Wage and Employment Determination
in Chinese State-Owned Enterprises

1980 – 1994

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Abstract

While the restructuring of state-owned enterprises (SOEs) in transitional economies involves a wide range of changes, wage and employment practices are especially important because they not only affect production efficiency, but also have potentially adverse social impacts on urban unemployment and income inequality. Using an extensive establishment-level panel data, I present some of the first empirical evidence on how Chinese SOEs have changed their employment and wage setting behaviour in response to gradual decentralization. Despite the deep-rooted egalitarian culture of China’s industrial system, I show that the link between workers’ pay and enterprise performance strengthened between 1980 and 1994. However, the effect of reform on employment decisions appears to have been much weaker. Drawing on a dynamic factor demand model, I find that employment adjustment to output or price shocks did not increase over the slow rates of the early 1980s. Given the existing distortions in the state sector, however, it appears that employment decisions are “efficient”: the marginal product of labour is equal to its opportunity costs (as measured by alternative wages) rather than to the firm-specific wage. This combination of worker rents in terms of higher than competitive wages, slow adjustment of employment, and employment setting on the basis of “alternative wages” implies that the decentralization in Chinese labour market is heavily skewed towards wage determination. The government continues to play an important role in employment decisions at least until the mid-1990s. These results also suggest that wages and employment are two separate instruments targeted at efficiency and equality respectively.
I. Introduction

A key element of economic reforms in transitional economies is the decentralization of decision-making for state-owned enterprises (SOEs). The success of this process, at least in terms of enhanced productivity, has strong interactions with the labour market. First, SOE restructuring involves a wide range of behavioural changes, wage and employment practices are central to improving their efficiency. Second, these practices have profound implications for workers’ welfare and related public policies. For example, increasing firms’ autonomy on workers’ compensation allows for stronger incentive schemes, which may increase labour productivity. Greater flexibility in hiring and dismissal decisions improves employment adjustments to demand shocks, and consequently enterprise profitability. However, from a macro perspective, these responses could, in turn, have an immense social impact on unemployment and income inequality, and possibly the sustainability of reforms. More generally, this relates to the public policy debate on maintaining a balance between efficiency and equity in transitional economies, where the social security systems are poorly developed.

The main focus of this paper is to examine changes in China’s labour market as it has evolved from a centrally planned system to a more decentralized environment. Labour policies in the Chinese state sector have changed substantially since economic reforms began in 1978. Bonuses were revived as incentive pay in workers’ compensation, and short-term contract labour was introduced in an attempt to increase mobility in the traditional “iron rice bowl” employment system. Although there has been much discussion of the effects of general reform policies on productivity (e.g., Li 1997), few empirical studies focus on the corresponding changes in underlying wage- and employment-setting behaviour. This study uses an extensive establishment-level panel data covering the early phase of reform through to the mid-1990s. The data provide in-depth information on over

\[\text{Recent examples are } \text{Woo et al. (1994), Jefferson, Rawski and Zheng (1996), Gordon and Li (1995) and Li (1997), who estimate the total factor productivity growth of state industry. Groves et al. (1994) and Yao (1997) concentrate on the impact of incentive pay on performance.}\]
750 SOEs, and allow for a thorough examination of the evolution of managers’ and the government’s role in labour decisions at various phases of the reform.

This paper sheds light not only on Chinese economic reform, but also contributes more generally to questions regarding the pace of labour market reforms. As Blanchard observes (1997), the “big bang” transitions in most Central and Eastern European countries led to the well-known U-shaped responses in output and employment – that is, an initial decline followed by recovery. With the exception of the Czech Republic, unemployment increased to more than 10 percent. In contrast, China’s urban unemployment rate remained constant at approximately 3 percent throughout the 1980s and mid-1990s. Therefore, comparisons between China and post-communist Central and Eastern countries\(^2\) (e.g., Basu, Estrin and Svejnar 1997) provide a more comprehensive assessment of emerging labour markets in transitional economies with different reform patterns.

What trends in wages and employment might we expect if Chinese SOEs began to behave like firms in a market economy? In the post-reform era, labour issues were no longer subject to direct control and mandatory plans. Decisions were made through formal or implicit negotiations between enterprise managers and the government. Both parties may have had several objectives other than profitability of the enterprise (e.g., see Walder 1989; Gorden and Li 1997). Although details of the negotiation process are not documented, the co-determination of wages and employment can be conceptualized in a Nash bargaining framework with three objectives: enterprise profits, employment, and workers’ compensation. Delegation of power from the government to managers implies shifting the emphasis towards profitability, which in turn affects the wage and employment setting behaviour in three ways.

First, workers’ pay will be related to the financial prosperity of the enterprise. The link between pay and profitability is generally referred to rent-sharing between workers and employers (e.g., see Hildreth and Oswald 1997). Workers in a centrally planned economy, on the other hand, are rewarded uniformly, regardless of their individual or enterprise productivity. Second, enterprise-specific wages will play a more decisive role in

\(^2\) For a survey of principal econometric studies of labour market issues in the Central and Eastern countries, see Svejnar (1998).
employment determination. According to a traditional labour demand model, profits are maximized when the marginal product of labour equals the firm’s specific wage rate. In contrast, a social planner (with “efficient contracting”) will equate the marginal product of labour across firms according to the outside opportunity costs (e.g., see Brown and Ashenfelter 1986); that is, employment is independent of the firm’s own wage. Third, greater flexibility of personnel decisions would increase the speed of employment adjustments to demand shocks (e.g., see Hamermesh and Pfann 1996).

Despite the deep-rooted egalitarian culture of China’s industrial system, this study finds empirical evidence in support of a strong link between workers’ pay and enterprise performance that has strengthened over the reform period. This trend is also associated with rising wage inequality across enterprises. However, the effect of reform on employment setting appears to be much weaker. Using a dynamic factor demand model (e.g., see Card 1986), it appears that employment decisions are “efficient”: the marginal product of labour is equal to its opportunity costs as measured by the alternative wage, rather than to the firm’s specific wage. More importantly, there is no evidence of increased speed of employment adjustment to output, wage, or price shocks. These results imply that, though SOEs have more control over wage determination, the government maintains a tight control on labour allocation after reforms. This is consistent with the conclusion of other studies (e.g., Brandt and Zhu 1998) that the Chinese government was committed to maintaining stable employment in the state sector throughout much of the transition.

