as the "control totals" in constructing the annual full-dimension matrices of the three series, denoted as $\mathbf{N}_{sgaejot}$, $\mathbf{H}_{sgaejot}$ and $\mathbf{C}_{sgaejot}$, respectively. This means that we can therefore derive annual average labour compensation series for each industry cross-classified by ownership type in terms of

compensation per labourer employed (*N*) and compensation per hour worked (*H*) as follows,

(12a) $$\mathbf{c}^{M(N)}_{s++++ot} = \frac{\sum_g^2 \sum_a^7 \sum_e^5 \sum_j^3 \mathbf{C}_{sgaejot}}{\sum_g^2 \sum_a^7 \sum_e^5 \sum_j^3 \mathbf{N}_{sgaejot}}$$

and

(12b) $$\mathbf{c}^{M(H)}_{s++++ot} = \frac{\sum_g^2 \sum_a^7 \sum_e^5 \sum_j^3 \mathbf{C}_{sgaejot}}{\sum_g^2 \sum_a^7 \sum_e^5 \sum_j^3 \mathbf{H}_{sgaejot}}.$$

The nature of our key problem in the construction of the full-dimension employment matrices is the same as that of the construction of the full-dimension compensation matrices. That is, how to best estimate the missing dimensions in the full-dimension matrices (Table 1) based on the available information. The more information available, the more reliable the full-dimension matrices can be constructed. It is therefore necessary to look for more information in addition to the "control totals" at least for some time points even though it may not be consistent with the "control totals" because of different sources or different sizes of sampling.

After combing through all available information, published and unpublished from the NBS archives, we decide to focus the additional data work on eight years as benchmarks. They are 1955, 1963 and 1982 for the pre-reform period and 1987, 1990, 1995, 2000 and 2005 for the post-reform period. We set the year 1982 as the point that divides the pre- and post-reform periods, which was the eve of China's industrial reform that began in 1984. Having fewer benchmarks for the pre-reform period is less satisfactory. But the three time points can just avoid the radical fluctuations in 1958-62 (the Maoist feverish Great Leap Forward and its aftermath) and in 1966-76 (the Cultural Revolution). In other words, they may better reflect the underlying trend of the employment dynamics and relative cost of labour with different human capital attributes in the long run, which may be more realistically anchoring the estimated time series.

5.1 Additional Marginal Matrices for the Benchmark Years

In this section, we describe how additional marginal matrices are constructed for the benchmarks using the sources other than those used for the construction of our three

annual matrices. Note that the additional matrices may not comply with the "control totals" as defined and constructed in Sections 4.1 and 4.2 and may have missing cells or incomplete dimension. Filling these gaps will be the tasks of Section 5.2 where the full-dimension matrices are constructed.

The 1955 and 1963 benchmarks

Our basic data used for extending the 1955 benchmark marginal matrix are from an unpublished NBS survey on 13,591 industrial firms which were state-owned or controlled by the state through state-private jointed ventures (DPES, 1955, pp. 133-5). They are, however, only available in two separate tables: numbers employed cross classified by occupation, industry and gender, and by occupation and age groups. With adjustment to our industrial classification, we can have two separate marginal matrices $\tilde{\mathbf{N}}^{M,55}_{sg++j}$ and $\tilde{\mathbf{N}}^{M,55}_{++a+j}$, but only for the state sector. Where the tilde "~" on the top of the matrix $\mathbf{N}$ indicates incomplete coverage of a dimension (here the "ownership" dimension) because of missing category (here the non-state categories) or missing cells.

The source, however, does not provide any information on education attainment. The only information on the education of industrial employees that we could find is from a brief summary of another unpublished NBS survey conducted in 1957, which reports total industrial employment with four levels of education attainment for workers and "other types of employees" (DPES, 1957, p. 41). To match the education data with the gender, age and industry data in 1955, we first decompose the "other types of employees" with education attainment into administrative, technical and service staffs, and then decompose the estimates by industry. This gives us an additional marginal matrix $\tilde{\mathbf{N}}^{M,55}_{s++ej}$ for the state sector. The data used in the decompositions are the occupation-by-industry information from the aforementioned 1955 survey and the occupation data for total industry from the 1982 population census (see work below on the 1982 benchmark).[29]

The only source that allows us to extend the existing employment marginal matrix for 1963 is from an unpublished NBS survey on 35,766 state industrial firms

[29] (Ximing, check if this exactly what you did as I am a bit confused; from your previous explanation it seems that you did not incorporate the 1955 information? Strictly speaking, the 1955 data should be given more weight in your estimation as they are very close to 1957).

available from the NBS archives (DPES, 1963, pp. 38-49). The survey results are only available in one table on numbers employed cross-classified by gender and occupation, but no information available on age and education with detailed industry breakdown (equivalent to 3-digit level by the 1972 CSIC), that is, $\tilde{\mathbf{N}}^{M,63}_{sg++j}$. We fill the education and age data by assuming that the 1963 benchmark is given by the linear trend that links the 1955 and 1982 benchmarks, i.e. $\tilde{\mathbf{N}}^{M,63}_{++a+j}$ and $\tilde{\mathbf{N}}^{M,63}_{s++ej}$.[30]

Additional data on labour compensation are even more limited. For the entire central planning period, there are only five "labour-wage surveys" from the NBS archives, i.e. 1955, 1959, 1960, 1961 and 1963, available in different formats. The 1959 survey is relatively more informative that covers almost all state enterprises with 19.98 million employees at the time of survey (DPES, 1959, pp. 42-47), very close to our mid-year estimate of 21.55 million for the state sector (Table x). This survey provides wage bills cross-classified by numbers employed and by occupation with industry breakdowns. After some classification adjustment, we can obtain a marginal compensation matrix for the state sector in 1959 as $\tilde{\mathbf{C}}^{M,59}_{s+++j}$. Available wage surveys for 1955 and 1963 only report total wage bills paid to all employees and to workers in particular. Assuming that the ratio of non-worker occupations to workers in wage in 1955 and 1963 is the same as in 1959, the 1959 survey data are then used to estimate wage bills paid to non-worker occupations (administrative staffs, technicians and service employees) in 1955 and 1963. Note that as discussed in Section 4.2, employees in services are removed from the industrial workforce but compensation to them are kept and treated as payment for their services by industrial employees. After such an adjustment, we have obtained an additional marginal compensation matrix for the state sector for 1955 and 1963, respectively, $\tilde{\mathbf{C}}^{M,55}_{s+++j}$ and $\tilde{\mathbf{C}}^{M,63}_{s+++j}$.[31]

The 1982 and 1987 benchmarks

After ten years of interruption of the routine statistical work due to the Cultural Revolution (1966-76) and a slow recovery, the 1982 Population Census, though far

[30] (Ximing, what I am putting here based on my understanding of what you did. Please confirm that this is actually done in your exercise.)

[31] Note that "ownership type" dimension is missing in the marginal matrices for 1955, 1959 and 1963 as all the available data refer to the state sector. Missing dimensions for other sectors will be estimated by iterative proportional filling approach discussed later.

from being sufficient or satisfactory by international standard, provides invaluable information for both the employment and labour compensation at the eve of the industrial reform. Importantly, as all institutions regulating employment and compensation experienced little change since the Cultural Revolution, the 1982 Census can serve as a close proxy for the period from the mid 1960s to the early 1980s.

The 1982 Population Census data are available in two formats: 1) national summary tables based on full samples and 2) full reports using one-percent of household samples in the census. The main problem in the 1982 Census data, as in later conducted censuses, is that the census questionnaires do not allow a direct integration (or full cross-classification) of the tables with different attributes. The best table available from the national summary is the numbers employed of each industry by age and gender (Ref. xxxx, pp. 440-447), which gives us a marginal matrix $\tilde{\mathbf{N}}^{M,82}_{sga+++}$. Another table is the numbers employed with different level of education attainment (Ref. xxxx, p. 461), which gives us another marginal matrix $\tilde{\mathbf{N}}^{M,82}_{s++e++}$. The one-percent of household samples of the 1982 Census also provides two useful tables for numbers employed by age, education and occupation and by gender, age and education, respectively, which allows us to obtain two more marginal matrices after, i.e. $\tilde{\mathbf{N}}^{M,82}_{++aej+}$ and $\tilde{\mathbf{N}}^{M,82}_{+gae++}$ (Ref. xxxx, Vol. 2, pp. 1560-1587 and 2072-2135; Vol. 3, pp. 2328-43 and 2392-99).[32]

Since the 1982 Census data on the education attainment by occupation are the only information available for the late central planning period, they are used to help decompose the education data for industrial workforce as a whole for 1957 that are the only information on education available for the central planning period as discussed above, and then construct a table of numbers employed cross-classified by occupation and education for 1955 ($\tilde{\mathbf{N}}^{M,55}_{s++ej}$).[33]

[32] (Ximing to check if my discussion for 1982 is correct – you give me many tables that are difficult to follow.)

[33] Note that these additional human capital marginal matrices for 1982 do not exactly matching the items in the 1957 survey. We apply the iterative proportional filling (IPF) approach to obtain the estimates that match the 1957 survey data, which will be given in the following sub-section.

An important reason for us to choose 1987 as the first benchmark for the post-reform period is because the NBS constructed its first SNA-type input-output table for that year with detailed labour compensation by industry (Ref. xxxx). Besides, there are also data from the NBS 1987 one-percent population sample survey (Ref. xxxx) (Ximing, I am not clear how is the 1987 one-percent population sample survey used in your estimation) and the 1988 Chinese Academy of Social Sciences (CASS) household survey conducted by the Institute of Economic Research of CASS, which covered about 20,000 households (Ref. xxxx, is this also part of the CHIP?). The CASS 1988 Household Survey provides average wage data that are cross-classified by four attributes of gender, age, education and occupation, but available only for two broad sectors, "mining" and "manufacturing & utilities". We assume the average wages of the CASS 1988 survey are close proxies for the average compensation of the same types of labour in 1987, that is, they satisfy the following relationship:

$$\mathbf{c}^{M,87}_{+gaej+} = \sum_{s}^{24}\sum_{o}^{3}\mathbf{c}^{87}_{sgaejo} = \frac{\sum_{s}^{24}\sum_{o}^{3}\mathbf{C}^{87}_{sgaejo}}{\sum_{s}^{24}\sum_{o}^{3}\mathbf{N}^{87}_{sgaejo}} \tag{13}$$

Therefore, for each of the three broad sectors we can have a marginal matrix $\tilde{\mathbf{c}}^{M,87}_{+gaej+}$.

For the 1982 benchmark, we just assume the *relative* wages of all types of employees are the same in 1982 as in 1987. We argue that although the reform had affected labour compensation, the impact was similar among industries because they were almost all controlled by the state then.[34]

The 1990 and 1995 benchmarks

Our work on the 1990 benchmark is based on our work for the 1987 benchmark and the 1990 Input-Output Table. Assuming the *relative* wages between all types of labourer available in 1987 are held for 1990, the average wage of each type of labour in 1987 is adjusted such that the average wage by industry is equal to the compensation per worker given by our "control totals" for 1990 in both numbers employed ($\mathbf{N}^{M,90}_{s+++jo}$) and total compensation paid ($\mathbf{C}^{M,90}_{s++++o}$) that is aligned with the

[34] Ximing, another issue, people would question us why we don't use any information from the 1985 industrial census here. We ourselves are inconsistent as we use both the 1985 and 1995 censuses in constructing time series marginal employment matrices, but not used the census data in constructing human capital. (Ximing, are we doing regression for all these benchmarks or only for 1987?)

1990 Input-Output Table. This gives us an additional marginal matrix for average labour compensation for 1990, $\tilde{\mathbf{c}}^{M,90}_{+gaej+}$.

There is no additional employment information for the 1995 benchmark matrix, but additional information on compensation from the 1995 CASS Household Survey. The procedure used is almost the same as that for the 1987 benchmark. In the CASS 1995 Household Survey, average wage is cross-classified by four attributes, namely, gender, age, education and occupation, which is available only for two broad sectors, "mining" and "manufacturing".[35] Based on the CASS 1995 Survey, following the same assumption as used for 1987 (Equation 13), we can construct a marginal matrix for average compensation for 1995, $\tilde{\mathbf{c}}^{M,95}_{+gaej+}$.

The 2000 benchmark

The additional information for the 2000 benchmark comes from the 2000 Population Census (Ref. xxx). Two of the census tables are used in this study, which allows two additional marginal matrices to be constructed. One is the 2000 Census Table 4-1, "Provincial Employment by Sector and Gender" that provides numbers employed in 92 two-digit industries, of which 6 are for mining, 30 for manufacturing and 3 for utilities. With such detailed industry breakdowns we can easily regroup these industries so as to align with the sectoral classification in this study (Table 1) and obtain $\tilde{\mathbf{N}}^{M,00}_{sg++++}$. The other source is the 2000 Census Table 4-5, "National Employment by Sector, Gender, Age, and Education". However, industries are only broadly defined as mining, manufacturing and public utilities. Therefore, we can have a marginal employment matrix cross-classified by gender, age and education for each of the three sectors, which can be denoted as $\tilde{\mathbf{N}}^{M,00}_{+gae++}$.

There are no additional labour compensation data to what used for constructing our annual series.[36] However, data from the China Income Project (CHIP)'s 2002 Household Income Survey can be used as a close proxy for 2000 (CASS/CHIP, xxxx).

[35] (Ximing, utilities is separately reported in the 1995 CASS ?)

[36] (Ximing, how about MOLSS data in your early writing in this footnote? Why stopped using the data?) MOLSS Labour Market Survey for 1999 and 2000 has a sample size of 724,000 employed people, which is the ever largest wage/salary survey conducted in China. Only the data for 2000 are used in this study. One of the main deficiencies in this survey is that it has high level aggregation for low-level education attainment, lumping together all types of labour with middle school-level education or below. (Are all dimensions available except that education is insufficient?).

The CHIP data set contains 6,835 sample households and their members (number?) in both urban and rural areas, only urban households data are used in this study (Ximing, check if the figures cited here refer to "urban" only).[37] From this data set, 9,584 individuals are identified as wage earners, of which 2,872 individuals work in mining, manufacturing and public utilities. Based on the CHIP income data we can construct average compensation by gender, age, (Ximing, no education in CHIP?) occupation and ownership types for three broad sectors, namely, mining, manufacturing and public utilities. Thus, for each sector we now have $\tilde{\mathbf{c}}^{M,00}_{+gaej+}$, where "00" stands for the 2000 benchmark for simplicity.

The 2005 benchmark

Ximing we need to add what we did for this benchmark for both employment and compensation, or give me some information, okay if in Chinese…

…

A summary of all the constructed marginal matrices

For readers to have a quick look of all constructed marginal matrices or "control totals" that will be used in the final construction of full-dimension matrices, we provide in Table 7 a summary of these marginal matrices for each benchmark year. In the last column of the table we also present matching marginal matrices from the annual marginal employment and compensation matrices constructed in Sections 4.1 and 4.2, as well as the average labour compensation matrices derived from them.

TABLE 7
MARGINAL MATRICES AVAILABLE FOR THE BENCHMARK YEARS

Benchmarks	Additional Marginal Matrix		Source of Data	Marginal Matrix used as the "Control Totals"
	Employment	Compensation		
1955	$\tilde{\mathbf{N}}^{M,55}_{sg++j}$, $\tilde{\mathbf{N}}^{M,55}_{++a+j}$, $\tilde{\mathbf{N}}^{M,55}_{s++ej}$	$\tilde{\mathbf{C}}^{M,55}_{s+++j}$, $\tilde{\mathbf{c}}^{M,55}_{s+++j}$	NBS archives: DPES *Bulletin*, 1955, 1959, 1960, 1961 and 1963	$\mathbf{N}^{M,55}_{s+++jo}$, $\mathbf{H}^{M,55}_{s+++jo}$ $\mathbf{C}^{M,55}_{s++++o}$, $\mathbf{c}^{M,55}_{s++++o}$
1963	$\tilde{\mathbf{N}}^{M,63}_{sg++j}$, $\tilde{\mathbf{N}}^{M,63}_{++a+j}$, $\tilde{\mathbf{N}}^{M,63}_{s++ej}$	$\tilde{\mathbf{C}}^{M,63}_{s+++j}$, $\tilde{\mathbf{c}}^{M,63}_{s+++j}$	As above…	$\mathbf{N}^{M,63}_{s+++jo}$, $\mathbf{H}^{M,63}_{s+++jo}$ $\mathbf{C}^{M,63}_{s++++o}$, $\mathbf{c}^{M,63}_{s++++o}$

[37] We exclude the rural household sample though it contains individuals working in the industrial sector. This is because part of rural household income is earned jointly by all family members especially in farming activities and it is impossible to separate such income among members.

1982	$\tilde{\mathbf{N}}^{M,82}_{sga+++}$, $\tilde{\mathbf{N}}^{M,82}_{s++e++}$, $\tilde{\mathbf{N}}^{M,82}_{++aej+}$, $\tilde{\mathbf{N}}^{M,82}_{+gae++}$	--	1982 Population Census	$\mathbf{N}^{M,82}_{s+++jo}$, $\mathbf{H}^{M,82}_{s+++jo}$ $\mathbf{C}^{M,82}_{s++++o}$, $\mathbf{c}^{M,82}_{s++++o}$
1987	--	$\tilde{\mathbf{c}}^{M,87}_{+gaej+}$	1988 CASS Household Survey; 1987 1%-Population Survey	$\mathbf{N}^{M,87}_{s+++jo}$, $\mathbf{H}^{M,87}_{s+++jo}$ $\mathbf{C}^{M,87}_{s++++o}$, $\mathbf{c}^{M,87}_{s++++o}$
1990	--	$\tilde{\mathbf{c}}^{M,90}_{+gaej+}$	Based on assumptions, see text…	$\mathbf{N}^{M,90}_{s+++jo}$, $\mathbf{H}^{M,90}_{s+++jo}$ $\mathbf{C}^{M,90}_{s++++o}$, $\mathbf{c}^{M,90}_{s++++o}$
1995	--	$\tilde{\mathbf{c}}^{M,95}_{+gaej+}$	1995 CASS Household Survey	$\mathbf{N}^{M,95}_{s+++jo}$, $\mathbf{H}^{M,95}_{s+++jo}$ $\mathbf{C}^{M,95}_{s++++o}$, $\mathbf{c}^{M,95}_{s++++o}$
2000	$\tilde{\mathbf{N}}^{M,00}_{sg++++}$, $\tilde{\mathbf{N}}^{M,00}_{+gae++}$	$\tilde{\mathbf{c}}^{M,00}_{+gaej+}$	2000 Population Census; 2002 CHIP Household Survey	$\mathbf{N}^{M,00}_{s+++jo}$, $\mathbf{H}^{M,00}_{s+++jo}$ $\mathbf{C}^{M,00}_{s++++o}$, $\mathbf{c}^{M,00}_{s++++o}$
2005	Ximing???	Ximing???	Ximing???	$\mathbf{N}^{M,05}_{s+++jo}$, $\mathbf{H}^{M,05}_{s+++jo}$ $\mathbf{C}^{M,05}_{s++++o}$, $\mathbf{c}^{M,05}_{s++++o}$

Note: For simplicity or conceptually, $\mathbf{c}^{M}_{s++++o}$ indicates compensation per unit of labour either per person (**C/N**) employed or per hour worked (**C/H**).

5.2 Construction of the Full-dimension Employment and Compensation Matrices

This section explains how the missing cells and dimensions are filled and estimated in order to construct full-dimension benchmark employment and compensation matrices, based on which the time series of the benchmark matrices can be constructed. We will first review the nature of the gaps and then introduce the iterative proportional filling (IPF) approach for these tasks.

The missing cells in the additional marginal matrices

There are two types of missing cells. One is a natural type simply because some classifications in employment do not or seldom exist naturally (e.g. managers or technicians in the youngest age group or young female workers in heavy industries). The other type is caused by some sampling biases, which is more likely when the sample size is small. Missing cells are a typical problem encountered by the additional marginal matrices for labour compensation because surveys on compensation are usually conducted on much smaller samples than those on employment that often take the form of industrial census, population census or one-percent population survey.

A regression approach is used to fill the missing compensation data in the available marginal matrices listed in Table 7. In the regression, the available compensation (often referring to wage or salary[38]) is regressed on a set of dummy variables that distinguish the effects of human capital attributes (Table 1). The results are fairly satisfactory with reasonably high $\overline{R}^2$ for cross-section analysis. The estimated coefficients of the dummy variables are then used to predict the missing values. (Ximing: A footnote to give the regression equation, the actual case, and report the regression results in Appendix?)

However, the likely biases contained in small sample size data are maintained in such a regression exercise, which cannot be easily fixed. Since the compensation surveys are reasonably designed, we argue that despite small samples the biases are moderate and will not cause significant distortion in the final results. (Ximing: for the regression, what I have written is still too general. Could you please based all you have written, list all cases/benchmarks when such regression approach is applied?)

The missing categories or dimensions in the additional marginal matrices

Here a discussion of the nature of missing categories or incomplete dimentions…

…

Estimation of the full-dimension matrices for benchmarks

The estimation of a full-dimension benchmark matrix is the key step for the construction of a complete time series matrix for labor employment and compensation. In our case, we need to estimate eight full-dimension benchmark matrices at this step.

Understanding the nature of the estimation especially the underlying assumptions of the estimation: the results are determined by the information from the "control totals" and additional marginal matrices in a given benchmark, and hence the likely biases…

…

[38] Compensation paid to auxiliary (non-industry) workers in industry should be considered as part of the compensation of industrial workers. – this should be discussed in the construction of the time series marginal matrices in 4.2 [check!!]

It is a scaling process to estimate a full-dimension matrix with the scope or size exactly the same as given by the "control totals". For example, the scaling up of the CASS survey results on compensation to the level of the 1987 "control totals", $\mathbf{C}^{M,87}_{s++++o}$, which is based on China 1987 Input-Output Table and the average wage/salary level by sector and occupation, gives us another marginal compensation matrix, $\mathbf{C}^{M,87}_{+gaej+}$, which is consistent with $\mathbf{C}^{M,87}_{s++++o}$.

…

Since the scaling does not affect the given structure of the marginal matrix involved, it assumes the structure of the "control totals" is held. Therefore, it is does not introduce any new problem.

…

Also, we believe that all the constructed marginal matrices, those used as the "control totals" and those as additional, are the best available.

…

In this study, we use the iterative proportional filling (IPF) approach to perform the task of estimating a full-dimension benchmark matrix from the available marginal matrices. The IPF is designed to link disintegrated tables containing partial data on cross-classification by generating the maximum likelihood estimate of each element of a matrix. It can also be used to fill missing cells (Bishop, Fienberg and Holland, 1975).[39]

This part is to be completed, including…

- The methodology in general
- Rules and principles
- Key elements
    - Initial value for filling blank cells
    - Common dimension of two seemingly disintegrated matrices
    - Control totals

- limitations

See the technical appendix for the application of IPF in estimating benchmark full-dimension compensation matrix.

6. RESULTS AND DISCUSSIONS

To be completed…

Growth of labour input, labour quality and hours worked

- Estimated time series, long-run movement of labour compensation, volume and price (Table 8)
- Estimated time series, long-run and period performance of volume, quality, quantity (Tables 8 and 9) (Figures 1 and 2)

Decomposition of quality changes

- Translog indices of volume and quality (Table A1 and A2)
- First-order quality changes, accounting for contributions (Figures 3 and 4)

Changes in composition of each quality attribute

- Sector and industry (Figure 5)
- Age and gender (Figures 6-7)
- Education (Figure 8)
- Occupation (Figure 9)
- Ownership types (legal forms or employment classes) (Figure 10)
- The key quality elements of the workforce (Figure 11)

[39] Interested readers may refer to for example the discussions of a five-dimension model with missing variables (pp. 45-46), of the rules for detecting existence of direct estimates (pp. 76-77), and of the basic elements of the IPF (p. 83).

7. CONCLUSION

To be completed…

Following the user cost theory on measuring labour input, this study carefully scans through both published and unpublished information and constructs employment and compensation matrices for the Chinese industrial workforce over the period 1949-2005. Our measures capture individual and interactive effects of changes in gender, age, education, occupation, industry and ownership types of the industrial workforce, and decompose the growth of labour input in Chinese industry into quantity and quality changes. We find that the annual growth of the labor input in Chinese industry experienced a substantial decline from 7.9 percent in the pre-reform period to 1.9 percent in the post-reform period. Quality improvement accounted for 15 percent in the pre-reform period, but it made negative contribution during the post-reform period. Our results show that although changes in education and age (capturing seniority and experience effects) of the industrial workforce made a larger impact in the reform period than under central planning, they were more than offset by the negative impact of changes in gender, industrial structure and ownership type along with the market oriented reform. This could be explained by the labor-intensive nature and export-orientation of China's post-reform industrialization, as well as policy correction to various distortions under central planning, including over-manning and over-focusing on heavy industries.

APPENDIX

(To be revised and finalized)

This appendix is devoted to gives a detail description of use of iterative proportional fitting technique proposed Bishop and etc. (1975), IPF technique for short below, by to compile compensation matrix.

Traditional way of using the IPF in compiling labour input is to derive employment matrix under a situation that one is cross-classifying workers by more characteristics of workers than those in data available. For instance, one might want to cross-classify total workers by six characteristics: sector, gender, age, educational

level, status of employment and occupation, while data sources available may only provided data on employment that are cross-classified by characteristics of less six. In order to obtain employment matrix with workers fully cross-classified by the six characteristics, the IPF technique has so far been employed. The application of this technique, however, doesn't confines to generation of employment matrix, and can also be made to estimate compensation matrix in the same setting. That is, if data or each of several data sets available on wage rates of workers that are not to be cross-classified by as many characteristics as we need, then the IPF technique can be employed to estimate compensation matrix for workers cross-classified by full dimensions of workers' characteristics, given availability of the number of corresponding types of workers. In the following we taking 1987 as example, gives a detail of how the iterative proportional fitting technique is applied for estimating compensation matrix.

The ultimate goal of constructing compensation matrix for 1987 is to estimate wage rate of each type of workers cross-classified by five characteristic used in this study. Data sources, however, don't provide employment data on worker at such great detail. There is broad accordance in categories of each of all characteristics except sector between data source of 1987 CASS household survey and that required in the study. Regarding the characteristics of sector, there is no further subdivision of mining and manufacturing in the CASS survey, while mining is further divided into 4 sub-sectors and manufacturing into 19 sub-sectors in this study. Furthermore, the sector of public utilities is included in manufacturing in 1988 CASS survey, and mining, manufacturing and public utilities are lumped together into one sector named industry in 1995 survey. So we need special device to estimate compensation matrix with workers classified by gender, age education and occupation for sub-sectors of each of mining and manufacturing, with the latter including public utilities.

Actually, two types of data on wage of workers are available for constructing compensation matrix in 1987. One, coming from CASS household survey, is wage rates of workers for whole mining, as well as whole manufacturing, with the workers cross-classified by other four characteristics: gender, age, education and occupation. Please note that the public utilities is included in manufacturing. We denote each element of the wage rates by w^{mi}_{gaeo} for mining and by w^{ma}_{gaeo} for manufacturing, inclusive of the public utilities. Other data is average compensation of workers for

each sub-sector of mining and manufacturing, as well as the public utilities, derived from 1987 IO Table as total compensation of each sector divided by the number of workers in the corresponding sub-sector. The number of sub-sectors, clearly, is 24, of which 4 for mining, 19 for manufacturing and 1 for public utilities. We denote a cell in vector of the sectoral average compensation by w_s^{mi} in mining and w_s^{ma} in manufacturing. Again w_s^{ma} includes the public utilities. With the two types of data, the maximum likelihood estimate of each cell in compensation matrix for each of mining and manufacturing can be derived by implementing the IPF technique. Detail of how to implement the technique is as follows.[40] Because it is exactly the same for mining and manufacturing, we only give description to manufacturing and omit it for mining.

If we use $\hat{w}_{sgaeo}^{ma}$ to denotes estimate of element of compensation matrix that we want to obtain, then it must meet two constraints given by the two types of wage data described just above. That is,

(A1) $$\sum_{s=1}^{20} \hat{w}_{sgaeo}^{ma} * e_{sgaeo}^{ma} = w_{gaeo}^{ma} * e_{+gaeo}^{ma}$$

(A2) $$\sum_{g=1}^{2}\sum_{a=1}^{7}\sum_{e=1}^{5}\sum_{o=1}^{4} \hat{w}_{sgaeo}^{ma} * e_{sgaeo}^{ma} = w_{s}^{ma} * e_{s++++}^{ma}$$

where 20 stands for the number of sub-sectors in manufacturing, including the public utilities. The first formula means that the sum of products of estimated wages and the number of workers over sub-sectors must equal total wage given by w_{gae}^{ma} for each type of workers classified by gender, age, education and occupation. And in the same way, the second formula means that the sum of products of estimated wages and the number of workers over gender, age and education must be equals to sectoral total of compensation that is given by w_s^{ma} for each of the 20 sub-sectors. Simple alteration to the two equations can produce other expressions that make the estimate $\hat{w}_{sgaeo}^{ma}$ much easier understand,

[40] See Chapter 3 of Bishop and etc. (1975) for detail of implementing the iterative procedure in a situation that is suitable to generate an employment matrix.

(A1-1) $$\sum_{s=1}^{20} \hat{w}_{sgaeo}^{ma} * \frac{e_{sgaeo}^{ma}}{e_{+gaeo}^{ma}} = w_{gaeo}^{ma}$$

(A2-1) $$\sum_{g=1}^{2}\sum_{a=1}^{7}\sum_{e=1}^{5}\sum_{o=1}^{4} \hat{w}_{sgaeo}^{ma} * \frac{e_{sgaeo}^{ma}}{e_{s++++}^{ma}} = w_{s}^{ma}$$

first of two equations implies that weighted average of estimated wages $\hat{w}_{sgaeo}^{ma}$ cross sectors within each type of workers cross-classified by gender, age and education is equals to wage rate available from CASS survey. Second of the two equations, of cause, can be explained in the same way.

Returning to how $\hat{w}_{sgaeo}^{ma}$ is estimated, the iterative proportional fitting procedure, starting with initial values of $\hat{w}_{sgaeo}^{ma}$, which we denote by $\hat{w}_{sgaeo}^{ma}(0)$ and usually set as $\hat{w}_{sgaeo}^{ma}(0)=1$, first fits to first constraint specified by equation (A1) by calculating $\hat{w}_{sgaeo}^{ma}$ as $\hat{w}_{sgaeo}^{ma}(1,1)$:

(A3) $$\hat{w}_{sgaeo}^{ma}(1,1) = \hat{w}_{sgaeo}^{ma}(0) * \frac{\hat{w}_{gaeo}^{ma} * e_{+gaeo}^{ma}}{\sum_{s=1}^{22} \hat{w}_{sgaeo}^{ma}(0) * e_{sgaeo}^{ma}}$$

where the first of two units in parentheses in left of the equation represent first constraint given by equation (A1), and the second 1 represents the time of iteration. It takes values of 1 because this is first cycle in iterative process. And it is clear from equation (A3) that after fitting to first constraint for the first time, all the $\hat{w}_{sgaeo}^{ma}(1,1)$ are assigned with the same value of average wage within the same type of workers cross-classified by gender, age and education. After the first fitting, $\hat{w}_{sgaeo}^{ma}(1,1)$ became to meet the first constraint specified by equation (A1), but doesn't meet the second constraint specified by equation (A2). So the procedure continues to fit to the second constraint by calculating $\hat{w}_{sgaeo}^{ma}(1,1)$ as $\hat{w}_{sgaeo}^{ma}(2,1)$:

(A4) $$\hat{w}_{sgaeo}^{ma}(2,1) = \hat{w}_{sgaeo}^{ma}(1,1) * \frac{w_{s}^{ma} * e_{s++++}^{ma}}{\sum_{g=1}^{2}\sum_{a=1}^{7}\sum_{e=1}^{5}\sum_{o=1}^{4} \hat{w}_{sgaeo}^{ma}(1,1) * e_{sgaeo}^{ma}}$$

where the first figure of 2 in parentheses in left of equation represents the second constraint given by equation (A2) above. And the second figure in parentheses

represents the time of iteration. It is takes value of 1 because one iteration is considered finished after fitting all the constraints and fitting the second constraint is second step of the first iteration.

After second fitting in the first iteration, $\hat{w}^{ma}_{sgaeo}(2,1)$ comes to meet the second constraint, but not meet the first constraint. The iterative procedure enters second cycle of iteration, fitting to the first constraint by repeating calculation shown in equation (A3) and then fitting to the second constraint by repeating calculation shown in equation (A4). And furthermore, the cycle itself is iterated as many times as desired. The estimate of $\hat{w}^{ma}_{sgaeo}(2,i)$ converge in the sense that for any small figure of ε, we can find an integer of n such that absolute value of difference $\hat{w}^{ma}_{sgaeo}$ between two successive cycles are smaller than ε when the times of iteration exceeds n. That is, $\left|\hat{w}^{ma}_{sgaeo}(2,n)-\hat{w}^{ma}_{sgaeo}(2,n-1)\right|<\varepsilon$. When ε is set as $\varepsilon=1\text{E-}06$, the absolute value of difference $\hat{w}^{ma}_{sgaeo}$ between two successive cycles usually become to be smaller than $1E-06$ after about 30 times of iteration.

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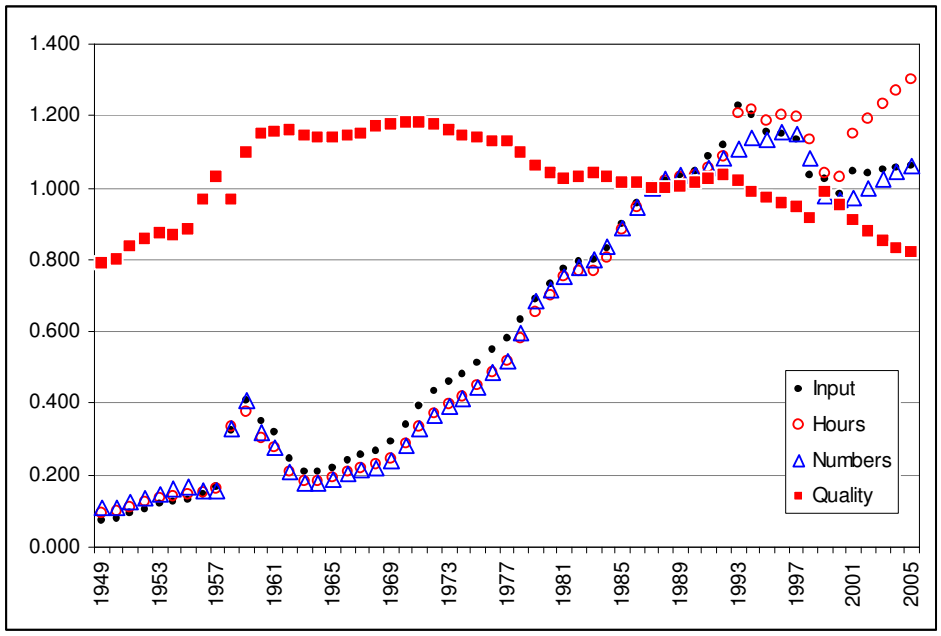
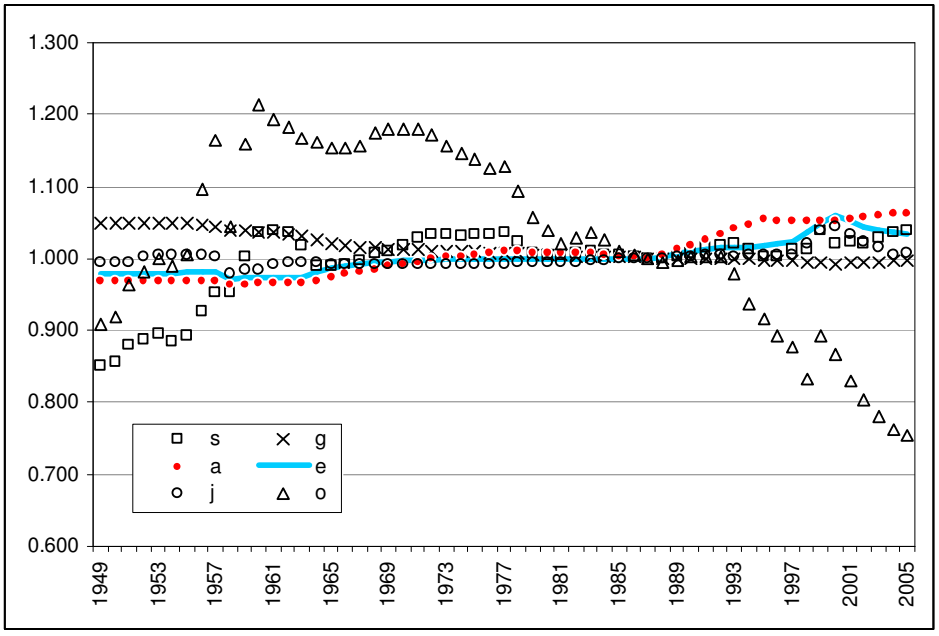
The Tables and Figures below are for the discussion in text; they are to be finalized…

Figure 1
Quantity, Quality and Total Labor Input in Chinese Industry, 1987=100



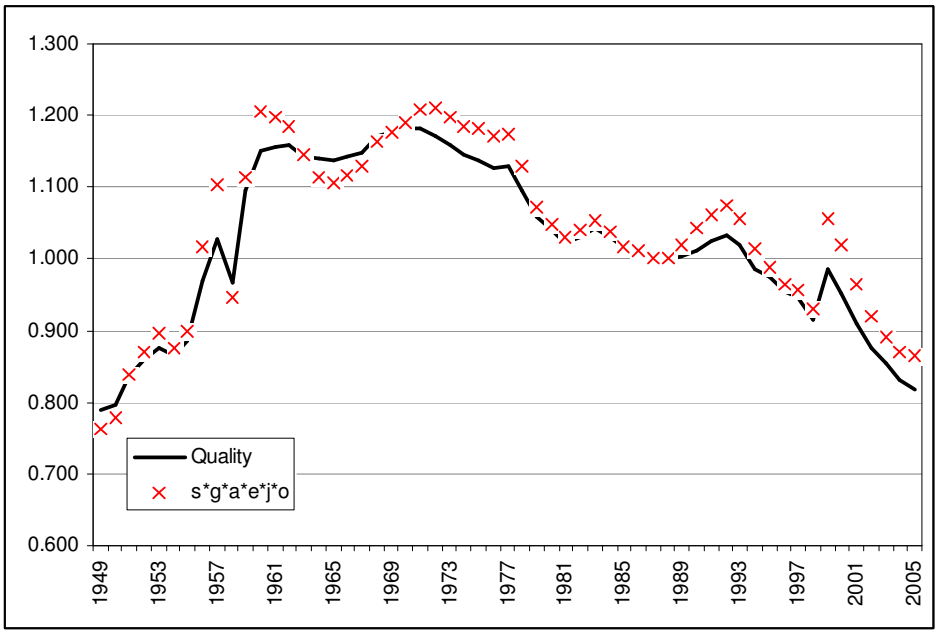
Sources: Authors' estimates.

Figure 2
Estimated Main Effects of Labor Quality Change, 1987=100



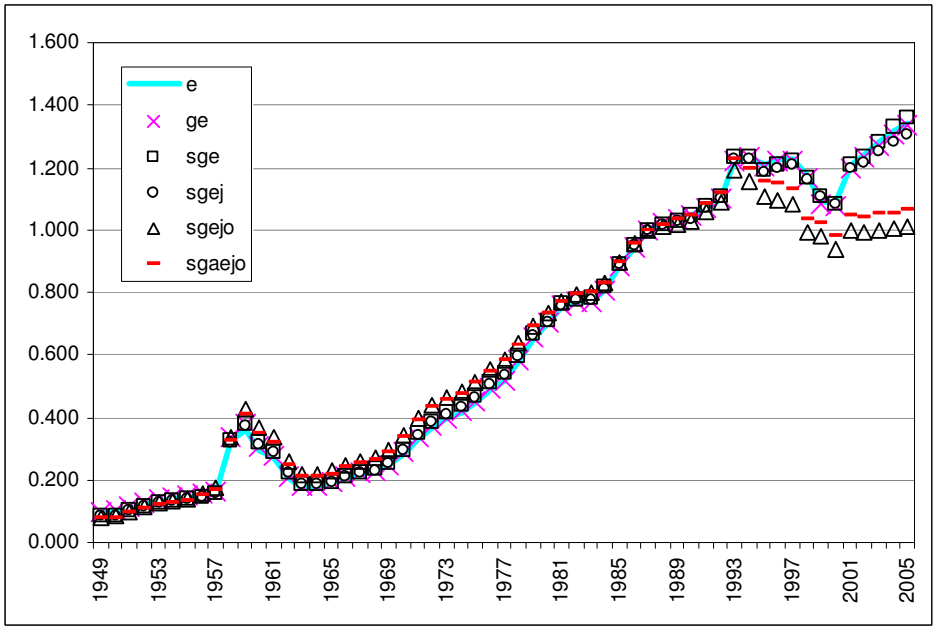
Sources: Authors' estimates.
Notes: s= industry/sector, g= gender; a= age; e= education; j= occupation; o= ownership type (see Table 1).

Figure 3
Quality Change versus the Combined Main Effects, 1987=100



Sources: Authors' estimates.
Notes: s= industry/sector, g= gender; a= age; e= education; j= occupation; o= ownership type (see Table 1).