The paper proceeds as follows. Section 2 outlines the background of the labour reform in China’s state sector. Section 3 presents a Nash bargaining model that conceptualizes the evolution of the underlying wage and employment setting behaviour over the reform period. Section 4 describes the key aspects of the longitudinal data set. Econometric specifications and empirical results are discussed in Section 5, while Section 6 offers concluding remarks.
II. Wage and Employment Reform in Chinese SOEs

Prior to the reform, Chinese industry was almost completely dominated by the state sector. It accounted for 78 percent of the total output as well as urban employment in 1978. SOEs had very limited autonomy on issues concerning prices, outputs, inputs, and investments. In December of 1978, economic reforms in both the agricultural and industrial sectors were initiated by the Chinese Community Party (CCP) leader, Deng Xiaoping, who believed that the market could function as an important supplement to the existing planned economy in order to improve efficiency. At the outset, only a few enterprises in Sichuan were selected for experiments to increase autonomy. The dual-track pricing system introduced in 1984 was considered as the cornerstone of industrial reforms in China. The basic rationale of this new pricing system is that enterprises were allowed to sell their products at a price freely adjusted to the market conditions after fulfilling the quotas predetermined by their supervisory agencies. In this section, I summarize the key aspects of changes in wage and employment policies during the 1980s.³

1. Wages

Monetary rewards⁴ for workers in Chinese SOEs mainly consist of two components: the basic wage and a bonus. A standardized national scale for the basic wage was first formulated by the central government in 1956. In order to ensure that workers were paid according to their “effort contributed,” wages were determined by workers’ experience and the skill level of their occupation. After adjusting for living standards in different geographic areas and various working conditions across industries, the scale turned out to be extremely complicated, with over 300 classes and 8 sub-grades within each class.⁵ However, the central government did not revise the scale frequently enough to keep up

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³ For a comprehensive picture of the Chinese industrial reform, see Naughton (1995).

⁴ In addition to monetary wages, workers’ compensation includes housing subsidies, medical insurance, and payments in kind, such as food and clothing.

⁵ Kao, 1991, p. 25.
with the changes in socioeconomic conditions. Only four minor adjustments were made between 1957 and 1977.\(^6\) Effectively, basic wages were frozen for two decades. The average real wage\(^7\) in 1977 was about 20 percent lower then in 1956.

During the 1950s and early 1960s, bonuses were distributed as a certain percentage\(^8\) of the basic wages if the enterprise was able to achieve the planned targets. However, Mao Zedong, Chairman of the CCP, criticized any materialistic incentive in workers’ pay as contrary to the Party’s political ideology. He believed that workers should be motivated by moral education. Consequently, all sorts of incentive pay, including bonuses, were officially abolished at the time of the Cultural Revolution in 1966. Bonuses were then replaced by supplementary wages, which were uniformly distributed across firms. In summary, the wage system in the state sector was far removed from a market, and compensation did not reflect workers’ or enterprise productivity. Egalitarianism was the main guideline in determining workers’ wage in the pre-reform era.

Following the death of Mao and the downfall of the Gang of Four, Deng reemphasized the link between pay and performance. Egalitarianism was no longer considered an ideological issue in the CCP. In accordance with the original principle for the uniform wage scale set in 1956, workers would be rewarded according to their “effort contributed.” As a result, a bonus system very similar to that of the 1950s, was revived\(^9\) as one of the key elements of the industrial reforms in 1978. Enterprises achieving the plan targets were entitled to bonus payments equal to a certain percentage of the total wage bill.\(^10\) Beginning in 1979, a new policy was introduced that allowed the bonus to be tied to enterprise profitability. Managers from selected SOEs were given the autonomy to determine the bonus amount which was paid out of their own retained profits. In order to

\(^6\) Adjustments were made in 1959, 1961, 1963 and 1971.

\(^7\) Average real wage refers to the average nominal wage of staff and workers in all state-owned units deflated by the cost of living index. Figures are from Statistical Yearbook of China 1983.

\(^8\) Usually less than 7 percent (Shirk 1993, p.16).

\(^9\) Besides bonuses, the piece-rate wages were also revived.

\(^10\) The bonus was 5 percent for achieving eight plan targets, but it was cut down to 3 percent for four targets (Shirk 1993, p. 198).
control the trend to rapidly increasing bonus payments, a cap of less than 2 months of the basic wage was imposed in 1982. Two years later, this limit was replaced by a progressive tax system. Bonuses of less than 2.5 months of the basic wages were tax free. Between 2.5 to 4 months the tax rate was 30 percent. This increased to 100 percent between 4 to 6 months, and to 300 percent for over 6 months. The percentage of the total wage bill paid as bonuses and piece-rate wages increased from 2.4 percent in 1978 to 23.3 percent in 1993, then declined by 6.5 percent over the next two years.

2. Employment

Allocation of industrial labour in the pre-reform era in China was even more bureaucratic than the Soviet Union. Instead of firms competing for labour, workers were directly assigned to them by the government. Labour movement between firms was restricted and most of the employment was for the worker’s lifetime. Under this “iron rice bowl” policy, the resulting surplus labour in the state sector has been a target of reformers. In my sample, 60 percent of the managers reported that more than one-fifth of their workers were redundant in 1994. This is consistent with the results from other studies. For example, Wu (1998) estimates that the redundancy rate was about 30 percent in 1994.

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11 The progressive tax rate was significantly lowered in 1985 and 1987. In 1987, no tax was imposed on bonuses up to 4 months of the basic wages. Between 4 to 5 months, the tax rate was only 20 percent. The rate increased to 50 percent between 5 to 6 months, 100 percent between 6 to 7 months, and 200 percent over 7 months.

12 Figures are from China Labour Statistical Yearbook 1996.

13 This is probably due to the fact that managers who are able to redirect part of the bonuses into basic wages as enterprises are given more autonomy in determining basic wages. There are two advantages to this kind of manipulation. First, shifting to basic wages can reduce the amount of accounting profits, which results in lower profit tax. Second, the bonus payment is under control without exceeding the tax free limit.

14 However, a recent study by Dong and Putterman (1999) provides an alternative interpretation of the problem of overstaffing. They argue that SOEs acted like a collective monopsonist in the pre- and early reform era. Hence, employment was set below the socially efficient level, and that when the state’s monopsony power was gradually eroded by competition from the private sector, profit maximizing SOEs should have expanded employment to competitive levels.
In order to improve labour mobility in the “iron rice bowl,” various policies were implemented in the mid-1980s. First, the labour contract system\textsuperscript{15} was officially applied to all new workers entering the state sector in 1986. The duration of the contract could vary from 3 to 20 years and renewal depended on the worker’s individual performance. The proportion of contract workers in the state sector increased dramatically from 13 percent of total workers in 1990 to 40 percent in 1995.\textsuperscript{16} In addition, direct state control over labour allocation was reduced and managers were granted more autonomy in hiring and dismissal of workers.\textsuperscript{17}

Despite these reforms, the state sector’s share of total urban employment declined only very slightly from 78.4 percent in 1978 to 73.5 percent in 1995.\textsuperscript{18} The Chinese government has been very cautious in reducing the existing redundant lifetime SOE workers. Since a considerably large portion of urban workers are employed in the state sector, massive layoffs would substantially increase the urban unemployment rate. This kind of economic imbalance might lead to social instability that would threaten the leadership of CCP cadres. In order to maintain a stable unemployment rate in urban cities, labour policy at the macro level is first designed by the Central Labour Bureau. Employment targets are then allocated to the local labour bureaus, whose task is to implement the national policy locally within their enterprises. A series of negotiations among the local labour bureaus and SOE managers follow to determine employment at the enterprise level. This suggests that economic reformers and the Central Labour Bureau have competing objectives concerning the improved flexibility of the labour market. One purpose of my study is to determine which groups seem to be holding greater sway.