Figure 4
Dynamics of Marginal Effects of Quality Changes, 1987=100



Sources: Authors' estimates.
Notes: s= industry/sector, g= gender; a= age; e= education; j= occupation; o= ownership type (see Table 1).

Figure 5
Industrial Structural Changes in the Chinese Industrial Workforce, 1949-2005

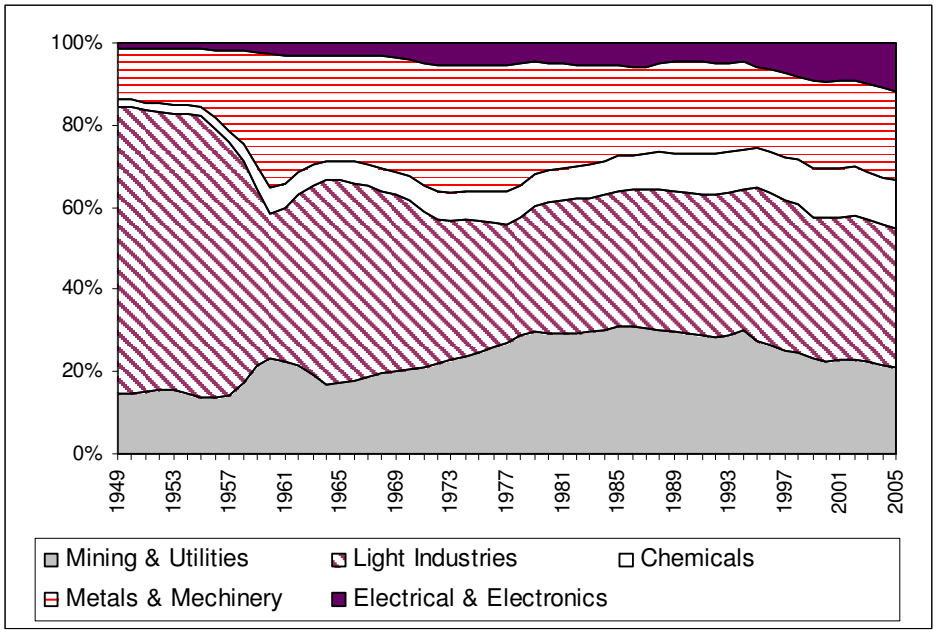
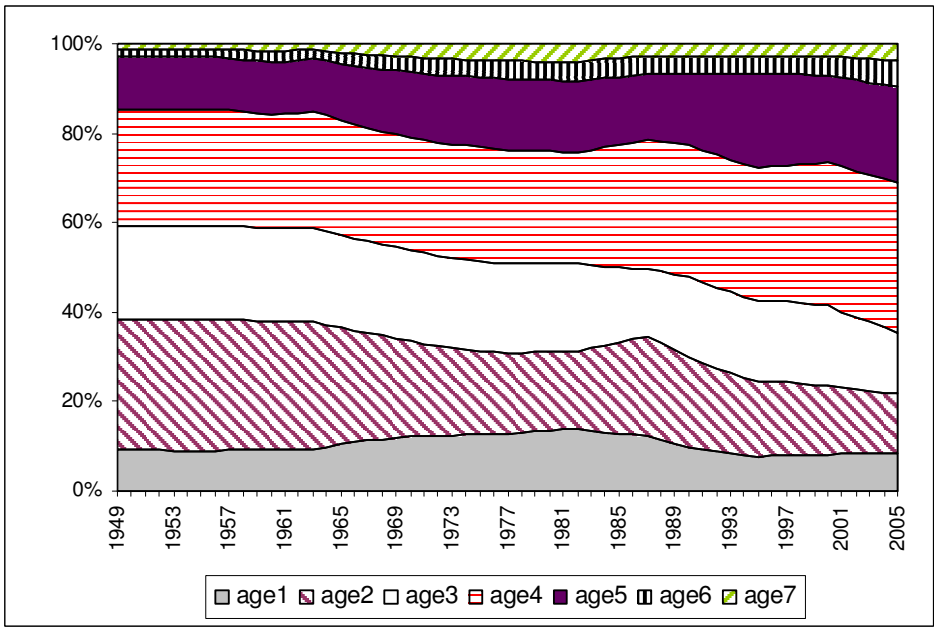
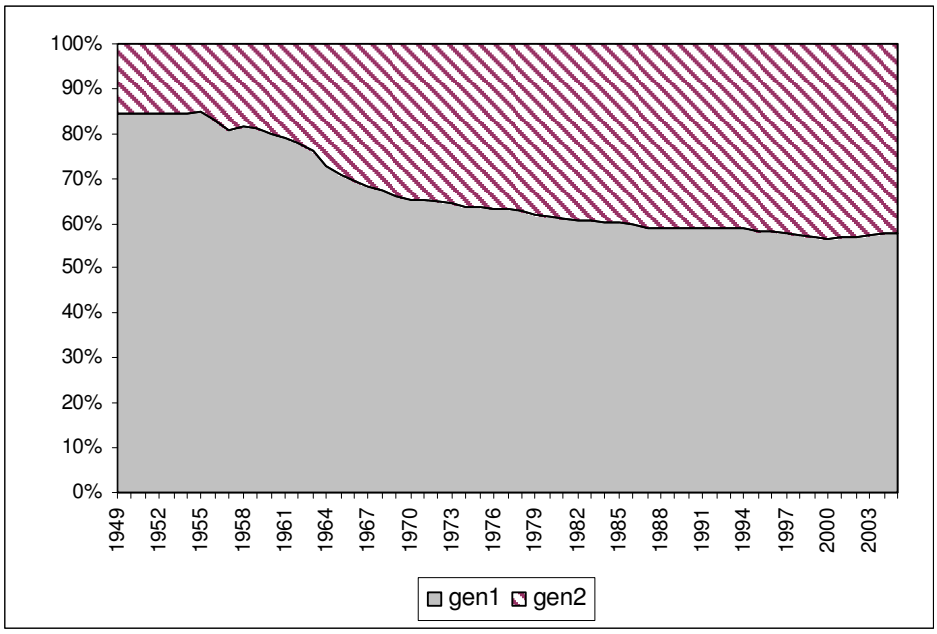


Figure 6
Age Structural Change of the Chinese Industrial Workforce, 1949-2005



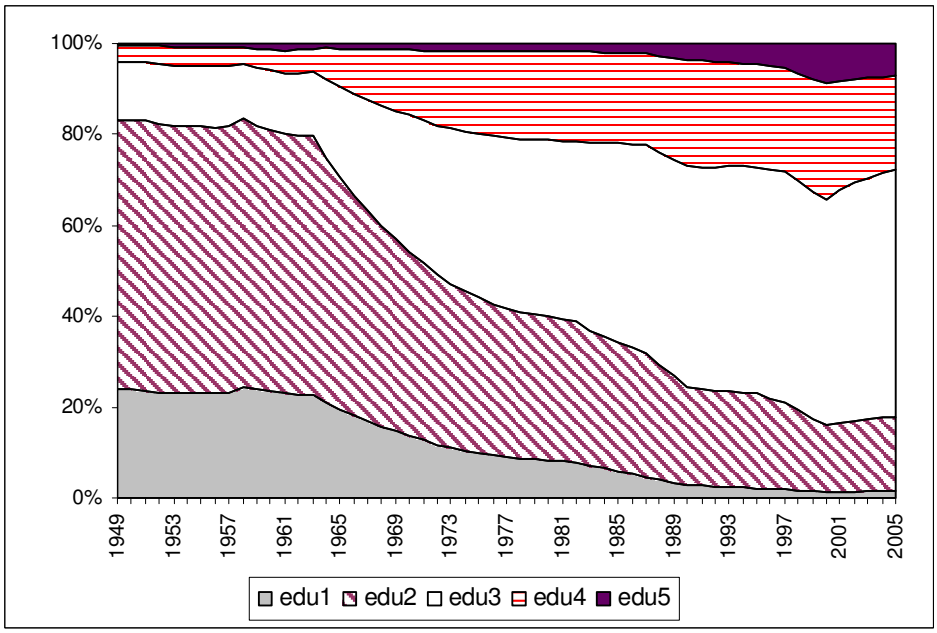
Sources: Authors' estimates.
Notes: Age1= 15-19; Age2= 20-24; Age3= 20-29; Age4= 30-39; Age5= 40-49; Edu6= 50-54; Edu7= >54 (see Table 1).

Figure 7
Gender Structural Change of the Chinese Industrial Workforce, 1949-2005



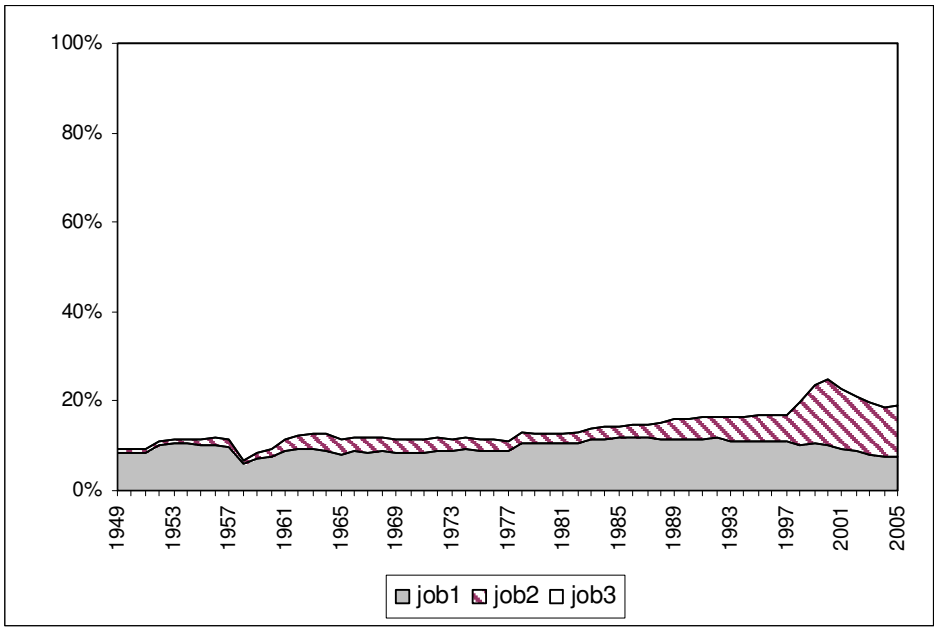
Sources: Authors' estimates.
Notes: Gen1= Male, Gen2= Female (see Table 1).

Figure 8
Structural Change of Education Attainment of the Chinese Industrial Workforce, 1949-2005



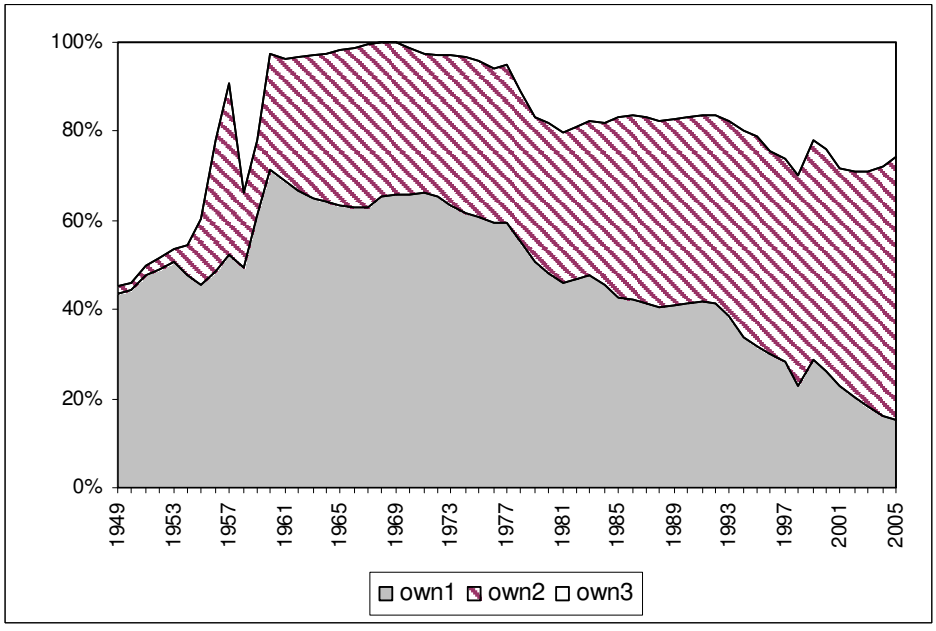
Sources: Authors' estimates.
Notes: Edu1= Illiteracy or semi-illiteracy, Edu2= Primary; Edu3= Junior high; Edu4= Senior high; Edu5= Tertiary (see Table 1).

Figure 9
Occupational Structural Change of the Chinese Industrial Workforce, 1949-2005



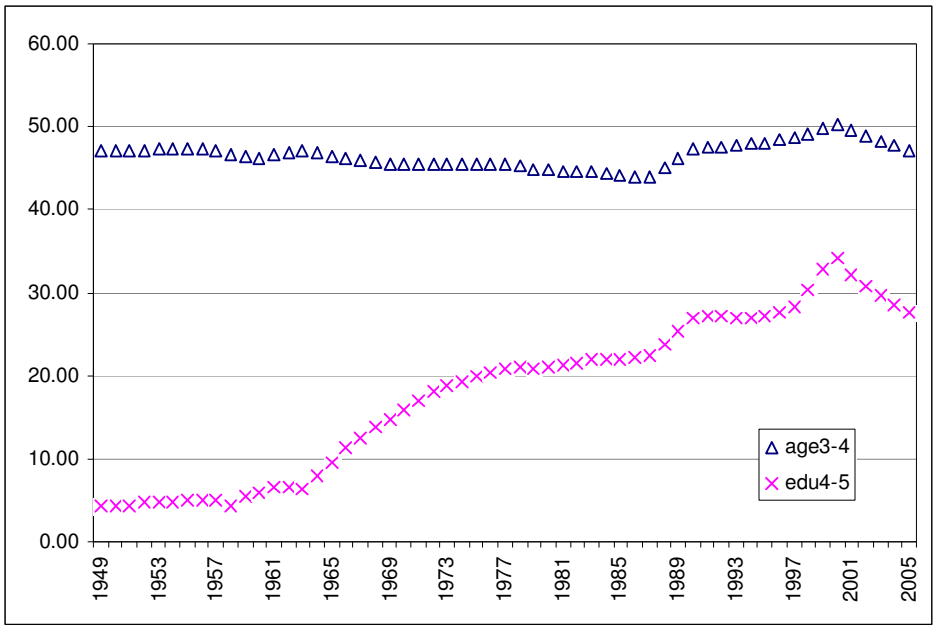
Sources: Authors' estimates.
Notes: Job1= Managerial and administrative; Job2= Technicians and engineers; Job3= workers (see Table 1).

Figure 10
Ownership-type Structural Change of Chinese Industrial Workforce, 1949-2005



Sources: Authors' estimates.
Notes: Own1= Ownership type 1, i.e. SOEs, Own2= Ownership type 2, i.e. non-SOEs at township level; Own3= Employed below township level (see Table 1).

Figure 11
The Share of Aged 25-39 and the Share of Education Attainment at the Level of Senior-High and Above in Chinese Industrial Workforce, 1949-2005



Sources: Authors' estimates.
Notes: Age3= 20-29, Age4= 30-39; Edu4= Senior high, Edu5= Tertiary (see Table 1).

Table 8: Labour Input of Chinese Industry

Year	Price index	Volume (mil. 87 yuan)	Outlay (mil. yuan)	Quality index	Number (1000s)	Hours (mils.)	Hours /week	Hourly wage (yuan)
1949	0.221	9,420	2,083	0.788	8,922	17,654	38.1	0.118
1950	0.237	9,935	2,359	0.797	9,255	18,397	38.2	0.128
1951	0.250	11,706	2,922	0.836	10,205	20,674	39.0	0.141
1952	0.284	13,271	3,763	0.858	11,153	22,824	39.4	0.165
1953	0.330	14,975	4,947	0.874	12,229	25,289	39.8	0.196
1954	0.361	15,536	5,615	0.866	13,479	26,490	37.8	0.212
1955	0.364	16,424	5,975	0.885	13,584	27,390	38.8	0.218
1956	0.412	18,460	7,606	0.969	12,844	28,134	42.1	0.270
1957	0.419	20,794	8,704	1.028	12,819	29,872	44.8	0.291
1958	0.305	40,388	12,323	0.968	27,343	61,576	43.3	0.200
1959	0.302	51,190	15,445	1.096	33,744	68,927	39.3	0.224
1960	0.363	43,441	15,771	1.151	26,152	55,725	41.0	0.283
1961	0.353	39,898	14,099	1.155	22,743	50,999	43.1	0.276
1962	0.385	30,596	11,777	1.158	17,257	38,988	43.4	0.302
1963	0.422	26,008	10,976	1.142	14,810	33,619	43.7	0.326
1964	0.425	26,076	11,086	1.141	14,807	33,740	43.8	0.329
1965	0.425	27,364	11,642	1.136	15,512	35,547	44.1	0.328
1966	0.418	29,788	12,455	1.142	16,746	38,517	44.2	0.323
1967	0.421	31,723	13,340	1.148	17,694	40,784	44.3	0.327
1968	0.408	33,285	13,585	1.170	18,229	41,979	44.3	0.324
1969	0.403	36,290	14,622	1.178	19,765	45,492	44.3	0.321
1970	0.384	42,242	16,204	1.182	23,072	52,773	44.0	0.307
1971	0.374	49,153	18,395	1.183	27,010	61,344	43.7	0.300
1972	0.389	54,074	21,017	1.173	30,013	68,058	43.6	0.309
1973	0.393	57,313	22,528	1.158	32,227	73,074	43.6	0.308
1974	0.390	59,774	23,299	1.146	34,008	76,981	43.5	0.303
1975	0.385	63,687	24,536	1.138	36,672	82,603	43.3	0.297
1976	0.382	68,644	26,242	1.127	40,274	89,938	42.9	0.292
1977	0.388	72,716	28,229	1.129	42,549	95,078	43.0	0.297
1978	0.423	79,274	33,569	1.097	48,962	106,715	41.9	0.315
1979	0.468	86,431	40,454	1.058	56,282	120,541	41.2	0.336
1980	0.536	91,363	48,990	1.041	59,223	129,502	42.1	0.378
1981	0.548	96,475	52,860	1.023	62,228	139,177	43.0	0.380
1982	0.570	98,983	56,424	1.031	64,265	141,747	42.4	0.398
1983	0.599	100,100	59,962	1.042	65,916	141,798	41.4	0.423
1984	0.722	103,838	74,998	1.030	69,149	148,791	41.4	0.504
1985	0.867	112,365	97,385	1.016	73,268	163,266	42.9	0.596
1986	0.996	119,468	118,932	1.011	77,955	174,452	43.0	0.682
1987	1.000	125,011	125,011	1.000	82,537	184,531	43.0	0.677
1988	1.273	127,350	162,172	1.000	84,359	188,047	42.9	0.862
1989	1.453	129,132	187,655	1.003	85,217	190,124	42.9	0.987
1990	1.832	130,866	239,784	1.012	85,339	190,799	43.0	1.257
1991	1.829	135,553	247,903	1.025	87,024	195,166	43.1	1.270
1992	1.942	140,062	272,059	1.033	89,349	200,235	43.1	1.359
1993	2.825	153,772	434,436	1.020	91,521	222,577	46.8	1.952
1994	4.012	149,910	601,411	0.986	94,075	224,376	45.9	2.680
1995	5.424	144,510	783,885	0.974	93,765	219,050	44.9	3.579
1996	7.655	143,415	1,097,834	0.955	95,350	221,647	44.7	4.953
1997	9.843	141,494	1,392,747	0.946	94,884	220,781	44.7	6.308
1998	11.043	129,511	1,430,246	0.914	89,386	209,070	45.0	6.841
1999	11.657	127,918	1,491,187	0.986	80,735	191,585	45.6	7.783
2000	13.828	122,488	1,693,807	0.952	79,836	190,020	45.8	8.914
2001	13.586	130,918	1,778,606	0.909	80,229	212,547	50.9	8.368
2002	14.317	130,057	1,862,020	0.875	82,147	219,317	51.3	8.490
2003	14.791	131,420	1,943,876	0.853	84,536	227,403	51.7	8.548
2004	16.136	131,933	2,128,845	0.831	86,264	234,236	52.2	9.088
2005	17.466	132,846	2,320,348	0.818	87,387	239,710	52.8	9.680
				Growth (% per annum)				
1949-78	*2.35*	*7.90*	*10.44*	*1.19*	*6.27*	*6.64*	*0.35*	*3.56*
1978-05	*14.77*	*1.93*	*16.99*	*-1.08*	*2.17*	*3.04*	*0.86*	*13.53*
1949-05	*8.11*	*4.84*	*13.35*	*0.07*	*4.16*	*4.77*	*0.58*	*8.19*

Table 9: Annual Growth Rate of Labour Input, Hours and Quality of Chinese Industry

(% per annum)

	Input	Hours	Quality	Sector (*s*)	Gender (*g*)	Age (*a*)	Education (*e*)	Occupation (*j*)	Ownership (*o*)
1949-1952	12.10	8.94	2.91	1.45	0.00	0.01	0.06	0.25	2.66
1953-1957	9.40	5.53	3.67	1.39	-0.10	0.01	0.02	0.02	3.45
1957-1959	56.90	51.90	3.29	2.60	-0.29	-0.25	-0.35	-0.99	-0.19
1959-1965	-9.91	-10.45	0.60	-0.22	-0.29	0.16	0.20	0.13	-0.08
1965-1971	10.25	9.52	0.67	0.67	-0.15	0.38	0.21	0.00	0.37
1971-1978	7.07	8.23	-1.08	-0.07	-0.06	0.19	0.02	0.05	-1.09
1949-1978	***7.90***	***6.64***	***1.19***	***0.66***	***-0.15***	***0.15***	***0.08***	***0.00***	***0.67***
1978-1984	4.60	5.70	-1.04	-0.29	-0.08	-0.06	0.02	0.06	-1.06
1984-1993	4.46	4.58	-0.11	0.15	-0.04	0.39	0.16	0.06	-0.53
1993-2000	-3.20	-2.23	-0.99	0.01	-0.11	0.14	0.61	0.57	-1.70
2000-2005	1.64	4.76	-2.98	0.39	0.10	0.22	-0.49	-0.73	-2.75
1978-2005	***1.93***	***3.04***	***-1.08***	***0.06***	***-0.04***	***0.19***	***0.13***	***0.05***	***-1.37***
1949-2005	***4.84***	***4.77***	***0.07***	***0.36***	***-0.09***	***0.17***	***0.10***	***0.02***	***-0.33***

Appendix Tables

Table A1: Indices of Labour Input in Chinese Industry

Year	Hours	*s*	*g*	*a*	*e*	*j*	*o*	*sg*
1949	0.096	0.081	0.100	0.093	0.094	0.095	0.087	0.084
1950	0.100	0.085	0.105	0.097	0.097	0.099	0.092	0.088
1951	0.112	0.099	0.118	0.108	0.110	0.111	0.108	0.101
1952	0.124	0.110	0.130	0.120	0.121	0.124	0.122	0.113
1953	0.137	0.123	0.144	0.133	0.134	0.138	0.137	0.126
1954	0.144	0.127	0.151	0.139	0.141	0.144	0.142	0.131
1955	0.148	0.132	0.156	0.144	0.146	0.149	0.149	0.136
1956	0.152	0.141	0.160	0.148	0.150	0.153	0.167	0.145
1957	0.162	0.154	0.169	0.157	0.159	0.162	0.188	0.158
1958	0.334	0.318	0.347	0.321	0.324	0.327	0.348	0.325
1959	0.374	0.374	0.388	0.360	0.364	0.367	0.433	0.383
1960	0.302	0.313	0.313	0.291	0.294	0.297	0.366	0.320
1961	0.276	0.287	0.286	0.267	0.269	0.274	0.330	0.293
1962	0.211	0.219	0.219	0.204	0.206	0.210	0.250	0.224
1963	0.182	0.185	0.188	0.176	0.177	0.181	0.212	0.189
1964	0.183	0.181	0.187	0.177	0.179	0.182	0.212	0.185
1965	0.193	0.190	0.197	0.187	0.190	0.191	0.222	0.194
1966	0.209	0.207	0.213	0.204	0.206	0.207	0.241	0.211
1967	0.221	0.220	0.225	0.217	0.219	0.219	0.255	0.224
1968	0.227	0.229	0.231	0.224	0.226	0.226	0.267	0.232
1969	0.247	0.249	0.250	0.244	0.245	0.244	0.291	0.252
1970	0.286	0.291	0.289	0.284	0.285	0.283	0.337	0.295
1971	0.332	0.342	0.336	0.331	0.332	0.329	0.392	0.345
1972	0.369	0.381	0.373	0.369	0.368	0.366	0.432	0.384
1973	0.396	0.409	0.400	0.397	0.395	0.393	0.458	0.412
1974	0.417	0.430	0.421	0.419	0.417	0.414	0.478	0.433
1975	0.448	0.463	0.452	0.450	0.447	0.444	0.509	0.465
1976	0.487	0.504	0.492	0.491	0.487	0.483	0.549	0.506
1977	0.515	0.534	0.519	0.520	0.515	0.510	0.581	0.536
1978	0.578	0.592	0.583	0.583	0.578	0.575	0.632	0.594
1979	0.653	0.659	0.657	0.658	0.652	0.649	0.691	0.661
1980	0.702	0.705	0.705	0.707	0.701	0.697	0.729	0.707
1981	0.754	0.757	0.757	0.759	0.753	0.750	0.770	0.758
1982	0.768	0.773	0.771	0.774	0.768	0.764	0.790	0.774
1983	0.768	0.775	0.771	0.774	0.768	0.766	0.797	0.776
1984	0.806	0.811	0.808	0.810	0.806	0.804	0.827	0.812
1985	0.885	0.888	0.887	0.888	0.885	0.883	0.893	0.889
1986	0.945	0.948	0.947	0.947	0.945	0.945	0.951	0.949
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.019	1.019	1.019	1.025	1.022	1.020	1.012	1.019
1989	1.030	1.031	1.030	1.043	1.037	1.033	1.028	1.032
1990	1.034	1.043	1.034	1.053	1.045	1.037	1.035	1.044
1991	1.058	1.073	1.058	1.086	1.071	1.062	1.060	1.075
1992	1.085	1.104	1.085	1.122	1.101	1.090	1.086	1.107
1993	1.206	1.230	1.205	1.255	1.224	1.210	1.179	1.232
1994	1.216	1.233	1.215	1.274	1.235	1.221	1.140	1.234
1995	1.187	1.189	1.185	1.251	1.208	1.194	1.088	1.188
1996	1.201	1.203	1.198	1.264	1.225	1.208	1.074	1.204
1997	1.196	1.210	1.193	1.258	1.225	1.203	1.048	1.211
1998	1.133	1.149	1.127	1.191	1.173	1.156	0.942	1.148
1999	1.038	1.078	1.032	1.093	1.090	1.077	0.927	1.077
2000	1.030	1.050	1.022	1.082	1.091	1.075	0.893	1.049
2001	1.152	1.177	1.145	1.214	1.210	1.189	0.955	1.176
2002	1.189	1.212	1.182	1.256	1.242	1.216	0.954	1.209
2003	1.232	1.266	1.227	1.306	1.281	1.250	0.961	1.262
2004	1.269	1.317	1.265	1.347	1.315	1.276	0.968	1.311
2005	1.299	1.351	1.295	1.380	1.343	1.308	0.980	1.344
				Growth (% per annum)				
1949-78	*6.637*	*7.345*	*6.480*	*6.794*	*6.718*	*6.634*	*7.346*	*7.247*
1978-05	*3.043*	*3.103*	*3.002*	*3.241*	*3.173*	*3.091*	*1.636*	*3.072*
1949-05	*4.768*	*5.145*	*4.671*	*4.943*	*4.872*	*4.790*	*4.422*	*5.082*

Table A1: Indices of Labour Input in Chinese Industry (cont'd)

Year	*sa*	*se*	*sj*	*so*	*ga*	*ge*	*gj*	*go*
1949	0.078	0.081	0.081	0.079	0.095	0.097	0.099	0.089
1950	0.082	0.085	0.084	0.083	0.099	0.101	0.103	0.094
1951	0.095	0.098	0.098	0.098	0.111	0.114	0.116	0.111
1952	0.105	0.109	0.109	0.110	0.123	0.126	0.129	0.125
1953	0.118	0.122	0.122	0.124	0.136	0.140	0.143	0.141
1954	0.122	0.127	0.127	0.129	0.143	0.146	0.150	0.146
1955	0.127	0.132	0.132	0.136	0.147	0.151	0.155	0.154
1956	0.136	0.141	0.141	0.152	0.151	0.155	0.159	0.172
1957	0.148	0.154	0.153	0.172	0.160	0.164	0.168	0.193
1958	0.305	0.316	0.311	0.342	0.328	0.336	0.338	0.356
1959	0.359	0.372	0.368	0.431	0.367	0.376	0.380	0.442
1960	0.300	0.311	0.308	0.366	0.297	0.304	0.307	0.374
1961	0.276	0.286	0.284	0.335	0.272	0.278	0.283	0.337
1962	0.211	0.218	0.217	0.256	0.207	0.212	0.216	0.254
1963	0.178	0.185	0.184	0.218	0.178	0.183	0.186	0.216
1964	0.175	0.182	0.180	0.216	0.179	0.183	0.186	0.216
1965	0.186	0.191	0.189	0.226	0.189	0.193	0.194	0.225
1966	0.203	0.209	0.206	0.244	0.205	0.210	0.210	0.244
1967	0.217	0.222	0.219	0.260	0.218	0.222	0.222	0.258
1968	0.226	0.231	0.227	0.272	0.225	0.229	0.228	0.270
1969	0.246	0.251	0.247	0.296	0.245	0.248	0.247	0.293
1970	0.289	0.294	0.289	0.343	0.285	0.288	0.286	0.340
1971	0.340	0.345	0.339	0.399	0.332	0.335	0.332	0.395
1972	0.379	0.384	0.378	0.438	0.370	0.372	0.368	0.436
1973	0.408	0.412	0.406	0.463	0.398	0.399	0.395	0.462
1974	0.430	0.434	0.427	0.482	0.420	0.420	0.416	0.481
1975	0.463	0.466	0.459	0.513	0.451	0.451	0.446	0.513
1976	0.505	0.507	0.500	0.553	0.492	0.491	0.485	0.552
1977	0.535	0.537	0.529	0.585	0.521	0.519	0.513	0.584
1978	0.595	0.596	0.589	0.635	0.585	0.582	0.577	0.636
1979	0.662	0.663	0.655	0.692	0.659	0.657	0.651	0.694
1980	0.710	0.710	0.701	0.731	0.707	0.705	0.698	0.733
1981	0.762	0.761	0.753	0.771	0.760	0.757	0.750	0.773
1982	0.779	0.777	0.769	0.790	0.774	0.770	0.764	0.793
1983	0.780	0.779	0.773	0.797	0.774	0.771	0.766	0.799
1984	0.815	0.815	0.810	0.826	0.811	0.809	0.805	0.828
1985	0.891	0.891	0.887	0.894	0.888	0.887	0.884	0.895
1986	0.950	0.950	0.948	0.952	0.948	0.947	0.945	0.952
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.024	1.018	1.019	1.013	1.025	1.021	1.020	1.012
1989	1.042	1.031	1.033	1.024	1.043	1.036	1.033	1.028
1990	1.059	1.044	1.045	1.036	1.053	1.045	1.038	1.036
1991	1.098	1.075	1.075	1.065	1.085	1.070	1.062	1.060
1992	1.138	1.107	1.107	1.092	1.120	1.099	1.091	1.086
1993	1.275	1.233	1.231	1.194	1.252	1.222	1.211	1.179
1994	1.286	1.236	1.235	1.157	1.270	1.232	1.221	1.139
1995	1.247	1.192	1.192	1.108	1.245	1.203	1.193	1.087
1996	1.262	1.210	1.206	1.097	1.258	1.220	1.206	1.072
1997	1.268	1.220	1.212	1.080	1.252	1.219	1.202	1.047
1998	1.204	1.170	1.162	0.978	1.183	1.164	1.154	0.940
1999	1.130	1.110	1.102	0.960	1.085	1.080	1.075	0.924
2000	1.101	1.090	1.078	0.914	1.073	1.079	1.072	0.890
2001	1.237	1.213	1.197	0.981	1.204	1.200	1.188	0.954
2002	1.275	1.240	1.222	0.983	1.245	1.231	1.214	0.953
2003	1.335	1.290	1.268	1.003	1.294	1.272	1.248	0.962
2004	1.390	1.336	1.309	1.019	1.335	1.307	1.274	0.970
2005	1.427	1.367	1.344	1.035	1.368	1.335	1.305	0.983
				Growth (% per annum)				
1949-78	*7.522*	*7.389*	*7.364*	*7.741*	*6.709*	*6.598*	*6.508*	*7.262*
1978-05	*3.297*	*3.123*	*3.105*	*1.824*	*3.197*	*3.121*	*3.069*	*1.624*
1949-05	*5.327*	*5.177*	*5.155*	*4.707*	*4.880*	*4.788*	*4.718*	*4.375*

Table A1: Indices of Labour Input in Chinese Industry (cont'd)

Year	*ae*	*aj*	*ao*	*ej*	*eo*	*jo*	*sga*	*sge*
1949	0.090	0.091	0.083	0.094	0.087	0.086	0.079	0.083
1950	0.094	0.095	0.087	0.098	0.091	0.090	0.083	0.087
1951	0.106	0.107	0.103	0.110	0.108	0.107	0.096	0.101
1952	0.117	0.119	0.116	0.123	0.121	0.121	0.107	0.112
1953	0.130	0.132	0.130	0.136	0.137	0.137	0.120	0.125
1954	0.136	0.138	0.135	0.142	0.142	0.142	0.124	0.130
1955	0.141	0.143	0.142	0.147	0.149	0.149	0.129	0.136
1956	0.145	0.147	0.159	0.151	0.167	0.167	0.138	0.144
1957	0.153	0.156	0.179	0.161	0.188	0.188	0.150	0.157
1958	0.314	0.314	0.331	0.323	0.347	0.341	0.308	0.322
1959	0.352	0.353	0.413	0.363	0.433	0.426	0.363	0.380
1960	0.285	0.286	0.349	0.294	0.366	0.361	0.303	0.317
1961	0.261	0.264	0.315	0.271	0.330	0.327	0.278	0.291
1962	0.199	0.202	0.238	0.208	0.250	0.248	0.213	0.223
1963	0.172	0.174	0.203	0.180	0.213	0.211	0.180	0.189
1964	0.174	0.176	0.204	0.180	0.213	0.211	0.177	0.185
1965	0.185	0.185	0.215	0.190	0.224	0.220	0.187	0.194
1966	0.202	0.202	0.233	0.206	0.242	0.239	0.204	0.212
1967	0.215	0.214	0.249	0.219	0.257	0.253	0.218	0.225
1968	0.222	0.221	0.261	0.225	0.269	0.265	0.227	0.233
1969	0.242	0.241	0.285	0.244	0.293	0.288	0.248	0.254
1970	0.282	0.280	0.332	0.284	0.340	0.334	0.290	0.297
1971	0.329	0.327	0.388	0.330	0.395	0.389	0.341	0.348
1972	0.367	0.364	0.429	0.366	0.436	0.429	0.381	0.387
1973	0.394	0.392	0.456	0.393	0.462	0.455	0.409	0.415
1974	0.416	0.413	0.476	0.414	0.481	0.474	0.431	0.436
1975	0.448	0.444	0.509	0.444	0.513	0.506	0.464	0.469
1976	0.488	0.485	0.550	0.484	0.552	0.545	0.506	0.510
1977	0.517	0.513	0.583	0.511	0.584	0.576	0.536	0.540
1978	0.580	0.578	0.635	0.576	0.636	0.629	0.595	0.598
1979	0.654	0.651	0.694	0.650	0.695	0.688	0.663	0.665
1980	0.703	0.699	0.733	0.699	0.733	0.726	0.710	0.712
1981	0.755	0.752	0.775	0.751	0.774	0.767	0.762	0.763
1982	0.770	0.767	0.795	0.766	0.794	0.787	0.778	0.779
1983	0.771	0.769	0.801	0.769	0.800	0.795	0.780	0.780
1984	0.808	0.806	0.830	0.807	0.830	0.825	0.815	0.816
1985	0.886	0.885	0.896	0.885	0.896	0.893	0.891	0.891
1986	0.947	0.946	0.952	0.946	0.952	0.950	0.950	0.950
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.031	1.025	1.018	1.019	1.013	1.012	1.024	1.017
1989	1.055	1.044	1.039	1.033	1.029	1.028	1.043	1.031
1990	1.069	1.054	1.052	1.040	1.039	1.037	1.061	1.044
1991	1.102	1.087	1.085	1.065	1.066	1.062	1.100	1.076
1992	1.139	1.123	1.119	1.094	1.093	1.089	1.140	1.108
1993	1.274	1.254	1.223	1.215	1.187	1.181	1.277	1.233
1994	1.294	1.272	1.190	1.226	1.148	1.143	1.286	1.235
1995	1.272	1.250	1.144	1.199	1.098	1.093	1.246	1.190
1996	1.290	1.263	1.128	1.215	1.086	1.079	1.261	1.208
1997	1.289	1.257	1.101	1.213	1.065	1.055	1.268	1.218
1998	1.234	1.205	0.990	1.168	0.967	0.958	1.202	1.167
1999	1.147	1.122	0.974	1.093	0.960	0.949	1.128	1.105
2000	1.146	1.117	0.938	1.094	0.934	0.919	1.098	1.085
2001	1.277	1.238	1.007	1.207	0.995	0.978	1.233	1.207
2002	1.313	1.268	1.009	1.229	0.989	0.971	1.270	1.234
2003	1.357	1.304	1.019	1.257	0.993	0.974	1.327	1.282
2004	1.395	1.332	1.029	1.276	0.998	0.976	1.380	1.327
2005	1.425	1.364	1.042	1.299	1.007	0.989	1.415	1.358
				Growth (% per annum)				
1949-78	*6.866*	*6.811*	*7.560*	*6.686*	*7.385*	*7.379*	*7.462*	*7.303*
1978-05	*3.383*	*3.234*	*1.851*	*3.058*	*1.718*	*1.687*	*3.262*	*3.083*
1949-05	*5.048*	*4.948*	*4.632*	*4.800*	*4.481*	*4.463*	*5.281*	*5.115*

Table A1: Indices of Labour Input in Chinese Industry (cont'd)

Year	*sgj*	*sgo*	*sae*	*saj*	*sao*	*sej*	*seo*	*sjo*
1949	0.083	0.081	0.078	0.077	0.075	0.081	0.078	0.078
1950	0.087	0.085	0.081	0.081	0.080	0.085	0.082	0.082
1951	0.100	0.100	0.094	0.093	0.094	0.098	0.097	0.097
1952	0.112	0.113	0.105	0.105	0.106	0.110	0.110	0.110
1953	0.125	0.127	0.117	0.117	0.119	0.123	0.123	0.124
1954	0.130	0.132	0.122	0.122	0.123	0.128	0.128	0.129
1955	0.136	0.139	0.127	0.127	0.130	0.133	0.135	0.136
1956	0.144	0.156	0.135	0.135	0.146	0.142	0.152	0.153
1957	0.157	0.176	0.147	0.147	0.165	0.154	0.172	0.172
1958	0.317	0.349	0.303	0.298	0.328	0.312	0.339	0.335
1959	0.375	0.440	0.358	0.353	0.414	0.370	0.429	0.425
1960	0.314	0.373	0.299	0.295	0.351	0.309	0.364	0.361
1961	0.289	0.341	0.275	0.272	0.321	0.286	0.333	0.331
1962	0.221	0.261	0.210	0.208	0.246	0.219	0.255	0.254
1963	0.188	0.222	0.178	0.177	0.209	0.186	0.217	0.216
1964	0.183	0.219	0.176	0.174	0.209	0.182	0.216	0.214
1965	0.192	0.229	0.186	0.183	0.220	0.191	0.226	0.224
1966	0.209	0.248	0.203	0.201	0.239	0.208	0.245	0.243
1967	0.221	0.263	0.217	0.214	0.255	0.221	0.261	0.258
1968	0.229	0.275	0.226	0.223	0.268	0.230	0.273	0.270
1969	0.249	0.299	0.247	0.244	0.292	0.250	0.297	0.293
1970	0.291	0.346	0.289	0.286	0.340	0.292	0.346	0.341
1971	0.341	0.402	0.340	0.336	0.396	0.343	0.401	0.396
1972	0.380	0.441	0.380	0.375	0.435	0.382	0.441	0.434
1973	0.407	0.466	0.408	0.403	0.461	0.409	0.466	0.460
1974	0.428	0.485	0.430	0.425	0.481	0.431	0.486	0.479
1975	0.460	0.516	0.463	0.458	0.513	0.463	0.517	0.510
1976	0.500	0.555	0.505	0.499	0.553	0.504	0.556	0.549
1977	0.529	0.587	0.535	0.529	0.586	0.533	0.589	0.580
1978	0.588	0.637	0.594	0.589	0.637	0.593	0.639	0.632
1979	0.654	0.694	0.662	0.657	0.695	0.660	0.696	0.689
1980	0.700	0.732	0.709	0.703	0.734	0.707	0.735	0.728
1981	0.751	0.772	0.762	0.755	0.775	0.758	0.776	0.768
1982	0.767	0.791	0.778	0.773	0.795	0.775	0.795	0.787
1983	0.772	0.797	0.780	0.776	0.800	0.779	0.801	0.795
1984	0.808	0.827	0.815	0.811	0.829	0.814	0.830	0.825
1985	0.886	0.895	0.891	0.888	0.897	0.891	0.897	0.894
1986	0.948	0.952	0.950	0.949	0.953	0.950	0.953	0.952
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.019	1.014	1.026	1.024	1.019	1.015	1.012	1.014
1989	1.034	1.024	1.047	1.042	1.035	1.027	1.023	1.025
1990	1.046	1.036	1.064	1.059	1.052	1.038	1.036	1.037
1991	1.077	1.067	1.102	1.098	1.089	1.069	1.066	1.066
1992	1.110	1.095	1.142	1.138	1.126	1.101	1.095	1.095
1993	1.234	1.196	1.279	1.272	1.237	1.224	1.196	1.195
1994	1.236	1.158	1.289	1.283	1.206	1.227	1.160	1.159
1995	1.193	1.109	1.250	1.244	1.163	1.183	1.111	1.111
1996	1.207	1.098	1.269	1.258	1.150	1.199	1.103	1.100
1997	1.213	1.081	1.279	1.263	1.132	1.207	1.088	1.083
1998	1.164	0.978	1.227	1.210	1.026	1.161	0.996	0.989
1999	1.104	0.960	1.163	1.146	1.007	1.104	0.986	0.974
2000	1.080	0.914	1.142	1.119	0.959	1.084	0.947	0.930
2001	1.199	0.981	1.274	1.245	1.031	1.199	1.010	0.993
2002	1.223	0.982	1.306	1.272	1.035	1.217	1.007	0.989
2003	1.266	1.002	1.359	1.320	1.058	1.256	1.023	1.004
2004	1.305	1.017	1.408	1.363	1.076	1.288	1.034	1.014
2005	1.337	1.032	1.441	1.399	1.094	1.314	1.047	1.030
				Growth (% per annum)				
1949-78	*7.265*	*7.659*	*7.540*	*7.535*	*7.917*	*7.373*	*7.794*	*7.760*
1978-05	*3.088*	*1.803*	*3.334*	*3.253*	*2.024*	*2.988*	*1.842*	*1.825*
1949-05	*5.099*	*4.657*	*5.354*	*5.312*	*4.892*	*5.103*	*4.742*	*4.717*