\textsuperscript{15} In China, contract workers are different from temporary workers. The former are employed under the state labour plan, and thus have rights comparable to those of the permanent workers, except lifetime employment. For details of the implementation of the labour contract system, see White (1987).

\textsuperscript{16} China Labour Statistical Year Book 1996.

\textsuperscript{17} More than 75\% of the managers in my sample reported that they had the right to refuse to accept employees assigned by higher authorities by 1994.

\textsuperscript{18} China Labour Statistical Yearbook 1996.
III. Conceptual Framework

The essence of the Chinese labour reform is to expand enterprise autonomy progressively by delegating power from higher authorities to enterprise managers. In this section, I develop a conceptual model to illustrate the impact of this process on wage and employment setting behaviour. The purpose is to identify testable implications in the empirical section.

1. Pre-Reform: Social Planner

Given the dominance of SOEs in the pre-reform era, they served not only as the government’s major source of income, but also as an effective instrument of controlling the urban unemployment rate. Workers are centrally allocated in order to maximize the social welfare which depends on the “social rents” and total employment of the entire state sector. Assuming workers are homogeneous, one representation of this problem can be stated as

\[
\text{Max } U^S = \left( \sum R^i(n_i) - a \sum n_i \right)^{\gamma_i} \left( \sum n_i \right)^{\gamma_r}
\]  

where \( R^i(n_i) \) and \( n_i \) are the revenue function and the number of workers employed in enterprise \( i \) respectively. Price and investment distortions due to ideological preferences of the CCP are reflected in the difference of \( R^i(n_i) \) across firms. The outside opportunity costs of employment is \( a \), which is usually measured by the alternative wage rate.\(^{19}\) Rents generated in enterprise \( i \) are defined as the amount of “remaining revenue,” \( R^i(n_i) - a n_i \). Therefore, the first term in equation (1), \( \sum R^i(n_i) - a \sum n_i \), represents the “social rents” of the entire state sector. The first order condition for \( n_i \) can be written as

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\(^{19}\) In a perfectly competitive market, the alternative wage rate is considered as the market clearing competitive wage.
\[ R^n_i(n_i) = \frac{-\gamma_2}{\gamma_1} \sum_{n_i} R^n_i(n_i) - a \sum_{n_i} n_i + a. \]  

(2)

If workers earn a portion \( s_w \) of the “social rents” from the government, their wage rate takes the general form

\[ w_i = s_w \left( \frac{\sum R^n_i(n_i)}{\sum n_i} - a \right) + a. \]  

(3)

Equations (2) and (3) provide a simple characterization of the wage and employment setting behaviour in Chinese SOEs before the reforms. First, workers are allocated administratively so that the marginal product of labour is equal across enterprises. For equation (2), the optimal level of employment depends on the outside opportunity wage \( a \) and the relative importance of “social rents” \( \gamma_1 \) and total employment \( \gamma_2 \). Employment determination is independent of the firm’s own wage \( w_i \). Second, all state workers are paid equally. Given the egalitarian wage policy after bonuses were abolished, equation (3) assumes that the “social rents” are evenly distributed between SOE workers. Therefore, the wage level depends only on the average labour productivity of the entire state sector, and is unrelated to the financial performance of each individual firm.

2. Post-Reform: Nash Bargaining

In the post-reform era, wage and employment decisions are made through formal or implicit bargaining between managers and the government rather than direct plan control. However, details of the negotiation process are not documented. The objectives and bargaining power of each party differ substantially over time and across provinces, industries, and levels of administration. In addition to firms’ profits, other goals may also

\[ \text{\textsuperscript{20}} \text{Considering the strong distributive objective (e.g., Gordon and Li 1997) of the Chinese government and the severe redundancy problem reported in SOEs, } \gamma_2 \text{ is likely to be greater than zero. In this case, firms are “overemployed” in the sense that the marginal product of labour is even below its opportunity cost (a).} \]
be pursued at the bargaining table. For instance, a recent study by Brandt and Zhu (1998) concluded that the Chinese government maintained a constant share of SOE employment by making use of the monetary and financial system to transfer resources from the non-state to the state sector. Likewise, SOE managers may have multiple goals other than profitability. In the early 1980s, a manager was evaluated on the basis of not only the firm’s financial performance but also the prosperity of all his workers. As described in Walder (1989), a manager is a sociopolitical community leader responsible for the welfare of the workers and their families.\footnote{Large enterprises provide a number of “supporting” facilities to their workers, for example, housing, schooling, and health care.}

For simplicity, and with no substantial loss of generality, the interests of government, managers, and workers can be conceived as lying in three different objectives: enterprise profits, employment, and workers’ compensation. In a Nash bargaining framework, the optimal levels of wage and employment are jointly determined within each enterprise that solves

\[
\text{Max}_{n,w} \quad U^B = \left( R(s_w, n) - wn \right)^{\alpha_1} n^{\alpha_2} (w - a)^{\alpha_3} \tag{4}
\]

where \(R(s_w, n)\) denotes the revenue function. Since workers in a particular SOE are no longer entitled to the “social rents” of the entire state sector, \(s_w\) in equation (4) only refers to the workers’ share of the rents within their own enterprise. If managers have to offer their workers at least the outside alternative wage \((a)\), the difference between the firm’s specific wage \((w)\) and the outside alternative wage represents the amount of rents per worker. It is assumed that bonuses are given out indiscriminately within the enterprise and that workers’ compensation takes the general form

\[
w = s_w \left( \frac{R(s_w, n)}{n} - a \right) + a \geq a \tag{5}
\]
Also, if profit sharing is effective in inducing workers’ effort, labour productivity will be increasing with $s_w$ which, in turn, would have positive effects on enterprise profitability (e.g., see Zhuang and Xu 1996; Li 1997). This implies that $\partial R(s_w, n) / \partial s_w > 0$ and $\partial^2 R(s_w, n) / \partial s_w^2 < 0$.

In the general case when emphasis is attached to all three objectives with $0 < \alpha_i < 1$ and $i = 1, 2, 3$, the first order conditions for wage and employment for the post-reform Nash bargaining model (4) are

$$w = \left( \varepsilon_r + \frac{\alpha_3}{\alpha_1} \right) \frac{\pi}{n} + a \quad \text{(6a)}$$

$$R_n(s_w, n) = \left( 1 - \frac{\alpha_3}{\alpha_3} \right) w + \frac{\alpha_3}{\alpha_3} a \leq w \quad \text{(6b)}$$

where $\varepsilon_r = R_{s_w}(s_w, (R(s_w, n) - an)) > 0$ is the elasticity of rents with respect to $s_w$.