Table A1: Indices of Labour Input in Chinese Industry (cont'd)

Year	*gae*	*gaj*	*gao*	*gej*	*geo*	*gjo*	*aej*	*aeo*
1949	0.093	0.094	0.084	0.097	0.089	0.088	0.091	0.082
1950	0.096	0.097	0.088	0.101	0.094	0.093	0.095	0.087
1951	0.108	0.110	0.104	0.114	0.110	0.109	0.106	0.102
1952	0.120	0.122	0.117	0.126	0.124	0.124	0.118	0.116
1953	0.133	0.135	0.132	0.140	0.140	0.140	0.131	0.130
1954	0.139	0.142	0.137	0.147	0.145	0.145	0.138	0.135
1955	0.144	0.147	0.144	0.152	0.153	0.153	0.142	0.142
1956	0.148	0.150	0.161	0.156	0.171	0.171	0.146	0.159
1957	0.156	0.159	0.181	0.165	0.192	0.192	0.155	0.180
1958	0.320	0.320	0.333	0.332	0.354	0.347	0.312	0.331
1959	0.359	0.361	0.415	0.373	0.441	0.434	0.351	0.413
1960	0.290	0.292	0.351	0.302	0.373	0.367	0.284	0.350
1961	0.265	0.268	0.317	0.278	0.337	0.332	0.262	0.316
1962	0.203	0.205	0.239	0.213	0.254	0.252	0.201	0.239
1963	0.174	0.177	0.203	0.183	0.216	0.214	0.174	0.203
1964	0.176	0.177	0.205	0.183	0.216	0.214	0.175	0.205
1965	0.186	0.187	0.215	0.192	0.226	0.223	0.185	0.216
1966	0.203	0.203	0.234	0.209	0.245	0.241	0.202	0.235
1967	0.216	0.216	0.249	0.221	0.260	0.255	0.214	0.250
1968	0.223	0.223	0.262	0.227	0.272	0.267	0.221	0.262
1969	0.243	0.242	0.286	0.246	0.295	0.290	0.241	0.286
1970	0.283	0.281	0.332	0.286	0.342	0.336	0.280	0.333
1971	0.330	0.328	0.388	0.332	0.398	0.391	0.327	0.389
1972	0.368	0.366	0.430	0.369	0.439	0.431	0.364	0.430
1973	0.396	0.393	0.457	0.396	0.465	0.457	0.392	0.457
1974	0.417	0.415	0.477	0.417	0.484	0.476	0.413	0.477
1975	0.449	0.446	0.510	0.447	0.516	0.507	0.444	0.509
1976	0.490	0.486	0.551	0.486	0.556	0.547	0.485	0.549
1977	0.519	0.515	0.584	0.514	0.588	0.578	0.513	0.582
1978	0.582	0.579	0.636	0.578	0.640	0.631	0.578	0.635
1979	0.656	0.653	0.695	0.652	0.699	0.689	0.651	0.693
1980	0.704	0.701	0.734	0.700	0.737	0.727	0.699	0.732
1981	0.756	0.753	0.776	0.752	0.778	0.768	0.752	0.774
1982	0.770	0.767	0.796	0.766	0.797	0.787	0.767	0.794
1983	0.771	0.770	0.801	0.769	0.803	0.795	0.770	0.800
1984	0.809	0.807	0.830	0.807	0.832	0.826	0.808	0.829
1985	0.887	0.886	0.897	0.886	0.898	0.893	0.887	0.896
1986	0.947	0.946	0.953	0.946	0.953	0.951	0.948	0.952
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.030	1.025	1.017	1.019	1.012	1.013	1.028	1.021
1989	1.053	1.044	1.038	1.032	1.029	1.029	1.049	1.044
1990	1.066	1.054	1.051	1.038	1.039	1.037	1.061	1.058
1991	1.098	1.086	1.084	1.063	1.064	1.063	1.093	1.091
1992	1.135	1.122	1.117	1.092	1.091	1.089	1.129	1.126
1993	1.269	1.252	1.220	1.213	1.185	1.181	1.261	1.230
1994	1.289	1.270	1.187	1.224	1.146	1.144	1.280	1.199
1995	1.266	1.247	1.140	1.197	1.095	1.093	1.259	1.154
1996	1.284	1.260	1.124	1.212	1.083	1.079	1.275	1.142
1997	1.282	1.253	1.097	1.210	1.062	1.055	1.272	1.119
1998	1.225	1.201	0.986	1.165	0.963	0.959	1.224	1.018
1999	1.138	1.118	0.970	1.089	0.956	0.950	1.144	1.010
2000	1.135	1.113	0.934	1.090	0.929	0.921	1.144	0.981
2001	1.265	1.234	1.002	1.202	0.990	0.980	1.267	1.050
2002	1.300	1.262	1.004	1.223	0.986	0.974	1.292	1.048
2003	1.344	1.298	1.015	1.250	0.992	0.978	1.323	1.055
2004	1.381	1.324	1.025	1.268	0.998	0.980	1.343	1.062
2005	1.411	1.355	1.039	1.291	1.008	0.993	1.367	1.073
				Growth (% per annum)				
1949-78	*6.788*	*6.731*	*7.518*	*6.580*	*7.310*	*7.295*	*6.830*	*7.561*
1978-05	*3.334*	*3.195*	*1.832*	*3.020*	*1.697*	*1.692*	*3.241*	*1.964*
1949-05	*4.985*	*4.889*	*4.602*	*4.729*	*4.434*	*4.425*	*4.960*	*4.689*

Table A1: Indices of Labour Input in Chinese Industry (cont'd)

Year	*ajo*	*ejo*	*sgae*	*sgaj*	*sgao*	*sgej*	*sgeo*	*sgjo*
1949	0.081	0.081	0.079	0.078	0.076	0.083	0.080	0.080
1950	0.086	0.086	0.083	0.082	0.081	0.087	0.084	0.084
1951	0.101	0.101	0.095	0.095	0.095	0.100	0.099	0.099
1952	0.115	0.115	0.107	0.107	0.107	0.112	0.112	0.112
1953	0.130	0.130	0.119	0.119	0.120	0.126	0.126	0.127
1954	0.135	0.135	0.124	0.124	0.125	0.130	0.131	0.131
1955	0.142	0.142	0.129	0.129	0.132	0.136	0.138	0.139
1956	0.159	0.159	0.137	0.137	0.148	0.145	0.155	0.156
1957	0.179	0.179	0.149	0.149	0.167	0.157	0.175	0.175
1958	0.324	0.324	0.306	0.301	0.330	0.317	0.346	0.341
1959	0.406	0.406	0.361	0.356	0.417	0.376	0.436	0.432
1960	0.344	0.344	0.301	0.298	0.353	0.314	0.370	0.366
1961	0.311	0.311	0.277	0.275	0.323	0.290	0.339	0.336
1962	0.236	0.236	0.212	0.210	0.248	0.222	0.259	0.258
1963	0.201	0.201	0.179	0.178	0.210	0.188	0.220	0.219
1964	0.202	0.202	0.177	0.175	0.210	0.184	0.219	0.217
1965	0.212	0.212	0.187	0.185	0.221	0.193	0.229	0.226
1966	0.231	0.231	0.205	0.202	0.240	0.210	0.248	0.245
1967	0.246	0.246	0.218	0.216	0.256	0.223	0.263	0.260
1968	0.259	0.259	0.227	0.225	0.268	0.231	0.276	0.272
1969	0.282	0.282	0.248	0.245	0.293	0.252	0.300	0.295
1970	0.328	0.328	0.291	0.287	0.341	0.294	0.348	0.342
1971	0.384	0.384	0.342	0.337	0.397	0.344	0.404	0.397
1972	0.425	0.425	0.381	0.377	0.436	0.383	0.443	0.436
1973	0.452	0.452	0.410	0.405	0.462	0.411	0.469	0.461
1974	0.472	0.472	0.431	0.426	0.482	0.432	0.488	0.480
1975	0.504	0.504	0.464	0.458	0.513	0.464	0.519	0.510
1976	0.545	0.545	0.506	0.500	0.553	0.504	0.559	0.549
1977	0.577	0.577	0.536	0.530	0.586	0.534	0.591	0.580
1978	0.631	0.631	0.595	0.590	0.637	0.593	0.642	0.632
1979	0.690	0.690	0.663	0.657	0.695	0.660	0.698	0.688
1980	0.728	0.728	0.710	0.704	0.734	0.706	0.737	0.726
1981	0.770	0.770	0.762	0.755	0.775	0.757	0.777	0.766
1982	0.790	0.790	0.779	0.772	0.795	0.774	0.797	0.785
1983	0.798	0.798	0.780	0.776	0.800	0.778	0.802	0.794
1984	0.827	0.827	0.816	0.812	0.829	0.814	0.831	0.824
1985	0.895	0.895	0.891	0.888	0.897	0.890	0.898	0.893
1986	0.951	0.951	0.951	0.949	0.953	0.950	0.954	0.951
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.017	1.017	1.026	1.024	1.019	1.015	1.012	1.014
1989	1.038	1.038	1.046	1.044	1.036	1.027	1.022	1.026
1990	1.051	1.051	1.062	1.061	1.053	1.037	1.036	1.038
1991	1.084	1.084	1.102	1.100	1.091	1.069	1.066	1.068
1992	1.118	1.118	1.142	1.140	1.128	1.101	1.096	1.097
1993	1.220	1.220	1.278	1.274	1.239	1.224	1.197	1.198
1994	1.188	1.188	1.287	1.284	1.207	1.227	1.159	1.161
1995	1.142	1.142	1.248	1.244	1.162	1.183	1.110	1.113
1996	1.127	1.127	1.267	1.259	1.150	1.199	1.102	1.102
1997	1.101	1.101	1.277	1.264	1.132	1.208	1.088	1.085
1998	1.000	1.000	1.223	1.211	1.025	1.162	0.994	0.991
1999	0.988	0.988	1.159	1.147	1.006	1.105	0.983	0.977
2000	0.955	0.955	1.137	1.120	0.958	1.084	0.943	0.934
2001	1.019	1.019	1.269	1.246	1.029	1.198	1.007	0.997
2002	1.014	1.014	1.298	1.270	1.032	1.214	1.003	0.992
2003	1.019	1.019	1.349	1.315	1.054	1.251	1.019	1.006
2004	1.022	1.022	1.396	1.355	1.070	1.281	1.030	1.014
2005	1.036	1.036	1.427	1.387	1.088	1.305	1.042	1.029
			Growth (% per annum)					
1949-78	*7.585*	*7.585*	*7.487*	*7.475*	*7.871*	*7.294*	*7.722*	*7.677*
1978-05	*1.851*	*1.851*	*3.292*	*3.218*	*1.999*	*2.963*	*1.813*	*1.823*
1949-05	*4.644*	*4.644*	*5.308*	*5.265*	*4.857*	*5.051*	*4.692*	*4.676*

Table A1: Indices of Labour Input in Chinese industry (cont'd)

Year	*saej*	*saeo*	*sajo*	*sejo*	*gaej*	*gaeo*	*gajo*	*gejo*
1949	0.078	0.075	0.075	0.078	0.093	0.083	0.083	0.088
1950	0.082	0.079	0.079	0.082	0.097	0.088	0.087	0.092
1951	0.094	0.093	0.093	0.097	0.109	0.104	0.103	0.109
1952	0.106	0.105	0.105	0.110	0.121	0.117	0.116	0.124
1953	0.118	0.118	0.119	0.124	0.134	0.132	0.132	0.140
1954	0.122	0.123	0.123	0.128	0.140	0.137	0.136	0.145
1955	0.128	0.130	0.130	0.136	0.145	0.144	0.144	0.153
1956	0.136	0.146	0.146	0.152	0.149	0.161	0.161	0.171
1957	0.148	0.165	0.165	0.172	0.158	0.181	0.181	0.192
1958	0.300	0.325	0.321	0.335	0.317	0.332	0.326	0.347
1959	0.356	0.411	0.407	0.424	0.357	0.416	0.409	0.435
1960	0.297	0.349	0.346	0.360	0.289	0.351	0.346	0.368
1961	0.275	0.319	0.317	0.331	0.266	0.317	0.313	0.333
1962	0.210	0.245	0.244	0.254	0.204	0.240	0.237	0.252
1963	0.179	0.208	0.207	0.216	0.176	0.204	0.202	0.214
1964	0.176	0.208	0.207	0.215	0.176	0.205	0.203	0.214
1965	0.186	0.219	0.217	0.225	0.186	0.216	0.213	0.224
1966	0.203	0.239	0.237	0.244	0.202	0.235	0.232	0.242
1967	0.216	0.254	0.252	0.259	0.215	0.250	0.247	0.257
1968	0.225	0.267	0.265	0.271	0.222	0.262	0.259	0.269
1969	0.246	0.292	0.289	0.295	0.242	0.286	0.283	0.292
1970	0.288	0.340	0.336	0.343	0.281	0.333	0.329	0.339
1971	0.338	0.395	0.392	0.399	0.328	0.389	0.384	0.394
1972	0.377	0.435	0.431	0.438	0.366	0.430	0.426	0.434
1973	0.405	0.461	0.457	0.463	0.393	0.457	0.453	0.460
1974	0.427	0.481	0.477	0.482	0.415	0.477	0.473	0.480
1975	0.460	0.512	0.508	0.513	0.446	0.510	0.505	0.511
1976	0.501	0.552	0.547	0.553	0.486	0.550	0.546	0.550
1977	0.531	0.585	0.580	0.585	0.515	0.583	0.578	0.582
1978	0.591	0.636	0.632	0.637	0.580	0.636	0.632	0.635
1979	0.659	0.694	0.690	0.694	0.653	0.695	0.691	0.694
1980	0.706	0.733	0.729	0.733	0.701	0.733	0.730	0.732
1981	0.758	0.774	0.770	0.773	0.753	0.775	0.771	0.772
1982	0.775	0.794	0.790	0.793	0.768	0.795	0.791	0.792
1983	0.779	0.800	0.797	0.800	0.771	0.801	0.799	0.800
1984	0.815	0.829	0.827	0.830	0.809	0.830	0.828	0.830
1985	0.892	0.897	0.895	0.898	0.888	0.897	0.895	0.897
1986	0.951	0.953	0.952	0.954	0.948	0.953	0.952	0.953
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.024	1.021	1.018	1.010	1.027	1.020	1.017	1.010
1989	1.041	1.038	1.034	1.019	1.048	1.042	1.038	1.024
1990	1.055	1.055	1.051	1.030	1.057	1.055	1.051	1.032
1991	1.093	1.092	1.088	1.060	1.089	1.088	1.084	1.058
1992	1.132	1.128	1.124	1.088	1.126	1.122	1.117	1.085
1993	1.265	1.240	1.234	1.188	1.258	1.227	1.219	1.177
1994	1.275	1.209	1.203	1.151	1.277	1.196	1.187	1.140
1995	1.236	1.167	1.160	1.104	1.256	1.150	1.141	1.090
1996	1.253	1.158	1.148	1.094	1.272	1.138	1.125	1.078
1997	1.262	1.142	1.129	1.079	1.269	1.115	1.100	1.056
1998	1.212	1.046	1.030	0.988	1.220	1.013	0.999	0.963
1999	1.152	1.035	1.014	0.977	1.140	1.005	0.988	0.957
2000	1.129	0.993	0.966	0.936	1.139	0.976	0.955	0.931
2001	1.254	1.063	1.033	0.997	1.261	1.044	1.019	0.988
2002	1.274	1.062	1.031	0.990	1.283	1.042	1.013	0.979
2003	1.315	1.081	1.047	1.001	1.313	1.050	1.018	0.980
2004	1.349	1.093	1.057	1.006	1.332	1.057	1.021	0.979
2005	1.375	1.107	1.074	1.016	1.354	1.069	1.034	0.988
				Growth (% per annum)				
1949-78	*7.518*	*7.941*	*7.929*	*7.800*	*6.762*	*7.523*	*7.541*	*7.330*
1978-05	*3.175*	*2.073*	*1.981*	*1.744*	*3.193*	*1.941*	*1.836*	*1.648*
1949-05	*5.265*	*4.928*	*4.876*	*4.696*	*4.903*	*4.659*	*4.616*	*4.420*

Table A1: Indices of Labour Input in Chinese industry (cont'd)