Comparing with the social planner outcomes (2) and (3), the implications of the Nash bargaining solutions on wage (6a) and employment (6b) setting behaviour during transitions can be characterized as:

i) Workers’ pay is related to their enterprise’s financial prosperity. Equation (6a) indicates that the optimal incentive payment scheme depends on the relative weight of workers’ compensation to enterprise profits ($\alpha_3/\alpha_1$), and the extent to which rent-sharing raises the total revenue ($\varepsilon_r$). Workers in a planned economy, by comparison, are rewarded uniformly, regardless of their individual or enterprise performance (i.e., wage equation (3)).

ii) The enterprise-specific wage will play a more decisive role in employment determination. For equation (6b), the optimal level of employment varies with both the firm’s specific and its alternative wage rates. Beginning in the mid-1980s, China’s reform policies seem to suggest that the bargaining focus is shifting from non-financial goals towards profitability. For example, performance contracts, which specified financial

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22 For details on the implementation of performance contracts in China, see Byrd (1991).
indicators\textsuperscript{23} as the primary target, were signed between managers and the government. That means $\alpha_2$ and $\alpha_3$ are decreasing relative to $\alpha_1$ as reform advances. In the extreme case in which no emphasis is attached to creating employment with $\alpha_2 = 0$, the first order conditions for employment (6b) reduces to

$$R_n(s_w, n) = w. \textsuperscript{24}$$

(6b')

As predicted in the traditional labour demand model, the firm’s profit is maximized when workers are paid by their marginal revenue product. In contrast to the pre-reform employment equation (2), the outside opportunity wage plays no role in employment determination.

It is instructive to look at the special case where employment decisions are identical before and after the reforms. When $\gamma_2 = 0$ in equation (1) or $\alpha_2 = \alpha_3$ in equation (4), we thus have the same first order condition for employment in the social planner’s case (2) and Nash bargaining (6b):

$$R_n(s_w, n) = a. \textsuperscript{24}$$

(6b’’)

The key assumptions of $\gamma_2 = 0$ and $\alpha_2 = \alpha_3$ imply that the primary objective of the enterprise is to maximize the amount of rents (i.e., $R'(n) - a_n$) which can be shared between managers, workers, and the government. As a result, the firm’s specific wage is a pure transfer between them. The “efficient” level of employment sets the marginal revenue product of labour equal to the alternative wage. Employment is independent of the firm’s

\textsuperscript{23} In my sample, 88 percent of the SOEs were under performance contracts by 1989. Seventy percent of the contracts indicated that the primary target was either profits or taxes.

\textsuperscript{24} Although the employment outcome (6b’) is identical to the traditional labour demand model, SOEs are not simply price takers in wage determination. Under the assumption that profit-sharing improves productivity, the optimal level of wage is set above the alternative wage and is related to the firm’s profitability. For example, in the case where SOEs are profit maximizing firms with $\alpha_2 = \alpha_3 = 0$, the first order condition for wage (6a) reduces to $w = \frac{\pi}{n} + a$. 
specific wage, and only depends on the alternative wage. In a Nash bargaining model, this result is normally referred as the “strong efficient” contracting outcome (e.g., see Brown and Ashenfelter 1986). Since the employment outcomes are identical for the social planner and Nash bargaining, we cannot empirically identify who has the control over employment determination without additional evidence.

IV. Data

In order to study the effect of economic reform on state-owned enterprises in China, the Chinese Academy of Social Sciences (CASS) conducted two extensive surveys, in 1990 and 1995. The first covered a balanced panel of 769 SOEs from 1980 to 1989. The enterprises are located in four provinces (Jiangsu, Jilin, Shanxi, and Sichuan) covering 10 sectors. The same set of firms were then resurveyed, extending the series to 1994. Although different questionnaires were used in the two surveys, they contained similar questions on various aspects of enterprise activities, including output, material inputs, employment and wages, finances, investments, and assets. By assembling the annual data from the two surveys, it is possible to construct a 15-year panel (1980-94) for the main variables of interest: output, employment, and wages. These key variables were carefully checked and corrected for apparent coding errors, inconsistencies, and missing values. As a result, an unbalanced panel of 9300 observations on 680 enterprises remained for estimation. Detailed descriptions of the data are given in Appendix A.

25 This panel data has been used by other studies (Groves et al. 1994, 1995 and Li 1997).

26 In the original survey, enterprises were classified into 35 industries. Details of the grouping from industries to sectors are given in appendix A.

27 Only 683 out of 769 enterprises were updated in the second survey.

28 The questionnaire in the 1995 survey was revised because of the new accounting system in state enterprises.

29 Besides, both questionnaires had a separate section, consisting mostly of qualitative questions relating to managers' behaviour and firms' autonomy.
Summary measures for the sampling distribution of enterprise average real wage and employment are presented in Table 1. There was a substantial growth in SOE average real wages over the sample period 1980-94. The mean wage increased from 758 yuan to 1120 yuan, or an annual increase of 2.6 percent. As shown in Figure 1, real wages remained more or less constant during the early stage of the economic reform until 1983. A sharp increase of 22 percent was evident in 1984, which was the beginning of the second phase of the accelerating reform. Subsequently wages rose steadily through 1993 before declining dramatically in 1994. One point worth mentioning is that labour productivity (proxied by real output per worker) followed a trend very similar to that of the real wages, especially after 1984. It would seem that SOE wages were more closely tied to overall workers’ productivity since enterprises were formally given the autonomy to determine the bonus fund paid out of their retained profits. Figure 1 also illustrates the tremendous increase in wage inequality across enterprises. The coefficient of variation of real wages doubled over the 15-year period.

The mean number of workers employed grew relatively smoothly by 25 percent throughout the period. With the mean level of employment per firm substantially greater than the median, the employment distribution is heavily skewed to the left. About 80 percent of the enterprises had employment below the mean. In contrast to the increasing wage inequality across SOEs, the coefficient of variation of firms’ employment decreased slightly by about 15 percent. This is consistent with the common belief that the Chinese government maintained tighter control over employment than wages during the reform.

The increasing trend in the coefficient of variation presented in Figure 1 implies divergence in wage growth across percentiles. That means enterprises at either end of the distribution may behave very differently. Figure 2 graphs the tenth percentile, median, and ninetieth percentile of the average real wage and employment for 1980-94. (For ease of comparison, the three series are indexed to 100 in 1980.) As is clear from the figure, the median wage and employment series exhibit a pattern very similar to that of the sample

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30 Average real wage of the firm is defined as the total wage bill divided by employment, using the provincial urban consumer price as the deflator.

31 The coefficient of skewness is about 9.5 depending on the sampling year.
mean observed in Figure 1. However, the story is significantly different for the tenth and ninetieth percentiles. For the low paying enterprises (tenth percentile), real wages declined by 30 percent from 1987 through 1994. On the other hand, remuneration in the ninetieth percentile enterprises rose steadily after 1983. Average real wages increase rapidly by almost 50 percent in the three years after 1990, before showing a 10 percent decrease in 1994. As a result, after 1½ decades, workers in the top 10 percent of high paying firms saw their wages nearly double in real terms, while workers’ wages in the bottom 10 percent remain unchanged. In terms of employment, small enterprises expanded more rapidly than large enterprises after 1984. The number of workers employed at the tenth percentile grew by 40 percent over the sample period, but by only 25 percent increase at the ninetieth percentile.