Year	*aejo*	*sgaej*	*sgaeo*	*sgajo*	*sgejo*	*saejo*	*gaejo*	*sgaejo*
1949	0.082	0.079	0.076	0.076	0.079	0.075	0.083	0.075
1950	0.086	0.083	0.080	0.080	0.083	0.079	0.087	0.079
1951	0.102	0.095	0.094	0.094	0.098	0.093	0.103	0.094
1952	0.116	0.107	0.106	0.107	0.111	0.105	0.117	0.106
1953	0.131	0.120	0.120	0.120	0.126	0.119	0.132	0.120
1954	0.135	0.124	0.124	0.125	0.130	0.123	0.137	0.124
1955	0.143	0.130	0.131	0.132	0.138	0.130	0.144	0.131
1956	0.160	0.138	0.147	0.148	0.155	0.146	0.161	0.148
1957	0.180	0.150	0.166	0.167	0.174	0.165	0.181	0.166
1958	0.326	0.303	0.328	0.324	0.339	0.321	0.328	0.323
1959	0.410	0.358	0.414	0.410	0.429	0.407	0.412	0.409
1960	0.347	0.300	0.351	0.348	0.364	0.346	0.348	0.347
1961	0.314	0.276	0.321	0.320	0.335	0.318	0.315	0.319
1962	0.238	0.212	0.246	0.245	0.257	0.244	0.239	0.245
1963	0.203	0.180	0.209	0.208	0.218	0.207	0.203	0.208
1964	0.204	0.177	0.209	0.208	0.217	0.208	0.204	0.209
1965	0.215	0.187	0.220	0.218	0.227	0.218	0.215	0.219
1966	0.233	0.204	0.239	0.238	0.246	0.238	0.233	0.238
1967	0.248	0.217	0.255	0.253	0.261	0.253	0.248	0.254
1968	0.261	0.226	0.268	0.266	0.273	0.266	0.261	0.266
1969	0.284	0.247	0.292	0.290	0.296	0.290	0.284	0.290
1970	0.330	0.289	0.340	0.337	0.344	0.337	0.331	0.338
1971	0.386	0.339	0.396	0.393	0.400	0.393	0.386	0.393
1972	0.427	0.379	0.435	0.432	0.439	0.432	0.427	0.433
1973	0.453	0.407	0.462	0.458	0.464	0.458	0.454	0.458
1974	0.473	0.428	0.481	0.477	0.483	0.478	0.474	0.478
1975	0.506	0.461	0.513	0.508	0.514	0.509	0.506	0.509
1976	0.546	0.502	0.553	0.548	0.553	0.549	0.547	0.549
1977	0.578	0.532	0.586	0.580	0.585	0.581	0.579	0.582
1978	0.632	0.592	0.637	0.633	0.637	0.634	0.633	0.634
1979	0.691	0.660	0.694	0.690	0.693	0.691	0.692	0.691
1980	0.729	0.706	0.734	0.729	0.732	0.730	0.731	0.731
1981	0.771	0.759	0.774	0.770	0.772	0.771	0.772	0.772
1982	0.791	0.776	0.794	0.790	0.791	0.791	0.792	0.792
1983	0.799	0.780	0.800	0.797	0.799	0.800	0.801	0.801
1984	0.829	0.816	0.829	0.827	0.829	0.830	0.831	0.831
1985	0.897	0.893	0.897	0.895	0.897	0.898	0.898	0.899
1986	0.953	0.952	0.954	0.952	0.954	0.955	0.954	0.956
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.018	1.024	1.020	1.019	1.010	1.019	1.017	1.019
1989	1.038	1.041	1.037	1.036	1.019	1.033	1.037	1.033
1990	1.050	1.054	1.053	1.053	1.029	1.048	1.047	1.047
1991	1.083	1.093	1.091	1.091	1.060	1.084	1.080	1.084
1992	1.116	1.132	1.128	1.127	1.089	1.120	1.114	1.120
1993	1.219	1.266	1.239	1.237	1.189	1.229	1.217	1.230
1994	1.188	1.275	1.208	1.205	1.153	1.198	1.186	1.199
1995	1.143	1.236	1.165	1.161	1.105	1.155	1.141	1.156
1996	1.130	1.254	1.156	1.150	1.096	1.145	1.129	1.147
1997	1.107	1.263	1.141	1.131	1.081	1.130	1.107	1.132
1998	1.008	1.214	1.043	1.032	0.990	1.034	1.008	1.036
1999	1.001	1.153	1.032	1.016	0.979	1.021	1.001	1.023
2000	0.972	1.130	0.990	0.969	0.938	0.977	0.972	0.980
2001	1.037	1.253	1.059	1.036	0.998	1.045	1.036	1.047
2002	1.031	1.271	1.057	1.032	0.990	1.040	1.029	1.040
2003	1.033	1.309	1.075	1.046	1.000	1.053	1.031	1.051
2004	1.034	1.340	1.086	1.055	1.004	1.059	1.032	1.055
2005	1.044	1.363	1.099	1.069	1.012	1.069	1.040	1.063
				Growth (% per annum)				
1949-78	*7.567*	*7.470*	*7.901*	*7.882*	*7.735*	*7.941*	*7.534*	*7.904*
1978-05	*1.876*	*3.136*	*2.042*	*1.961*	*1.733*	*1.955*	*1.855*	*1.931*
1949-05	*4.648*	*5.223*	*4.893*	*4.843*	*4.659*	*4.869*	*4.622*	*4.839*