Figures 1 and 2 suggest overall rising wage inequality across SOEs during the reform. It is possible that this divergence was due to increasing variations between groups, such as disproportionate wage growth in a particular province or sector. I next decompose the variance of wages into components accounted for between and within group differences using a standard analysis of variance (ANOVA) on a main-effect-only model\textsuperscript{32} with four groups: province, sector, level of administration, and size.\textsuperscript{33} The basic message from the ANOVA is that the increasing wage inequality comes from both between and within groups. Between group differentials are primarily due to the disproportionate wage growth in the province of Jiangsu. Figure 3 addresses this issue, plotting provincial means of log real wages for 1980-94. Although Jiangsu started off as the lowest pay province at the early stage of the reform, since 1986 it paid the highest wages to its workers. In contrast to the very low or even negative wage growth in the other three provinces, real wages in Jiangsu kept growing at a faster rate after 1990. This further enlarged the wage gap between provinces to over 0.25 log points after 1992.

\textsuperscript{32} For details on estimating variance components in a linear model on unbalanced data, see Searle (1987).

\textsuperscript{33} A detailed description of each group is given in Appendix A.
V. Empirical Estimation and Results

1. Wage: Link between Pay and Performance

First order condition (6a) indicates that there exists a link between workers’ pay and enterprise profitability if wage-setting behaviour in the post-reform era can be conceptualized as a Nash bargaining between the government and managers. A number of recent studies\(^{34}\) have been conducted to test for the existence for such a link in market economies. In contrast to the standard competitive model prediction of no relation between pay and firm (as opposed to worker) productivity, empirical results suggest that movements in firms’ financial performance feed through into long-run changes in workers’ compensation.\(^{35}\) The underlying wage equation for estimating the extent of rent-sharing takes the general form

$$w_{i,t} = \mu_i + \beta_i w_{i,t-1} + \sum_{j=0}^{\lambda_j} \tau_j \epsilon_{i,t} + \nu \tau \epsilon_{y,t} + \epsilon_{i,t} \quad (7)$$

The dependent variable is the log of the average nominal wage for enterprise i at time t \((w_{i,t})\). Last period wage \((w_{i,t-1})\) is included to explain the autoregressive properties of the series. The key variable of interest in wage equation (7) is the firm’s financial prosperity at time t \((p_{i,t})\). Following the existing rent-sharing literature, profit and output (sales) per employee are two common measures of \(p_{i,t}\). However, it is not clear which performance measure is a better proxy for the amount of rents generated in the enterprise. On one hand, accounting profits in planned economies may not be reliable since investment decisions are heavily distorted by the ideology preference of the CCP. On the other hand, total output does not take into consideration of the firm’s production costs, even though it has been

\(^{34}\) Recent studies on rent-sharing include Christofides and Oswald (1992), Van Reenen (1996) and Hidreth and Oswald (1997).

\(^{35}\) The steady state profit-per-employee elasticity of wages available in the rent-sharing literature ranges from 0.02 to 0.05 depending on various kinds of data and countries (Hidreth and Oswald 1997).
used in similar studies of other socialist countries.\textsuperscript{36} Realizing these potential problems, two performance measures are entered separately in equation (7) to test whether they provide similar results on $\lambda_j$. Surprisingly, it turns out that there is little difference in the choice of two measures, but the estimates on $\lambda_j$ are sensitive to the functional forms. Entering the measures in logs give much higher estimates than those in levels. To reconcile the inconsistency in results, each performance measure is then entered both in logs and levels in equation (7). Estimates from this “combined” functional form are in agreement with the log-linear specification. This indicates the logarithmic specification provides the more appropriate summary of the data. Since I have to omit all observations with negative profits in the preferred log-linear model, nominal output per worker is used as the proxy for SOEs’ rents or ability to pay.

The immediate output effect on workers’ wage is captured in $\lambda_0$. For the long-term dynamics of lagged profitability and current wages, lagged output up to $t - 2$ is allowed in the specifications.\textsuperscript{37} The implied long-run wage elasticity with respect to output per worker is the sum of all output coefficients adjusted for the lagged dependent variable (i.e., $\Sigma \lambda_j/(1 - \beta_1)$). In addition, wages are determined by a vector of external factors ($E_t$), including the urban cost of living index, alternative wage rate,\textsuperscript{38} and aggregate industry output. All three variables are at the provincial level\textsuperscript{39} and entered in logarithmic form. Dummy variables, $D_y$ and $\mu_i$, are enterprise unobserved fixed effects\textsuperscript{40} and year effects, respectively.

\textsuperscript{36} One example is Basu et al. (1995). They examine the relationship between wage and output per employee in the Czech Republic, Hungary, Poland, and Slovakia.

\textsuperscript{37} I have replicated the analysis with lags on output longer than $t - 2$. Estimates on the additional lags are virtually zero and the standard errors are much greater than the estimates. Also, they have no impact on the rest of the estimated coefficients.

\textsuperscript{38} Alternative wage is measured as the provincial average wage of collectively-owned units.

\textsuperscript{39} As mentioned in Moulton (1990), regressions of firm-level micro observations using aggregate provincial data as explanatory variables may lead to downward bias of the standard errors. The bias only affects the statistical significance for the aggregate variables, which are not the main interest of this analysis.

\textsuperscript{40} Since the group specific effects (province, sector, size and levels of administration) do not change over time within a firm, they are implicitly incorporated into the firm’s fixed effect.
I begin with a fixed effects model estimated by least squares on deviations from means. To ensure that there is sufficient variation in the explanatory variables, only enterprises with 3 or more observations are included in the sample for this part of analysis. Results presented in Table 2 show that wages depend positively on SOEs’ contemporaneous performance or productivity. For the full sample period between 1982 to 1994, the overall short-run output-per-employee elasticity of wages ($\lambda_0$) from column 1 is 0.14. The implied steady state elasticity is 0.11, which is approximately the same as the short-run elasticity. That means a 10 percent increase in average output will lead to an immediate rise in current wages of 1 percent, but there will be no subsequent effects in later periods.

Also, the lagged dependent variable has a high coefficient of 0.7. It is consistent with the first order autoregressive process of wages. The estimated coefficient of the general price index is close to unity (0.89). This suggests that workers’ wages are almost fully indexed for changes in the cost of living. The alternative wage has an expected positive coefficient of about 0.5. After controlling for alternative wages and prices, aggregate output has a small, but negative impact on wages.

The estimated wage elasticity of 0.1 is low by the standards of similar studies on transitional economies in Central and East European countries. This may be due to the fact that estimates from column 1 cover a much earlier and longer period beginning in 1982, while studies of the Central and East European countries mainly focus on the “big bang” transitions after 1989. If the link between pay and performance in China is getting

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41 The standard within-group estimation is subject to two potential econometric problems: i) simultaneity bias from wages to profitability, and ii) asymptotic bias in dynamic panel models (e.g., see Nickell 1981). These problems can be eliminated by using a generalized methods of moments (GMM) estimator suggested in Arelano and Bond (1991). Within-group estimates presented in Table 3 and 4 are taken as the benchmark results. Also, as shown in Hildreth and Oswald (1997) who estimated a wage equation similar to (7), both ordinary least squares (OLS) and GMM estimation gave similar coefficients.

42 OLS estimation of the model gives an even higher estimate of 0.89, indicating the existence of firm’s fixed effects.

43 Wage elasticities with respect to sales per worker in CEE countries during transitions range from 0.3 to 0.4 (Svejnar 1998).
stronger as predicted by the reformers, we would expect to find a higher estimate for the wage elasticity when reform accelerated after 1992.