Table A2: Decomposition of Labour Quality in Chinese Industry

Year	Quality	*s*	*g*	*a*	*e*	*j*	*o*	*sg*
1949	0.788	0.851	1.050	0.968	0.978	0.995	0.908	0.980
1950	0.797	0.856	1.050	0.968	0.978	0.995	0.919	0.980
1951	0.836	0.880	1.050	0.968	0.978	0.995	0.963	0.980
1952	0.858	0.888	1.050	0.968	0.979	1.003	0.982	0.980
1953	0.874	0.894	1.050	0.969	0.980	1.005	1.000	0.980
1954	0.866	0.885	1.050	0.969	0.980	1.004	0.988	0.980
1955	0.885	0.892	1.050	0.969	0.980	1.005	1.006	0.980
1956	0.969	0.926	1.048	0.969	0.981	1.005	1.097	0.980
1957	1.028	0.951	1.045	0.969	0.980	1.003	1.164	0.981
1958	0.968	0.952	1.039	0.963	0.972	0.979	1.043	0.985
1959	1.096	1.002	1.039	0.964	0.974	0.984	1.160	0.985
1960	1.151	1.036	1.037	0.965	0.974	0.985	1.213	0.985
1961	1.155	1.039	1.036	0.965	0.974	0.991	1.194	0.986
1962	1.158	1.037	1.034	0.965	0.974	0.994	1.181	0.988
1963	1.142	1.018	1.031	0.965	0.974	0.996	1.166	0.991
1964	1.141	0.990	1.025	0.969	0.980	0.995	1.162	0.996
1965	1.136	0.988	1.021	0.973	0.985	0.991	1.154	0.998
1966	1.142	0.993	1.018	0.978	0.989	0.992	1.153	0.999
1967	1.148	0.997	1.016	0.981	0.991	0.992	1.155	0.999
1968	1.170	1.006	1.015	0.985	0.994	0.992	1.175	0.999
1969	1.178	1.011	1.013	0.988	0.995	0.991	1.179	0.999
1970	1.182	1.019	1.012	0.992	0.996	0.991	1.179	0.999
1971	1.183	1.029	1.011	0.996	0.998	0.991	1.180	0.998
1972	1.173	1.033	1.011	0.999	0.998	0.992	1.172	0.997
1973	1.158	1.033	1.010	1.002	0.998	0.991	1.157	0.997
1974	1.146	1.032	1.009	1.003	0.999	0.992	1.145	0.997
1975	1.138	1.034	1.009	1.005	0.999	0.991	1.138	0.997
1976	1.127	1.034	1.008	1.007	0.999	0.991	1.126	0.996
1977	1.129	1.036	1.008	1.009	0.999	0.991	1.127	0.996
1978	1.097	1.024	1.007	1.009	0.999	0.994	1.093	0.996
1979	1.058	1.009	1.006	1.007	0.999	0.994	1.057	0.997
1980	1.041	1.005	1.005	1.007	0.999	0.994	1.039	0.997
1981	1.023	1.004	1.004	1.007	0.999	0.994	1.021	0.998
1982	1.031	1.006	1.004	1.007	0.999	0.995	1.029	0.998
1983	1.042	1.009	1.003	1.007	1.000	0.997	1.037	0.998
1984	1.030	1.006	1.003	1.005	1.000	0.998	1.025	0.998
1985	1.016	1.004	1.002	1.004	1.000	0.999	1.010	0.999
1986	1.011	1.003	1.001	1.002	1.000	1.000	1.006	0.999
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	0.999	1.000	1.006	1.003	1.001	0.994	1.000
1989	1.003	1.001	1.000	1.013	1.007	1.002	0.997	1.000
1990	1.012	1.009	1.000	1.019	1.011	1.003	1.001	1.001
1991	1.025	1.014	1.000	1.027	1.013	1.004	1.003	1.002
1992	1.033	1.018	1.000	1.034	1.014	1.005	1.001	1.003
1993	1.020	1.020	0.999	1.041	1.015	1.003	0.978	1.002
1994	0.986	1.014	0.999	1.048	1.016	1.004	0.937	1.002
1995	0.974	1.001	0.998	1.054	1.017	1.006	0.917	1.002
1996	0.955	1.002	0.997	1.053	1.020	1.006	0.894	1.003
1997	0.946	1.012	0.997	1.051	1.024	1.006	0.876	1.004
1998	0.914	1.014	0.995	1.051	1.036	1.020	0.831	1.005
1999	0.986	1.038	0.994	1.053	1.050	1.038	0.893	1.005
2000	0.952	1.020	0.992	1.051	1.059	1.044	0.867	1.006
2001	0.909	1.022	0.994	1.054	1.051	1.033	0.829	1.004
2002	0.875	1.019	0.994	1.057	1.045	1.023	0.803	1.003
2003	0.853	1.028	0.995	1.059	1.040	1.014	0.780	1.001
2004	0.831	1.037	0.996	1.061	1.036	1.005	0.762	0.999
2005	0.818	1.040	0.997	1.063	1.033	1.007	0.754	0.998
				Growth (% per annum)				
1949-78	*1.19*	*0.66*	*-0.15*	*0.15*	*0.08*	*-0.00*	*0.67*	*0.06*
1978-05	*-1.08*	*0.06*	*-0.04*	*0.19*	*0.13*	*0.05*	*-1.37*	*0.01*
1949-05	*0.07*	*0.36*	*-0.09*	*0.17*	*0.10*	*0.02*	*-0.33*	*0.03*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*sa*	*se*	*sj*	*so*	*ga*	*ge*	*gj*	*go*
1949	0.991	1.017	0.994	1.066	0.976	0.990	0.988	0.980
1950	0.991	1.017	0.994	1.059	0.976	0.990	0.988	0.980
1951	0.991	1.017	0.994	1.031	0.976	0.990	0.988	0.980
1952	0.991	1.017	0.994	1.020	0.976	0.990	0.988	0.980
1953	0.991	1.017	0.994	1.012	0.976	0.990	0.988	0.980
1954	0.991	1.018	0.995	1.023	0.976	0.990	0.988	0.980
1955	0.991	1.018	0.995	1.018	0.976	0.991	0.988	0.980
1956	0.991	1.018	0.994	0.983	0.976	0.991	0.988	0.979
1957	0.991	1.017	0.993	0.960	0.976	0.991	0.989	0.980
1958	0.996	1.023	1.000	1.032	0.983	0.996	0.995	0.983
1959	0.995	1.022	1.000	0.994	0.982	0.996	0.995	0.983
1960	0.995	1.022	0.999	0.964	0.982	0.996	0.995	0.984
1961	0.995	1.023	0.999	0.976	0.983	0.997	0.995	0.985
1962	0.996	1.023	0.998	0.989	0.983	0.998	0.996	0.986
1963	0.997	1.025	0.998	1.007	0.983	0.998	0.996	0.987
1964	1.000	1.023	0.999	1.026	0.985	0.998	0.996	0.991
1965	1.001	1.020	1.001	1.026	0.987	0.998	0.997	0.993
1966	1.002	1.017	1.001	1.024	0.988	0.998	0.997	0.995
1967	1.002	1.016	1.001	1.020	0.989	0.998	0.997	0.995
1968	1.001	1.014	1.001	1.011	0.990	0.998	0.997	0.996
1969	1.001	1.013	1.001	1.006	0.991	0.999	0.997	0.996
1970	1.000	1.012	1.001	1.000	0.992	0.999	0.997	0.997
1971	0.998	1.010	1.001	0.989	0.992	0.999	0.997	0.997
1972	0.996	1.010	1.000	0.980	0.992	1.000	0.996	0.997
1973	0.996	1.009	1.000	0.979	0.993	1.000	0.996	0.997
1974	0.996	1.009	1.000	0.979	0.994	1.000	0.996	0.998
1975	0.995	1.008	1.000	0.975	0.994	1.000	0.996	0.998
1976	0.995	1.008	1.000	0.974	0.994	1.000	0.996	0.998
1977	0.994	1.008	1.000	0.973	0.995	1.000	0.996	0.998
1978	0.996	1.007	1.000	0.982	0.995	1.000	0.996	0.999
1979	0.998	1.007	1.001	0.993	0.996	1.000	0.996	0.999
1980	0.999	1.007	1.001	0.997	0.996	1.000	0.996	0.999
1981	1.000	1.007	1.001	0.997	0.996	1.000	0.996	1.000
1982	1.000	1.006	1.000	0.994	0.997	1.000	0.996	1.000
1983	0.999	1.005	1.000	0.991	0.997	1.000	0.997	0.999
1984	0.999	1.004	1.000	0.994	0.998	1.000	0.998	1.000
1985	0.999	1.003	1.000	0.997	0.998	1.000	0.998	1.000
1986	1.000	1.001	1.000	0.998	0.999	1.000	0.999	1.000
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	0.999	0.996	1.000	1.002	1.000	1.000	1.000	1.000
1989	0.998	0.993	0.999	0.995	0.999	0.999	1.000	1.000
1990	0.997	0.990	0.999	0.992	0.999	0.999	1.000	1.000
1991	0.997	0.989	0.998	0.990	0.999	0.999	1.000	1.000
1992	0.997	0.989	0.998	0.988	0.998	0.999	1.000	1.000
1993	0.996	0.988	0.998	0.993	0.998	0.999	1.001	1.000
1994	0.996	0.987	0.997	1.001	0.998	0.998	1.001	1.000
1995	0.996	0.986	0.997	1.017	0.998	0.998	1.001	1.001
1996	0.996	0.985	0.996	1.020	0.998	0.998	1.001	1.001
1997	0.996	0.985	0.995	1.018	0.998	0.998	1.002	1.002
1998	0.997	0.984	0.992	1.024	0.999	0.998	1.003	1.003
1999	0.996	0.981	0.985	0.998	0.999	0.997	1.004	1.003
2000	0.997	0.980	0.982	1.004	0.999	0.997	1.005	1.005
2001	0.997	0.980	0.984	1.004	0.998	0.997	1.005	1.004
2002	0.996	0.980	0.986	1.010	0.997	0.997	1.004	1.005
2003	0.995	0.979	0.987	1.015	0.996	0.997	1.003	1.005
2004	0.995	0.979	0.989	1.015	0.995	0.997	1.002	1.006
2005	0.994	0.979	0.988	1.016	0.994	0.997	1.001	1.006
				Growth (% per annum)				
1949-78	*0.02*	*-0.04*	*0.02*	*-0.29*	*0.07*	*0.04*	*0.03*	*0.07*
1978-05	*0.00*	*-0.11*	*-0.04*	*0.13*	*0.00*	*-0.01*	*0.02*	*0.03*
1949-05	*0.01*	*-0.07*	*-0.01*	*-0.09*	*0.03*	*0.01*	*0.02*	*0.05*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*ae*	*aj*	*ao*	*ej*	*eo*	*jo*	*sga*	*sge*
1949	0.998	0.991	0.982	1.011	1.019	0.992	1.011	1.007
1950	0.998	0.991	0.982	1.011	1.019	0.992	1.011	1.007
1951	0.998	0.991	0.982	1.011	1.019	0.992	1.011	1.007
1952	0.998	0.990	0.982	1.009	1.019	0.992	1.011	1.007
1953	0.998	0.990	0.982	1.008	1.019	0.992	1.011	1.007
1954	0.998	0.990	0.983	1.008	1.019	0.994	1.011	1.007
1955	0.998	0.990	0.983	1.008	1.020	0.995	1.011	1.007
1956	0.998	0.990	0.983	1.008	1.020	0.996	1.011	1.007
1957	0.998	0.990	0.983	1.008	1.020	0.996	1.011	1.007
1958	1.005	0.998	0.988	1.016	1.024	1.000	1.005	1.001
1959	1.004	0.998	0.989	1.015	1.026	1.001	1.005	1.001
1960	1.004	0.997	0.989	1.014	1.027	1.000	1.005	1.001
1961	1.004	0.997	0.989	1.015	1.028	0.999	1.005	1.000
1962	1.004	0.996	0.989	1.016	1.028	0.998	1.005	1.000
1963	1.004	0.996	0.990	1.016	1.028	0.997	1.005	1.000
1964	1.003	0.996	0.992	1.012	1.025	0.998	1.004	1.000
1965	1.002	0.996	0.993	1.009	1.021	1.000	1.003	1.000
1966	1.001	0.996	0.993	1.007	1.018	1.000	1.003	1.000
1967	1.000	0.996	0.993	1.006	1.016	1.000	1.003	1.000
1968	0.999	0.996	0.993	1.005	1.015	1.000	1.002	1.000
1969	0.998	0.996	0.993	1.004	1.013	1.000	1.002	1.000
1970	0.997	0.996	0.993	1.004	1.012	1.001	1.002	1.000
1971	0.997	0.996	0.993	1.003	1.011	1.001	1.002	1.000
1972	0.996	0.996	0.993	1.003	1.010	1.001	1.002	1.000
1973	0.996	0.996	0.994	1.003	1.009	1.001	1.002	1.000
1974	0.996	0.996	0.994	1.003	1.009	1.001	1.002	1.000
1975	0.996	0.996	0.994	1.003	1.008	1.002	1.002	1.000
1976	0.995	0.996	0.995	1.003	1.008	1.002	1.003	1.000
1977	0.995	0.996	0.995	1.003	1.007	1.002	1.003	1.000
1978	0.995	0.996	0.996	1.003	1.007	1.002	1.002	1.000
1979	0.996	0.996	0.998	1.003	1.007	1.002	1.002	1.000
1980	0.996	0.996	0.999	1.003	1.007	1.002	1.002	1.000
1981	0.996	0.996	0.999	1.003	1.006	1.002	1.002	1.000
1982	0.996	0.996	0.999	1.003	1.006	1.001	1.002	1.000
1983	0.996	0.997	0.998	1.003	1.005	1.001	1.001	1.000
1984	0.997	0.997	0.999	1.003	1.004	1.001	1.001	1.000
1985	0.998	0.998	0.999	1.002	1.002	1.001	1.001	1.000
1986	0.999	0.999	1.000	1.001	1.001	1.000	1.001	1.000
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.003	0.999	0.999	0.997	0.998	0.999	1.000	1.000
1989	1.004	0.998	0.998	0.994	0.995	0.998	1.001	1.000
1990	1.004	0.998	0.997	0.991	0.993	0.998	1.002	1.000
1991	1.002	0.997	0.996	0.990	0.992	0.998	1.001	1.000
1992	1.000	0.996	0.996	0.989	0.992	0.997	1.001	1.000
1993	1.000	0.995	0.996	0.989	0.992	0.998	1.001	1.000
1994	1.000	0.995	0.997	0.988	0.992	0.999	1.001	1.000
1995	1.000	0.994	0.997	0.987	0.992	0.999	1.002	1.000
1996	1.000	0.994	0.998	0.986	0.992	1.000	1.001	1.000
1997	1.001	0.993	0.999	0.984	0.992	1.000	1.001	1.000
1998	1.000	0.992	1.000	0.976	0.992	0.997	1.001	1.000
1999	1.000	0.989	0.999	0.966	0.987	0.987	1.001	1.000
2000	1.000	0.988	1.000	0.961	0.988	0.986	1.000	1.000
2001	1.001	0.988	1.000	0.966	0.991	0.991	1.001	1.000
2002	1.001	0.987	1.000	0.967	0.992	0.995	1.001	1.000
2003	1.000	0.985	1.001	0.967	0.994	0.999	1.002	1.000
2004	0.999	0.983	1.001	0.965	0.995	1.003	1.002	1.001
2005	0.999	0.982	1.001	0.961	0.995	1.003	1.002	1.001
				Growth (% per annum)				
1949-78	*-0.01*	*0.02*	*0.05*	*-0.03*	*-0.04*	*0.03*	*-0.03*	*-0.02*
1978-05	*0.01*	*-0.05*	*0.02*	*-0.16*	*-0.05*	*0.00*	*0.00*	*0.00*
1949-05	*0.00*	*-0.02*	*0.03*	*-0.09*	*-0.04*	*0.02*	*-0.02*	*-0.01*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*sgj*	*sgo*	*sae*	*saj*	*sao*	*sej*	*seo*	*sjo*
1949	1.008	1.016	1.002	1.007	1.017	1.000	0.980	1.009
1950	1.008	1.016	1.002	1.007	1.017	1.000	0.980	1.009
1951	1.008	1.016	1.002	1.007	1.017	1.000	0.980	1.009
1952	1.008	1.016	1.002	1.007	1.017	1.000	0.980	1.009
1953	1.008	1.016	1.002	1.007	1.017	1.000	0.980	1.010
1954	1.008	1.016	1.002	1.007	1.017	1.000	0.979	1.008
1955	1.008	1.016	1.002	1.007	1.017	1.000	0.979	1.008
1956	1.008	1.017	1.002	1.007	1.017	1.000	0.980	1.009
1957	1.008	1.017	1.002	1.007	1.017	1.000	0.981	1.009
1958	1.001	1.014	0.996	1.001	1.011	0.994	0.974	1.000
1959	1.001	1.013	0.996	1.001	1.010	0.995	0.973	1.000
1960	1.001	1.013	0.997	1.001	1.011	0.996	0.973	1.001
1961	1.001	1.013	0.997	1.001	1.011	0.995	0.972	1.002
1962	1.001	1.011	0.996	1.001	1.010	0.994	0.972	1.003
1963	1.001	1.009	0.996	1.000	1.009	0.994	0.971	1.003
1964	1.000	1.005	0.995	1.000	1.007	0.997	0.973	1.002
1965	1.000	1.003	0.995	1.000	1.006	0.997	0.976	1.000
1966	1.000	1.002	0.995	1.001	1.006	0.998	0.979	1.000
1967	1.000	1.002	0.996	1.001	1.006	0.998	0.981	0.999
1968	1.000	1.002	0.996	1.001	1.006	0.998	0.983	0.999
1969	1.000	1.001	0.996	1.001	1.006	0.998	0.985	0.999
1970	1.000	1.001	0.997	1.001	1.006	0.999	0.987	0.999
1971	1.000	1.002	0.997	1.001	1.006	0.999	0.988	1.000
1972	1.000	1.002	0.997	1.001	1.005	0.999	0.989	1.000
1973	1.000	1.001	0.998	1.001	1.005	0.999	0.990	0.999
1974	1.000	1.001	0.998	1.001	1.004	0.999	0.991	0.999
1975	1.000	1.001	0.998	1.001	1.004	0.999	0.991	0.999
1976	1.000	1.001	0.998	1.001	1.004	0.999	0.992	0.999
1977	1.000	1.001	0.998	1.001	1.004	0.999	0.993	0.999
1978	1.000	1.001	0.998	1.001	1.002	0.999	0.993	0.999
1979	1.000	1.001	0.998	1.001	1.001	0.999	0.993	0.999
1980	1.000	1.000	0.998	1.001	1.000	0.999	0.993	0.999
1981	1.000	1.000	0.998	1.001	0.999	0.999	0.994	0.999
1982	1.000	1.000	0.998	1.001	1.000	0.999	0.994	0.999
1983	1.000	1.000	0.999	1.001	1.001	0.999	0.996	1.000
1984	1.000	1.000	0.999	1.001	1.000	0.999	0.997	1.000
1985	1.000	1.000	0.999	1.000	1.000	1.000	0.998	1.000
1986	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	1.000	1.001	1.000	1.001	1.000	1.002	1.001
1989	1.000	1.000	1.000	1.000	1.002	1.001	1.004	1.001
1990	1.000	1.000	1.000	1.001	1.003	1.001	1.006	1.001
1991	1.000	1.000	1.000	1.001	1.003	1.002	1.007	1.002
1992	0.999	1.000	1.000	1.001	1.003	1.002	1.008	1.002
1993	0.999	1.000	1.000	1.001	1.003	1.002	1.008	1.002
1994	1.000	1.000	1.000	1.001	1.003	1.003	1.008	1.001
1995	1.000	1.000	1.000	1.002	1.003	1.003	1.008	1.001
1996	0.999	0.999	1.000	1.002	1.002	1.004	1.008	1.001
1997	0.999	0.999	1.000	1.002	1.002	1.004	1.008	1.002
1998	0.999	0.998	1.000	1.002	1.001	1.005	1.008	1.003
1999	0.999	0.998	1.000	1.002	1.001	1.007	1.010	1.006
2000	0.999	0.997	1.000	1.002	1.001	1.008	1.010	1.006
2001	0.999	0.997	1.000	1.002	1.000	1.007	1.009	1.005
2002	0.999	0.997	0.999	1.002	1.000	1.006	1.008	1.003
2003	0.999	0.997	0.999	1.003	1.000	1.005	1.007	1.001
2004	0.999	0.996	0.999	1.003	0.999	1.005	1.006	0.998
2005	0.999	0.996	0.999	1.003	0.999	1.006	1.005	0.998
				Growth (% per annum)				
1949-78	*-0.03*	*-0.05*	*-0.02*	*-0.02*	*-0.05*	*0.00*	*0.05*	*-0.03*
1978-05	*0.00*	*-0.02*	*0.00*	*0.01*	*-0.01*	*0.02*	*0.04*	*-0.01*
1949-05	*-0.02*	*-0.04*	*-0.01*	*-0.01*	*-0.03*	*0.01*	*0.04*	*-0.02*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*gae*	*gaj*	*gao*	*gej*	*geo*	*gjo*	*aej*	*aeo*
1949	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1950	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1951	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1952	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1953	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1954	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1955	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1956	1.008	1.011	1.009	1.004	1.008	1.009	1.009	1.004
1957	1.008	1.011	1.009	1.004	1.007	1.008	1.009	1.004
1958	1.002	1.005	1.002	0.998	1.002	1.002	1.002	0.998
1959	1.002	1.005	1.002	0.998	1.002	1.002	1.002	0.998
1960	1.002	1.005	1.002	0.998	1.002	1.002	1.002	0.998
1961	1.002	1.005	1.002	0.998	1.001	1.002	1.002	0.998
1962	1.002	1.004	1.002	0.997	1.001	1.002	1.003	0.997
1963	1.002	1.004	1.002	0.997	1.000	1.001	1.003	0.997
1964	1.001	1.004	1.002	0.998	1.000	1.001	1.003	0.997
1965	1.001	1.004	1.001	0.998	1.000	1.001	1.003	0.997
1966	1.001	1.004	1.001	0.999	1.000	1.000	1.003	0.997
1967	1.001	1.004	1.001	0.999	1.000	1.000	1.003	0.997
1968	1.001	1.004	1.001	0.999	1.000	1.000	1.003	0.997
1969	1.001	1.004	1.001	0.999	1.000	1.000	1.003	0.997
1970	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1971	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1972	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1973	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1974	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1975	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1976	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1977	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1978	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1979	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1980	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1981	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.997
1982	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.998
1983	1.000	1.004	1.001	1.000	1.000	1.000	1.003	0.998
1984	1.000	1.003	1.001	1.000	1.000	1.000	1.002	0.998
1985	1.000	1.002	1.000	1.000	1.000	1.000	1.002	0.999
1986	1.000	1.001	1.000	1.000	1.000	1.000	1.002	0.999
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1989	0.999	1.000	1.000	1.000	1.000	1.000	1.000	0.999
1990	0.999	1.000	1.000	0.999	1.000	1.000	1.000	0.998
1991	0.999	1.000	1.000	0.999	1.000	1.000	1.001	0.999
1992	1.000	1.000	1.001	1.000	1.000	1.000	1.002	1.000
1993	1.000	1.000	1.001	1.000	1.000	1.000	1.002	1.000
1994	1.001	1.000	1.001	1.000	1.000	1.000	1.003	1.001
1995	1.001	1.000	1.000	1.001	1.000	1.000	1.003	1.001
1996	1.002	1.000	1.000	1.001	1.000	1.000	1.003	1.001
1997	1.002	1.000	1.000	1.001	1.000	1.000	1.004	1.000
1998	1.002	1.000	0.999	1.001	1.000	1.000	1.005	1.000
1999	1.002	1.000	1.000	1.001	1.001	1.000	1.006	1.000
2000	1.002	1.000	0.999	1.001	1.001	1.000	1.006	1.000
2001	1.002	1.000	0.999	1.000	1.001	1.000	1.007	1.000
2002	1.002	1.000	0.999	0.999	1.001	1.000	1.008	1.001
2003	1.002	1.000	0.999	0.999	1.000	1.000	1.008	1.002
2004	1.002	1.001	1.000	0.998	1.000	1.000	1.009	1.002
2005	1.002	1.001	1.000	0.999	1.000	1.000	1.010	1.002
				Growth (% per annum)				
1949-78	*-0.03*	*-0.03*	*-0.03*	*-0.02*	*-0.03*	*-0.03*	*-0.02*	*-0.03*
1978-05	*0.01*	*-0.01*	*0.00*	*-0.01*	*0.00*	*0.00*	*0.03*	*0.02*
1949-05	*-0.01*	*-0.02*	*-0.02*	*-0.01*	*-0.01*	*-0.02*	*0.00*	*0.00*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*ajo*	*ejo*	*sgae*	*sgaj*	*sgao*	*sgej*	*sgeo*	*sgjo*
1949	1.009	0.944	0.993	0.993	0.992	0.993	0.993	0.991
1950	1.009	0.944	0.993	0.993	0.992	0.993	0.993	0.991
1951	1.009	0.944	0.993	0.993	0.992	0.993	0.993	0.991
1952	1.009	0.944	0.993	0.993	0.992	0.993	0.993	0.991
1953	1.008	0.944	0.993	0.993	0.992	0.993	0.993	0.991
1954	1.008	0.943	0.993	0.993	0.992	0.993	0.993	0.991
1955	1.008	0.943	0.993	0.993	0.992	0.993	0.993	0.991
1956	1.008	0.943	0.993	0.993	0.992	0.994	0.993	0.991
1957	1.008	0.943	0.993	0.993	0.992	0.994	0.993	0.992
1958	1.002	0.940	1.000	0.999	0.999	1.001	0.999	0.998
1959	1.002	0.939	1.000	0.999	0.998	1.000	0.999	0.998
1960	1.002	0.940	0.999	0.999	0.998	1.000	0.999	0.998
1961	1.002	0.938	1.000	0.999	0.998	1.000	0.999	0.998
1962	1.001	0.936	1.000	1.000	0.999	1.001	1.000	0.998
1963	1.001	0.935	1.000	1.000	0.999	1.001	1.000	0.999
1964	1.001	0.943	1.000	1.000	0.999	1.000	1.000	0.999
1965	1.001	0.949	1.000	1.000	0.999	1.000	1.000	1.000
1966	1.001	0.955	1.000	1.000	0.999	1.000	1.000	1.000
1967	1.001	0.959	1.000	1.000	0.999	1.000	1.000	1.000
1968	1.001	0.963	1.000	1.000	0.999	1.000	1.000	1.000
1969	1.002	0.967	1.000	1.000	0.999	1.000	1.000	1.000
1970	1.002	0.970	1.000	1.000	0.999	1.000	1.000	1.000
1971	1.002	0.975	1.000	1.000	0.999	1.000	1.000	1.000
1972	1.002	0.979	1.000	1.000	0.999	1.000	1.000	1.000
1973	1.002	0.982	1.000	1.000	0.999	1.000	1.000	1.000
1974	1.002	0.985	1.000	1.000	0.999	1.000	1.000	1.000
1975	1.002	0.988	1.000	1.000	0.999	1.000	1.000	1.000
1976	1.002	0.990	1.000	1.000	0.999	1.000	1.000	1.000
1977	1.002	0.992	1.000	1.000	0.999	1.000	1.000	1.000
1978	1.001	0.994	1.000	1.000	0.999	1.000	1.000	1.000
1979	1.001	0.994	1.000	1.000	0.999	1.000	1.000	1.000
1980	1.001	0.994	1.000	1.000	0.999	1.000	1.000	1.000
1981	1.001	0.995	1.000	1.000	0.999	1.000	1.000	1.000
1982	1.001	0.996	1.000	1.000	0.999	1.000	1.000	1.000
1983	1.001	0.996	1.000	1.000	0.999	1.000	1.000	1.000
1984	1.001	0.996	1.000	1.000	0.999	1.000	1.000	1.000
1985	1.001	0.997	1.000	1.000	1.000	1.000	1.000	1.000
1986	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	1.007	1.000	1.000	1.000	1.000	1.000	1.000
1989	1.000	1.014	1.000	1.000	1.000	1.000	1.000	1.000
1990	1.000	1.019	1.000	1.000	1.000	1.000	1.000	1.000
1991	1.001	1.026	1.000	1.000	1.000	1.000	1.000	1.000
1992	1.001	1.032	1.000	1.000	0.999	1.000	1.000	1.000
1993	1.001	1.038	1.000	1.000	0.999	1.000	1.000	1.000
1994	1.001	1.044	0.999	1.000	0.999	1.000	1.000	1.000
1995	1.001	1.050	0.999	1.000	0.999	1.000	1.000	1.000
1996	1.001	1.047	0.999	1.000	1.000	1.000	1.000	1.000
1997	1.001	1.044	0.999	1.000	1.000	1.000	1.000	1.000
1998	1.000	1.040	0.999	1.000	1.000	1.000	1.000	1.000
1999	1.001	1.040	0.999	1.000	1.000	1.000	0.999	1.000
2000	1.001	1.034	0.999	1.000	1.001	1.000	0.999	1.000
2001	1.001	1.036	0.999	1.000	1.001	1.001	0.999	1.001
2002	1.001	1.041	0.999	1.000	1.000	1.001	0.999	1.001
2003	1.002	1.047	0.999	1.000	1.000	1.001	0.999	1.001
2004	1.002	1.053	0.999	1.000	1.000	1.001	1.000	1.002
2005	1.002	1.060	0.999	1.000	1.000	1.001	1.000	1.001
			Growth (% per annum)					
1949-78	*-0.03*	*0.18*	*0.02*	*0.03*	*0.03*	*0.02*	*0.03*	*0.03*
1978-05	*0.00*	*0.24*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*0.01*
1949-05	*-0.01*	*0.21*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.02*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*saej*	*saeo*	*sajo*	*sejo*	*gaej*	*gaeo*	*gajo*	*gejo*
1949	0.993	0.995	0.992	1.052	0.994	0.993	0.993	1.047
1950	0.993	0.995	0.992	1.052	0.994	0.993	0.993	1.047
1951	0.993	0.995	0.992	1.052	0.994	0.993	0.993	1.047
1952	0.993	0.995	0.992	1.052	0.994	0.993	0.993	1.047
1953	0.993	0.995	0.992	1.052	0.994	0.993	0.993	1.047
1954	0.993	0.995	0.992	1.053	0.994	0.993	0.993	1.047
1955	0.993	0.995	0.993	1.053	0.994	0.993	0.993	1.047
1956	0.993	0.995	0.993	1.053	0.994	0.993	0.993	1.047
1957	0.993	0.995	0.992	1.053	0.994	0.993	0.993	1.047
1958	1.000	1.001	0.999	1.059	1.000	0.999	0.999	1.054
1959	1.000	1.001	0.999	1.059	1.000	0.999	0.999	1.054
1960	1.000	1.001	0.999	1.059	1.000	0.999	0.999	1.054
1961	1.000	1.001	0.999	1.060	1.000	0.999	0.999	1.055
1962	1.000	1.002	0.999	1.060	1.000	1.000	0.999	1.056
1963	1.000	1.002	0.999	1.060	1.001	1.000	0.999	1.056
1964	1.001	1.002	0.999	1.055	1.001	1.000	1.000	1.053
1965	1.000	1.002	0.999	1.049	1.000	1.000	1.000	1.047
1966	1.000	1.002	0.999	1.044	1.000	1.000	1.000	1.042
1967	1.000	1.002	0.999	1.040	1.000	1.000	1.000	1.038
1968	1.000	1.002	0.999	1.036	1.000	1.000	1.000	1.034
1969	1.000	1.002	0.999	1.033	1.000	1.000	1.000	1.031
1970	1.000	1.002	0.999	1.029	1.000	1.000	1.000	1.027
1971	1.000	1.002	0.999	1.024	1.000	1.000	1.000	1.023
1972	1.000	1.001	0.999	1.020	1.000	1.000	1.000	1.018
1973	1.000	1.001	0.999	1.017	1.000	1.000	1.000	1.015
1974	1.000	1.001	0.999	1.014	1.000	1.000	1.000	1.013
1975	0.999	1.001	0.999	1.012	1.000	1.000	1.000	1.010
1976	0.999	1.001	0.999	1.009	1.000	1.000	1.000	1.007
1977	0.999	1.001	0.999	1.007	1.000	1.000	1.000	1.005
1978	0.999	1.001	0.999	1.006	1.000	1.000	1.000	1.004
1979	0.999	1.001	0.999	1.005	1.000	1.000	1.000	1.004
1980	0.999	1.001	0.999	1.005	1.000	1.000	1.000	1.003
1981	0.999	1.001	0.999	1.004	1.000	1.000	1.000	1.002
1982	0.999	1.001	0.999	1.003	1.000	1.000	1.000	1.002
1983	1.000	1.001	0.999	1.004	1.000	1.000	1.000	1.003
1984	1.000	1.001	1.000	1.003	1.000	1.000	1.000	1.002
1985	1.000	1.000	1.000	1.002	1.000	1.000	1.000	1.002
1986	1.000	1.000	1.000	1.001	1.000	1.000	1.000	1.001
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	1.000	1.000	0.993	1.000	1.000	1.000	0.993
1989	1.000	1.001	1.000	0.987	1.000	1.000	1.000	0.988
1990	0.999	1.001	1.000	0.982	1.001	1.000	1.000	0.983
1991	0.999	1.001	0.999	0.976	1.000	1.000	1.000	0.977
1992	0.999	1.000	0.999	0.970	1.000	1.000	1.000	0.972
1993	0.998	1.000	0.999	0.965	1.000	1.000	1.000	0.966
1994	0.998	1.000	0.999	0.959	1.000	1.000	1.000	0.960
1995	0.998	1.000	0.999	0.953	1.000	1.000	1.000	0.955
1996	0.998	1.000	0.999	0.955	1.000	1.000	1.000	0.957
1997	0.998	1.000	0.999	0.958	1.000	1.000	1.000	0.960
1998	0.998	1.000	0.999	0.961	0.999	1.000	1.000	0.963
1999	0.998	1.000	0.999	0.965	0.999	0.999	1.000	0.968
2000	0.998	1.001	0.999	0.970	0.999	0.999	1.000	0.973
2001	0.998	1.001	0.999	0.968	0.999	1.000	1.000	0.969
2002	0.998	1.001	0.999	0.964	1.000	1.000	1.000	0.965
2003	0.998	1.001	0.999	0.961	1.000	1.000	1.000	0.961
2004	0.998	1.000	0.999	0.957	1.000	1.000	1.000	0.957
2005	0.998	1.000	0.999	0.952	1.000	1.000	1.000	0.954
				Growth (% per annum)				
1949-78	*0.02*	*0.02*	*0.03*	*-0.16*	*0.02*	*0.02*	*0.02*	*-0.15*
1978-05	*-0.01*	*0.00*	*0.00*	*-0.20*	*0.00*	*0.00*	*0.00*	*-0.19*
1949-05	*0.01*	*0.01*	*0.01*	*-0.18*	*0.01*	*0.01*	*0.01*	*-0.17*

Table A2: Decomposition of Labour Quality in Chinese Industry (cont'd)

Year	*aejo*	*sgaej*	*sgaeo*	*sgajo*	*sgejo*	*saejo*	*gaejo*	*sgaejo*
1949	1.047	1.007	1.007	1.007	0.955	0.956	0.955	1.047
1950	1.047	1.007	1.007	1.007	0.955	0.956	0.955	1.047
1951	1.047	1.007	1.007	1.007	0.955	0.956	0.955	1.047
1952	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1953	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1954	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1955	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1956	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1957	1.047	1.007	1.007	1.007	0.955	0.955	0.955	1.047
1958	1.053	1.000	1.000	1.001	0.948	0.949	0.949	1.054
1959	1.054	1.000	1.000	1.001	0.948	0.949	0.948	1.055
1960	1.054	1.000	1.001	1.001	0.948	0.949	0.948	1.055
1961	1.055	1.000	1.000	1.001	0.948	0.948	0.948	1.055
1962	1.055	1.000	1.000	1.000	0.947	0.948	0.948	1.055
1963	1.055	1.000	1.000	1.000	0.947	0.948	0.948	1.055
1964	1.053	1.000	1.000	1.000	0.950	0.950	0.950	1.052
1965	1.047	1.000	1.000	1.000	0.955	0.955	0.955	1.047
1966	1.042	1.000	1.000	1.000	0.959	0.960	0.959	1.043
1967	1.038	1.000	1.000	1.000	0.963	0.964	0.963	1.038
1968	1.034	1.000	1.000	1.000	0.967	0.967	0.967	1.035
1969	1.031	1.000	1.000	1.000	0.970	0.971	0.970	1.031
1970	1.027	1.000	1.000	1.000	0.973	0.974	0.973	1.027
1971	1.022	1.000	1.000	1.000	0.978	0.979	0.978	1.023
1972	1.018	1.000	1.000	1.000	0.982	0.983	0.982	1.019
1973	1.015	1.000	1.000	1.000	0.985	0.986	0.985	1.015
1974	1.012	1.000	1.000	1.000	0.987	0.988	0.987	1.013
1975	1.010	1.000	1.000	1.000	0.990	0.991	0.990	1.010
1976	1.007	1.000	1.000	1.000	0.992	0.993	0.993	1.008
1977	1.005	1.000	1.000	1.000	0.994	0.995	0.995	1.006
1978	1.003	1.000	1.000	1.000	0.996	0.997	0.996	1.004
1979	1.003	1.000	1.000	1.000	0.996	0.997	0.996	1.004
1980	1.003	1.000	1.000	1.000	0.997	0.998	0.997	1.003
1981	1.002	1.000	1.000	1.000	0.998	0.999	0.998	1.002
1982	1.001	1.000	1.000	1.000	0.998	0.999	0.998	1.002
1983	1.002	1.000	1.000	1.000	0.997	0.998	0.998	1.002
1984	1.002	1.000	1.000	1.000	0.998	0.998	0.998	1.002
1985	1.001	1.000	1.000	1.000	0.998	0.999	0.998	1.002
1986	1.001	1.000	1.000	1.000	0.999	0.999	0.999	1.001
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	0.993	1.000	1.000	1.000	1.007	1.007	1.007	0.993
1989	0.988	1.000	1.000	1.000	1.013	1.013	1.013	0.987
1990	0.983	1.000	1.000	1.000	1.017	1.018	1.017	0.983
1991	0.977	1.000	1.000	1.000	1.023	1.024	1.023	0.977
1992	0.971	1.000	1.000	1.000	1.029	1.030	1.029	0.972
1993	0.965	1.000	1.000	1.000	1.035	1.037	1.035	0.966
1994	0.959	1.001	1.000	1.000	1.041	1.043	1.042	0.960
1995	0.954	1.001	1.000	1.000	1.047	1.049	1.047	0.955
1996	0.956	1.001	1.000	1.000	1.045	1.047	1.045	0.957
1997	0.959	1.001	1.000	1.000	1.042	1.044	1.042	0.959
1998	0.962	1.001	1.000	1.000	1.038	1.040	1.039	0.963
1999	0.967	1.001	1.000	1.000	1.033	1.035	1.033	0.968
2000	0.973	1.001	1.000	1.000	1.027	1.028	1.028	0.973
2001	0.969	1.001	1.000	1.000	1.032	1.033	1.032	0.969
2002	0.965	1.000	1.000	1.000	1.036	1.038	1.037	0.965
2003	0.960	1.000	1.000	1.000	1.040	1.042	1.041	0.961
2004	0.956	1.000	1.000	1.000	1.044	1.047	1.045	0.957
2005	0.952	1.000	1.000	1.000	1.048	1.051	1.049	0.953
				Growth (% per annum)				
1949-78	*-0.15*	*-0.02*	*-0.02*	*-0.02*	*0.15*	*0.15*	*0.15*	*-0.15*
1978-05	*-0.19*	*0.00*	*0.00*	*0.00*	*0.19*	*0.20*	*0.19*	*-0.19*
1949-05	*-0.17*	*-0.01*	*-0.01*	*-0.01*	*0.17*	*0.17*	*0.17*	*-0.17*