To show the evolution of the link, columns 2 to 4 in Table 2 break down the sample into three sub-periods. The results in column 2 provide some empirical evidence that more profitable firms tended to pay higher wages to their workers even at the early stage of the reform between 1982 and 1985. The coefficient of the current output per worker is positive (0.14) and statistically significant at the 1 percent level. The short-run elasticity increases dramatically to 0.23 for the period 1986-89, then drops sharply to 0.1 over the next four years. This cyclical pattern is also evident in the long-run elasticity. It appears that the relationship between pay and performance is related to the economic cycle. The link is much stronger at the peak (1986-89), than at the troughs. This cyclical behaviour may be due to retrenchment in reform that usually occurs during recessions, in which the government reasserts control over wage and employment decisions to stabilize the economy. It may also suggest that the soft budget constraints enable SOEs to provide some “insurance” for their workers against economic fluctuations.

I next provide separate wage elasticities depending on the aggregate performance of the industry. The parameters of lagged dependent variable (β₁) and output-per-worker terms (λₖ) in equation (7) are specified as a linear function of constant and economic fluctuations at t (fₜ). Also, a time trend (t) is included to see if the link strengthens over the reform period. That is,

$$\theta = a_0 + b_0 f_t + c_0 t, \quad \theta = \beta_1, \lambda_j$$

Substituting equation (8) into (7) is equivalent to interacting last period’s wage and firm’s output with the economic cycle and time trend.

As shown in panel A of Table 3, the contemporaneous link between pay and performance is related to the overall performance of the state sector. One percentage

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44 fₜ is measured as the growth rate of the provincial total industry output between t and t - 1. I have replicated the empirical analysis using alternative measures for fₜ, such as GDP growth rate. The results (not reported) are similar to those reported in Table 3.
increase in aggregate output will raise the short-run elasticity of wages by 0.002. Considering the volatility of aggregate output during transition, the actual effect on wage elasticity may not be as small as it appears. For example, the growth rate of aggregate output in the state sector was 7.7 and 35.5 percent in 1990 and 1993 respectively. Therefore, economic fluctuations alone can generate a difference of 0.056 in the short run elasticity between these two years. The coefficient of current output interacted with the time trend \( (c_{\lambda_0}) \) is negative and statistically significant, indicating a downward trend over the years. After controlling for the economic cycle effect, short-run elasticity decreases by 0.06 in a decade.

In contrast, no cycle effect \( (\sum b_{\lambda_j} \sim 0) \) or trend \( (\sum c_{\lambda_j} \sim 0) \) is evident in the long-run elasticity. Although the sum of all output coefficients \( (\sum \lambda_j) \) remains pretty constant, the link between workers’ pay and enterprise long-term financial performance strengthens over the period because of the upward trend in \( \beta_1 \) \( (c_{\beta_1} = 0.0232) \). The overall short-run and long-run output-per-worker elasticities are presented in Figure 4. The short-run effect is declining modestly over time and ranges from 0.10 in 1990 to 0.16 in 1985. The long-run elasticity of wages increases steadily from 0.05 to 0.16 for the period between 1982 and 1994.

Since housing subsidies are another major component of the workers’ total compensation, it is worthwhile to investigate whether more profitable enterprises provide better housing benefits for their workers. I replicate equation (7) by using non-productive assets per worker as the proxy for the amount of average housing subsidies. Results are presented in Panel B of Table 3 and Figure 4. Comparing with the estimates using workers’ wage, the link between housing subsidies and output per worker exhibits a similar pattern: cyclical behaviour in the short run and a steady upward trend in the long run. The long-run elasticity remained basically zero until the second phase of reform in 1985 and then increased sharply to 0.45\(^45\) in the following decade.

\(^{45}\) Although very similar patterns are shown in the long-run elasticities of wages and housing subsidies, we have to be aware of the two separate effects, \( \beta_1 \) and \( \sum \lambda_j \), which give rise to the overall trend. As noted above, the output effect on wages is mainly due to the upward trend in \( \beta_1 \). On the other hand, the effect on housing subsidies is from both \( \beta_1 \) and \( \sum \lambda_j \).
The basic message of Figure 4 is that, on average, workers’ pay is more closely related to enterprise performance over the years. However, it is reasonable to suspect that this average pattern applies uniformly across enterprises. To investigate this issue, one possibility is to allow the parameter $a_0$ in equation (8) to vary across groups—that is, interacting last period wage, firm’s current and lagged outputs with the group dummies, economic cycle and time trend. In view of the wage growth differentials across provinces exhibited in Figure 3, I begin with the provincial effects. The long-run elasticities of wages are presented in Figure 5a. Jiangsu, which is considered as the most liberalized province among the other three, maintains the strongest link throughout the period followed by Sichuan, Shanxi, and Jilin. I next replicate the analysis on sizes (Figure 5b) and levels of administration (Figure 5c). Clearly, the extent to which pay is tied to financial prosperity varies significantly across these groups. Medium size enterprises at the municipal level provide the strongest incentive payment to their workers.

In summary, the evidence indicates that both monetary compensation and non-wage benefits have been increasingly responsive to enterprise financial performance over the period. As discussed in section 3, this result is consistent with the Nash bargaining outcome that rent-sharing exists in wage determination after reforms. Differences in the extent of rent-sharing across provinces, sizes, and level of administrations suggest that increasing enterprise autonomy tends to strengthen the link between pay and performance.

2. Employment

The first order approximation of employment equation (6b)\(^{46}\) gives a general reduced form employment equation:

$$\log n = \text{cons} + e_1 \log X + e_2 \log w + e_3 \log a + \epsilon$$  \hspace{1cm} \text{(9)}$$

\(^{46}\) That is, $\log R_n(s, n) = (1 - \alpha_2/\alpha_3) \log w + (\alpha_2/\alpha_3) \log a$. I also assume that $\log R_n(s, n) = \text{cons} + e_1 \log X - \log n$. For example, consider the simple case of a downward sloping demand, $p(q)$, and a Cobb-Douglas production function, $q = (s, n)^{k_1}m^{k_2}$. $R_n(s, n) = \frac{K}{n}pq(1+1/\epsilon_p)$ where $m$ and $\epsilon_p$ are the other inputs and elasticity of demand respectively. Then $\log R_n(s, n) = \log k_1 + \log pq + \log (1+1/\epsilon_p) - \log n$. 

21
where \( e_2 = -(1 - \alpha_2/\alpha_3) \), \( e_3 = -(\alpha_2/\alpha_3) \), and \( X \) represents other explanatory variables that affect workers’ marginal revenue product. It is useful to illustrate the implications of two polar cases of employment determination:

i) Workers are allocated administratively by the government. The first order condition (2) indicates that employment only depends on the alternative wage \( a \) and is independent of the firm’s specific wage \( w \). A social planner model implies \( e_2 = 0 \) in equation (9).

ii) Enterprises have direct control over employment decisions. According to equation (6b), profits are maximized when the marginal product of labour is equal to the firm-specific wage. Employment is independent of the alternative wage. In a completely decentralized labour market, \( e_3 = 0 \) in equation (9).