Table B1: Quality of Labour Quality in Chinese Industry

Year	q	qsgaejo	qgaejo	qaejo	qejo	qej	qeo
1949	0.788	0.763	0.898	0.855	0.883	0.973	0.888
1950	0.797	0.778	0.908	0.865	0.894	0.973	0.899
1951	0.836	0.838	0.953	0.908	0.938	0.973	0.942
1952	0.858	0.871	0.981	0.934	0.965	0.982	0.962
1953	0.874	0.895	1.001	0.954	0.985	0.985	0.980
1954	0.866	0.875	0.989	0.942	0.972	0.984	0.968
1955	0.885	0.899	1.008	0.960	0.991	0.985	0.986
1956	0.969	1.016	1.097	1.047	1.081	0.986	1.075
1957	1.028	1.103	1.159	1.110	1.145	0.984	1.141
1958	0.968	0.945	0.993	0.956	0.993	0.951	1.014
1959	1.096	1.114	1.112	1.071	1.111	0.958	1.129
1960	1.151	1.206	1.163	1.122	1.163	0.959	1.181
1961	1.155	1.198	1.153	1.113	1.153	0.965	1.163
1962	1.158	1.185	1.142	1.104	1.144	0.969	1.151
1963	1.142	1.145	1.125	1.091	1.131	0.970	1.136
1964	1.141	1.114	1.125	1.098	1.133	0.975	1.139
1965	1.136	1.107	1.120	1.097	1.127	0.977	1.137
1966	1.142	1.118	1.126	1.106	1.131	0.981	1.140
1967	1.148	1.129	1.133	1.115	1.136	0.983	1.146
1968	1.170	1.164	1.157	1.140	1.158	0.985	1.167
1969	1.178	1.177	1.165	1.149	1.163	0.987	1.173
1970	1.182	1.190	1.168	1.154	1.164	0.988	1.175
1971	1.183	1.208	1.175	1.161	1.166	0.989	1.177
1972	1.173	1.211	1.172	1.160	1.160	0.990	1.170
1973	1.158	1.197	1.159	1.147	1.146	0.990	1.156
1974	1.146	1.185	1.148	1.138	1.134	0.990	1.144
1975	1.138	1.181	1.142	1.132	1.126	0.990	1.136
1976	1.127	1.171	1.132	1.123	1.115	0.990	1.125
1977	1.129	1.175	1.134	1.125	1.115	0.990	1.126
1978	1.097	1.130	1.103	1.095	1.086	0.993	1.092
1979	1.058	1.073	1.064	1.057	1.050	0.993	1.056
1980	1.041	1.049	1.044	1.039	1.032	0.993	1.038
1981	1.023	1.029	1.025	1.021	1.014	0.993	1.020
1982	1.031	1.040	1.034	1.030	1.023	0.994	1.028
1983	1.042	1.053	1.044	1.041	1.034	0.997	1.037
1984	1.030	1.037	1.031	1.028	1.023	0.998	1.025
1985	1.016	1.018	1.014	1.012	1.008	0.999	1.010
1986	1.011	1.012	1.008	1.007	1.005	1.000	1.006
1987	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1988	1.000	1.002	1.002	1.003	0.997	1.003	0.996
1989	1.003	1.020	1.019	1.019	1.006	1.009	1.004
1990	1.012	1.044	1.035	1.035	1.016	1.014	1.013
1991	1.025	1.062	1.047	1.047	1.019	1.017	1.016
1992	1.033	1.074	1.055	1.056	1.020	1.019	1.015
1993	1.020	1.056	1.035	1.036	0.995	1.018	0.992
1994	0.986	1.015	1.001	1.002	0.956	1.020	0.952
1995	0.974	0.988	0.986	0.989	0.938	1.023	0.933
1996	0.955	0.964	0.963	0.965	0.917	1.026	0.912
1997	0.946	0.957	0.946	0.949	0.902	1.030	0.897
1998	0.914	0.931	0.919	0.924	0.878	1.057	0.861
1999	0.986	1.056	1.017	1.023	0.972	1.089	0.937
2000	0.952	1.020	1.000	1.008	0.959	1.106	0.918
2001	0.909	0.964	0.943	0.949	0.900	1.085	0.872
2002	0.875	0.919	0.902	0.907	0.858	1.069	0.839
2003	0.853	0.892	0.868	0.872	0.823	1.055	0.811
2004	0.831	0.871	0.840	0.843	0.794	1.042	0.790
2005	0.818	0.864	0.831	0.834	0.785	1.040	0.779
			Growth (% per annum)				
1949-78	*1.19*	*1.41*	*0.74*	*0.89*	*0.74*	*0.07*	*0.74*
1978-05	*-1.08*	*-0.99*	*-1.04*	*-1.00*	*-1.19*	*0.17*	*-1.24*
1949-05	*0.07*	*0.22*	*-0.14*	*-0.04*	*-0.21*	*0.12*	*-0.23*

Table B2: Age Distribution of the Chinese Industrial Workforce

Year	age1	age2	age3	age4	age5	age6	age7
1949	9.07	29.21	21.16	25.94	11.53	2.01	1.09
1950	9.07	29.21	21.16	25.94	11.53	2.01	1.09
1951	9.06	29.20	21.16	25.94	11.53	2.01	1.09
1952	9.04	29.15	21.18	26.01	11.52	2.01	1.09
1953	9.03	29.13	21.19	26.03	11.52	2.01	1.09
1954	9.03	29.13	21.18	26.03	11.53	2.01	1.09
1955	9.02	29.12	21.18	26.04	11.53	2.01	1.09
1956	9.03	29.10	21.18	26.03	11.54	2.02	1.10
1957	9.03	29.09	21.16	26.01	11.55	2.04	1.12
1958	9.22	28.95	20.97	25.57	11.60	2.30	1.39
1959	9.24	28.71	20.91	25.53	11.63	2.43	1.54
1960	9.28	28.55	20.85	25.44	11.66	2.55	1.67
1961	9.20	28.56	20.92	25.63	11.65	2.47	1.58
1962	9.12	28.66	20.99	25.80	11.64	2.34	1.44
1963	9.06	28.79	21.07	25.95	11.62	2.21	1.30
1964	9.72	27.45	20.95	25.88	12.16	2.29	1.55
1965	10.30	26.19	20.76	25.64	12.64	2.53	1.94
1966	10.78	25.05	20.62	25.49	13.06	2.73	2.26
1967	11.16	24.09	20.50	25.40	13.44	2.89	2.51
1968	11.46	23.20	20.41	25.36	13.80	3.04	2.72
1969	11.77	22.41	20.32	25.30	14.11	3.17	2.91
1970	12.05	21.59	20.23	25.26	14.44	3.31	3.11
1971	12.11	20.85	20.20	25.34	14.81	3.46	3.24
1972	12.15	20.18	20.18	25.42	15.14	3.59	3.35
1973	12.30	19.65	20.13	25.40	15.36	3.68	3.47
1974	12.47	19.20	20.09	25.36	15.53	3.76	3.59
1975	12.57	18.73	20.07	25.38	15.74	3.84	3.67
1976	12.67	18.32	20.04	25.39	15.92	3.92	3.75
1977	12.70	17.99	20.03	25.42	16.08	3.98	3.80
1978	13.03	17.68	19.97	25.28	16.11	4.01	3.91
1979	13.47	17.55	19.89	25.03	16.02	4.00	4.05
1980	13.65	17.43	19.85	24.92	16.02	4.01	4.13
1981	13.75	17.31	19.83	24.86	16.05	4.02	4.18
1982	13.79	17.21	19.81	24.83	16.10	4.04	4.22
1983	13.32	18.41	18.63	25.88	15.84	4.07	3.85
1984	13.00	19.54	17.56	26.75	15.53	4.09	3.55
1985	12.70	20.56	16.57	27.55	15.26	4.10	3.26
1986	12.43	21.47	15.71	28.27	15.01	4.11	3.00
1987	12.26	22.32	14.94	28.90	14.74	4.09	2.75
1988	11.47	21.56	16.00	29.05	15.15	4.04	2.74
1989	10.60	20.77	17.04	29.23	15.61	4.02	2.74
1990	9.79	20.00	18.03	29.39	16.05	3.99	2.74
1991	9.30	19.24	18.05	29.49	17.14	3.96	2.82
1992	8.84	18.52	18.06	29.59	18.16	3.93	2.89
1993	8.41	17.88	18.13	29.70	19.09	3.87	2.94
1994	7.96	17.19	18.16	29.81	20.05	3.83	3.00
1995	7.59	16.58	18.16	29.87	20.94	3.80	3.07
1996	7.79	16.42	18.12	30.23	20.60	3.85	2.99
1997	8.00	16.22	18.07	30.61	20.26	3.93	2.91
1998	8.05	15.94	18.07	31.15	19.89	4.05	2.86
1999	8.00	15.56	18.04	31.70	19.65	4.21	2.84
2000	8.17	15.31	18.01	32.22	19.23	4.30	2.75
2001	8.25	14.89	16.98	32.50	19.76	4.63	3.00
2002	8.30	14.50	16.04	32.78	20.26	4.91	3.22
2003	8.31	14.12	15.19	33.04	20.73	5.19	3.43
2004	8.30	13.75	14.41	33.29	21.18	5.45	3.62
2005	8.30	13.44	13.71	33.50	21.58	5.68	3.80
			Growth (% per annum)				
1949-78	*1.30*	*-1.78*	*-0.21*	*-0.09*	*1.20*	*2.49*	*4.66*
1978-05	*-1.66*	*-1.01*	*-1.38*	*1.05*	*1.09*	*1.30*	*-0.10*
1949-05	*-0.16*	*-1.38*	*-0.77*	*0.46*	*1.13*	*1.87*	*2.25*

Table B3: Gender and Education Distribution of the Chinese Industrial Workforce

Year	gen1	gen2	edu1	edu2	edu3	edu4	edu5
1949	84.68	15.32	23.77	59.30	12.70	3.70	0.52
1950	84.68	15.32	23.77	59.30	12.70	3.70	0.53
1951	84.68	15.32	23.75	59.28	12.72	3.71	0.53
1952	84.70	15.30	23.35	58.71	13.25	4.08	0.61
1953	84.70	15.30	23.24	58.55	13.39	4.19	0.64
1954	84.72	15.28	23.25	58.55	13.35	4.19	0.65
1955	84.74	15.26	23.21	58.44	13.39	4.27	0.69
1956	82.90	17.10	23.19	58.39	13.41	4.30	0.71
1957	80.73	19.27	23.27	58.43	13.29	4.28	0.73
1958	81.69	18.31	24.30	59.24	12.05	3.55	0.87
1959	81.38	18.62	23.78	58.10	12.71	4.19	1.21
1960	79.80	20.20	23.63	57.55	12.90	4.47	1.44
1961	79.12	20.88	23.10	56.92	13.52	4.97	1.49
1962	77.82	22.18	22.91	56.89	13.69	5.11	1.39
1963	76.18	23.82	22.86	57.10	13.72	5.09	1.24
1964	72.93	27.07	20.94	54.00	17.09	6.95	1.02
1965	70.81	29.19	19.50	51.20	19.71	8.51	1.08
1966	69.33	30.67	18.03	48.49	22.27	10.04	1.17
1967	68.12	31.88	16.81	46.30	24.39	11.29	1.21
1968	67.22	32.78	15.67	44.24	26.36	12.47	1.27
1969	66.25	33.75	14.68	42.45	28.09	13.47	1.30
1970	65.41	34.59	13.65	40.61	29.86	14.51	1.37
1971	65.07	34.93	12.64	38.85	31.50	15.55	1.45
1972	64.76	35.24	11.71	37.29	32.99	16.48	1.53
1973	64.24	35.76	11.05	36.12	34.15	17.13	1.56
1974	63.78	36.22	10.49	35.13	35.13	17.68	1.57
1975	63.54	36.46	9.93	34.15	36.09	18.23	1.60
1976	63.34	36.66	9.43	33.28	36.95	18.71	1.63
1977	63.13	36.87	9.04	32.58	37.63	19.11	1.65
1978	62.77	37.23	8.74	32.04	38.27	19.33	1.63
1979	62.09	37.91	8.65	31.81	38.62	19.36	1.55
1980	61.51	38.49	8.46	31.44	38.99	19.58	1.53
1981	61.13	38.87	8.25	31.05	39.37	19.82	1.52
1982	60.77	39.23	8.03	30.65	39.71	20.09	1.52
1983	60.56	39.44	7.16	29.69	41.25	20.17	1.73
1984	60.33	39.67	6.47	28.98	42.58	20.10	1.87
1985	60.11	39.89	5.84	28.35	43.79	20.02	2.01
1986	59.70	40.30	5.23	27.67	44.88	20.06	2.15
1987	59.14	40.86	4.68	27.09	45.87	20.09	2.27
1988	59.00	41.00	4.08	25.30	46.77	21.14	2.71
1989	59.14	40.86	3.46	23.43	47.66	22.25	3.19
1990	59.19	40.81	2.86	21.64	48.57	23.30	3.63
1991	59.11	40.89	2.70	21.31	48.91	23.18	3.90
1992	59.01	40.99	2.57	21.07	49.17	23.05	4.14
1993	58.88	41.12	2.47	21.06	49.49	22.72	4.26
1994	58.83	41.17	2.37	20.96	49.73	22.48	4.46
1995	58.23	41.77	2.25	20.70	49.95	22.38	4.72
1996	57.99	42.01	2.09	19.92	50.34	22.56	5.08
1997	57.87	42.13	1.92	19.05	50.79	22.80	5.44
1998	57.14	42.86	1.69	17.61	50.34	23.74	6.63
1999	56.94	43.06	1.45	16.11	49.65	24.82	7.98
2000	56.35	43.65	1.23	14.87	49.72	25.39	8.78
2001	56.97	43.03	1.33	15.28	51.12	24.05	8.21
2002	57.03	42.97	1.42	15.59	52.21	22.97	7.81
2003	57.30	42.70	1.50	15.83	53.12	22.04	7.51
2004	57.53	42.47	1.57	16.01	53.87	21.25	7.31
2005	57.72	42.28	1.63	16.18	54.55	20.52	7.13
			Growth (% per annum)				
1949-78	*-1.06*	*3.22*	*-3.51*	*-2.18*	*4.02*	*6.08*	*4.12*
1978-05	*-0.31*	*0.47*	*-6.04*	*-2.50*	*1.32*	*0.22*	*5.63*
1949-05	*-0.68*	*1.83*	*-4.68*	*-2.29*	*2.64*	*3.11*	*4.77*

Table B4: Occupation and Ownership Structure of the Chinese Industrial Workforce

Year	job1	job2	job3	own1	own2	own3
1949	8.54	0.70	90.75	43.51	1.67	54.82
1950	8.55	0.70	90.75	44.22	1.85	53.93
1951	8.60	0.71	90.69	47.54	2.17	50.29
1952	10.20	0.81	88.99	49.12	2.51	48.37
1953	10.61	0.86	88.53	50.78	2.80	46.42
1954	10.37	1.01	88.62	47.61	6.78	45.62
1955	10.25	1.31	88.45	45.40	14.84	39.76
1956	10.26	1.35	88.40	48.35	29.81	21.84
1957	9.67	1.56	88.76	52.47	38.14	9.38
1958	5.77	0.87	93.36	49.29	17.16	33.55
1959	7.33	1.26	91.40	61.16	16.94	21.91
1960	7.55	1.50	90.96	71.24	26.23	2.53
1961	8.91	2.41	88.68	68.62	27.51	3.87
1962	9.10	3.15	87.75	66.75	29.95	3.30
1963	9.07	3.57	87.37	64.81	32.33	2.86
1964	8.92	3.51	87.57	64.25	33.32	2.43
1965	8.15	3.25	88.60	63.27	35.05	1.68
1966	8.66	3.13	88.21	62.87	36.04	1.09
1967	8.60	3.02	88.38	63.05	36.40	0.55
1968	8.64	2.98	88.38	65.44	34.36	0.20
1969	8.59	2.87	88.54	66.00	33.92	0.08
1970	8.56	2.77	88.68	65.87	32.76	1.37
1971	8.55	2.74	88.71	66.37	31.04	2.59
1972	9.01	2.70	88.29	65.35	31.78	2.88
1973	8.93	2.52	88.55	63.17	33.74	3.09
1974	9.10	2.47	88.43	61.51	34.99	3.49
1975	9.00	2.37	88.63	60.77	34.93	4.30
1976	9.01	2.26	88.72	59.68	34.49	5.83
1977	8.80	2.31	88.89	59.54	35.38	5.09
1978	10.49	2.36	87.15	55.29	33.86	10.84
1979	10.53	2.17	87.30	50.76	32.41	16.83
1980	10.44	2.20	87.36	48.18	33.49	18.33
1981	10.47	2.19	87.33	46.07	33.66	20.27
1982	10.70	2.38	86.92	46.72	34.16	19.12
1983	11.38	2.65	85.98	47.53	34.67	17.79
1984	11.45	2.67	85.89	45.61	36.23	18.16
1985	11.70	2.65	85.65	42.77	40.16	17.07
1986	11.74	2.91	85.35	42.03	41.49	16.48
1987	11.65	3.24	85.12	41.27	41.87	16.87
1988	11.37	3.89	84.74	40.47	41.89	17.64
1989	11.32	4.50	84.19	40.97	41.67	17.36
1990	11.43	4.67	83.90	41.49	41.66	16.85
1991	11.51	4.74	83.74	41.57	42.12	16.31
1992	11.57	4.96	83.47	41.38	42.02	16.60
1993	11.10	5.16	83.74	38.25	43.83	17.92
1994	11.00	5.46	83.54	33.63	46.42	19.95
1995	11.03	5.83	83.14	31.60	47.19	21.21
1996	10.94	5.87	83.19	29.80	45.73	24.47
1997	10.91	5.93	83.15	28.07	45.62	26.31
1998	10.26	9.62	80.12	22.84	47.03	30.14
1999	10.44	12.92	76.64	28.85	49.25	21.89
2000	10.04	14.66	75.30	26.04	50.03	23.94
2001	9.25	13.39	77.36	22.69	49.09	28.22
2002	8.65	12.40	78.96	20.15	50.72	29.12
2003	8.08	11.65	80.27	17.98	52.74	29.28
2004	7.51	10.90	81.59	16.15	55.82	28.03
2005	7.55	11.27	81.18	15.00	59.05	25.95
			Growth (% per annum)			
1949-78	*0.74*	*4.42*	*-0.14*	*0.86*	*11.35*	*-5.62*
1978-05	*-1.21*	*5.96*	*-0.26*	*-4.72*	*2.08*	*3.28*
1949-05	*-0.22*	*5.08*	*-0.20*	*-1.88*	*6.57*	*-1.33*