In general, labour decisions in the post-reform era are made through negotiations between the government and managers. If the Nash bargaining hypothesis is correct, the first order condition for employment (6b) implies that both \( e_2 \) and \( e_3 \) would be significantly different than zero. As the Chinese labour market is evolving from a centrally planned system to a decentralized competitive one, we expect \( e_2 \) to be decreasing (more negative), while \( e_3 \) approaches zero. Therefore, a simple test of decentralization in employment decisions is whether the coefficient of the firm-specific wage is zero \( (H_0: e_2 = 0) \). Rejection of the null hypothesis supports the Nash bargaining model in which the firm-specific wage plays at least some role in employment determination. A typical approach to this test is to estimate equation (9) using lagged wages as instruments for \( w \) (e.g., Brown and Ashenfleter 1986; Currie 1991).

However, there is a missing feature in the static model (9): employment dynamics. Even in market economies, it takes time for firms to adjust their labour demand in response to input shocks. The conventional explanation for this stickiness is the adjustment costs

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47 As noted in section 3, both the social planner model and the special case of “strong” efficient contracting in Nash bargaining give \( e_2 = 0 \). It is necessary to rely on other evidence to distinguish between these two models.

48 The expected sign for \( e_2 \) can be positive or negative depending on whether \( \alpha_2 \) is greater or smaller \( \alpha_3 \).

49 For an extensive literature review on the effect of adjustment costs in factor demand, see Hamermesh and Pfann (1996).
of changing the amount of input used. In addition to the costs of hiring, training, severance
pay and disruptions to production due to restructuring, adjustment costs in transitional
economies directly relate to the flexibility of the emerging labour market. Changes in
government policies that affect the flexibility in hiring and dismissal decisions will have an
impact on the speed and the optimal path of labour adjustments. For example, if the labour
contract system is effective in increasing flexibility in the “iron rice bowl” in China, the slow
employment adjustments to demand shocks would be improved. It is important to examine
the differences in employment dynamics at various phases of the reform.

Following Kennan (1979) and Card (1986), the traditional method of extending the
static model to a dynamic setting involves two additional adjustment costs. The first is the
cost of maintaining a sub-optimal level of employment, \( n_t \neq n_t^* \). Since \( C'(n_t^*) = 0 \),

\[
C(n_t) \equiv C(n_t^*) + \frac{g_1}{2} \left( \log n_t - \log n_t^* \right)^2
\]  

(10)

where \( C(n_t^*) \) denotes the minimum cost of producing \( y_t \), given \( w_t \) and \( r_t \). The second order
expansion coefficient \( g_1 \) is assumed to be constant over time.\(^{50}\) The second adjustment cost
is the cost of changing the size of employment between periods \( t \) and \( t - 1 \). For empirical
tractability, I impose a symmetric\(^{51}\) convex structure on this cost which can be summarized
as

\[
d(n_t, n_{t-1}) = \frac{g_2}{2} \left( \log n_t - \log n_{t-1} \right)^2
\]  

(11)

\(^{50}\) In general, \( g_{1t} = C''(n_t^*) \) is a function of \( t \). I assume that its sample average (\( g_1 \)) provides a reasonable
approximation.

\(^{51}\) Given the rigidity of the ‘iron rice bowl’ employment, negative adjustments (layoffs) are more costly
than positive ones. However, there is no explicit analytical solution for the reduced form employment
equation in the case of asymmetric costs.
Therefore, the optimal employment decision in a dynamic model is made by comparing the expected cost of maintaining a sub-optimal level of employment with the cost of adjusting the number of workers. With this setup, the dynamic employment equation is derived by minimizing the expected present value of the firm’s total cost,

\[
\min_{n_t} \mathbb{E} \sum_{j=0}^{\infty} \delta^j \left[ c(n^*_t) + \frac{g_1}{2} \left( \log n_{t+j} - \log n^*_t \right)^2 + \frac{g_2}{2} \left( \log n_{t+j} - \log n_{t+j-1} \right)^2 \right]
\]

where \( \delta \) is a constant discount factor that lies between zero and one. First order necessary conditions for the cost minimization of (12) consists of the standard partial adjustment solution\(^{52}\)

\[
\log n_t = \eta \log n_{t-1} + (1 - \eta)(1 - \eta \delta) \sum_{j=0}^{\infty} (\eta \delta)^j \mathbb{E}_t \log n^*_t + (1 - \eta \delta) \sum_{j=0}^{\infty} (\eta \delta)^j \mathbb{E}_t \log n^*_t
\]

where \( \eta^2 = \left( 1 + \delta + \frac{g_1}{g_2} \right) \eta + \frac{1}{\delta} = 0 \). The adjustment parameter \( \eta \), which lies between zero and one, reflects the persistence of the employment level. It depends on the relative size of the two adjustment costs (\( g_1/g_2 \)), and is increasing with \( g_2 \). Intuitively, a relatively high cost of changing the size of the labour force (\( g_2 \)) will slow down the adjustment process. Substituting equation (9) into the first order employment condition (13) yields

\[
\log n_t = \eta \log n_{t-1} + (1 - \eta) \left\{ (1 - \eta \delta) \sum_{j=0}^{\infty} (\eta \delta)^j \mathbb{E}_t \left[ \text{cons} + \epsilon_1 \log X_{t+j} + \epsilon_2 \log W_{t+j} + \epsilon_3 \log A_{t+j} + \epsilon_{t+j} \right] \right\}
\]

where \( X_t \) only includes the firm’s output (\( y_t \)) as an explanatory variable on employment. According to the employment equation (14), present employment is the weighted average

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\(^{52}\) For details of solving of this quadratic control problem and the transversality conditions, see Sargent (1978) Chapters 9 and 14.
of past employment and the discounted expected future values of output, firm-specific wages, and alternative wage rates. In fact, employment may be dependent on other factor prices, such as capital and non-labour inputs. For lack of reliable series, other effects on employment are assumed to be captured in enterprise’s fixed effects and year dummies. Finally, in order to derive a reduced form equation for empirical estimation, it is necessary to further restrict the stochastic processes of output, firms’ specific wages, and alternative wages. I adopt the following AR(2) forecasting equations:

\[
\begin{align*}
\log y_t &= \phi_0 + \phi_1 \log y_{t-1} + \phi_2 \log y_{t-2} + \zeta_{yt} \\
\log w_t &= \psi_0 + \psi_1 \log w_{t-1} + \psi_2 \log w_{t-2} + \zeta_{wt} \\
\log a_t &= \varphi_0 + \varphi_1 \log a_{t-1} + \varphi_2 \log a_{t-2} + \zeta_{at}
\end{align*}
\]

All the forecasting errors \((\zeta_{yt}, \zeta_{at}, \zeta_{wt})\) are serially uncorrelated. Substitute equations (15a)-(15c) into (14) to get

\[
\begin{align*}
\log n_t &= \text{cons} + \eta \log n_{t-1} + \left(1 - \eta\right) \left( e_{t1}^1 \log y_t + e_{t2}^2 \log y_{t-1} \right) \\
&\quad + \left( e_{t1}^b \log w_t + e_{t2}^b \log w_{t-1} \right) + \left( e_{t1}^c \log a_t + e_{t2}^c \log a_{t-1} \right) + \epsilon_t^c
\end{align*}
\]

where each \(e_{ij}^h\) depends on the coefficient \(e_i\) in employment equation (14) and the free parameters in forecasting equation (15). A detailed derivation of equation (16) is presented in Appendix B.

In order to capture the second-order autoregressive representation of employment\(^{53}\), I assume the productive shock \(\epsilon_t\) in (9) is specified as the AR(1) process, \(\epsilon_t = \rho \epsilon_{t-1} + \xi_t\), where \(\xi_t\) is white noise and uncorrelated with output, employment and wages. In order to eliminate the serial correlation in error terms \(\epsilon_t^c\), the final reduced form equation is obtained by subtracting \(\rho n_{t-1}\) from both sides of (16), and then using (15a)-

---

\(^{53}\) A simple AR(2) specification of employment with enterprise fixed effects and year dummies suggests that it follows a second order autoregressive process.
(15c) to substitute for the current values of output, wages, and prices. As a result, the model generates a second order employment equation that expresses current employment in terms of two lagged values on employment, firm’s output, wage rates, and alternative wages:

\[
\log n_t = \text{cons} + (\eta + \rho) \log n_{t-1} - \rho \log n_{t-2} + (1 - \eta) \left[ (E_{11} \log y_{t-1} + E_{12} \log y_{t-2} + E_{21} \log w_{t-1} + E_{22} \log w_{t-2} \\
+ E_{31} \log a_{t-1} + E_{32} \log a_{t-2}) + (\epsilon'_t - \rho \epsilon'_{t-1}) \right]
\]

(17)

The implied coefficients \(E_{ij}\) of the reduced form equation (17) are functions of the coefficients of equations (14) and (15), and the serial correlation coefficient \(\rho\) of the productive shock.\(^{54}\)

One point worth mentioning is the difference between equation (17) and its unrestricted version in the role of alternative wage in employment determination. If the forecasting equation for firm-specific wage (15b) is not a simple AR(2), but also depends on the lagged alternative wages, the alternative wage would influence employment directly in a Nash bargaining model, and indirectly as predictors of firm’s future wages. To disentangle these two effects, it is necessary to focus on the underlying structural coefficients (i.e., \(e_2\) and \(e_3\) in equation (9)).

The entire empirical model consists of the reduced form employment equation (17) and three forecasting questions for an enterprise’s total output (15a), average wage (15b), and alternative wage (15c).\(^{55}\) All series including the lags are detrended by regressing them on an enterprise specific intercept and year dummies. Then the residuals from these regressions are used in the estimation. Fitting the enterprise fixed effects and year effects outside the main model can simplify the estimation by dropping the constants in (15) and (17). Furthermore, I assume that the effects of other non-labour factor prices on employment determination can be partially captured in the detrending procedure.

\(^{54}\) For example, \(E_{11} = e_{11}^a \phi_1 + e_{12}^a - e_{11}^a \rho\). The results are similar for other coefficients \(E_{ij}\) in equation (14).

\(^{55}\) For details of the formal definitions of each variable, see Section 5.1 and Appendix A.
The method of maximum likelihood is used to estimate the structural parameters \( (\phi, \varphi, \psi, \eta, \rho, e_1, e_2, e_3) \). These estimates are obtained by maximizing the negative of the log determinant of the residual covariance matrix associated with the vector autoregression (15) and (17). I begin with the two polar cases of employment determination by setting \( e_3 = 0 \) in the decentralized “competitive” model and \( e_2 = 0 \) in the social planner model. For the period 1982-94, estimates of the structural parameters are presented in columns 1 and 2 of Table 4. A simple comparison of these two sets of results seems to suggest that the social planner model provides a better fit to the employment series. The key parameter of interest, \( e_2 \), is positive, but virtually zero in the restricted decentralized “competitive” model. The standard error is much greater than the estimate. On the contrary, \( e_3 \) is statistically significant with the expected negative sign in the alternative model. Both polar models provide very similar estimates of the output elasticity (\( e_1 \)), adjustment parameter (\( \eta \)) and serial correlation coefficient (\( \rho \)). In column 3, I present the estimates for the general Nash bargaining model which allows the shadow value of labour to depend on both the firm’s specific and alternative wages. The estimated own wage elasticity (\( e_2 \)) is still positive and becomes marginally significant at the 10 percent level. The link between alternative wages and employment remains very strong (\( e_3 = -1.52 \)). Since employment is insensitive to the firm’s specific wage, it appears that employment is not adjusting along a downward sloping labour demand where workers are paid according to their marginal products.

In order to examine changes in employment setting behaviour over the reform period, I re-estimate the model on two sub-periods. Results for the periods 1982-85 and 1991-94 are reported in columns 4 and 5 of Table 4 respectively. The basic conclusion is that there was no significant change in the underlying employment setting behaviour between the early 1980s and 1990s. Only the outside opportunity wage played a significant role in determining the employment level. As discussed in the conceptual framework, this result can be explained in both the social planner model and the Nash bargaining framework. To distinguish between them, the speed of labour adjustments may provide

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56 The discount rate \( \delta \) is treated as constant equal to 0.99.
additional information on the labour market. Even though to increase flexibility in the “iron rice bowl” system was a main focus of the labour reform, empirical results do not reflect any impact of this policy change. Employment does not seem to adjust more rapidly in response to demand shocks. The structural parameter $\eta$, which infers the speed of adjustment, remains constant at 0.8 in both sub-samples. This combination of slow employment adjustments and employment setting on the basis of alternative wage favour the social planner model, in which government continues to play an important role in labour decisions after a decade of reform.

VI. Conclusion

One of the fundamental questions in centrally planned economies is how state owned units adjust their employment and wages in response to the transition towards a market economy. This study provides some insights into such an adjustment process in Chinese SOEs during the period 1980-94.

First, in contrast to the egalitarian wage system in a centrally planned system, the revival of bonuses has been successful in tying workers’ remuneration to enterprise overall performance. I find that firms with stronger financial performance are more likely to pay higher wages to their workers even in the early stages of reform. In addition, this link between pay and enterprise long-term performance strengthens over the reform period. This, in turn, leads to enhanced productivity if profit sharing is effective in motivating workers. From an equity perspective, given that wage inequality increases significantly after 1990, it appears that the “social rents” are not evenly distributed across firms. Workers in more productive firms are able to get a larger piece of the pie. In order to address the notion of overall economic efficiency, more work has to be done on the distribution of rents across firms. What characterizes the source of rents is an important question that has not yet been answered.

Second, the labour reform appears to have had less impact on employment decisions. In order to maintain a low urban unemployment rate, the Chinese government
continues to play an important role in employment decisions. However, given the existing distortions in price levels and investments in the state sector, this administrative labour allocation process is “efficient”: the marginal product of labour is equal to its opportunity costs as measured by alternative wages. Despite the fact that redundancy is described as one of the major problems in Chinese SOEs, I find no empirical support that employment is adjusting according to a downward sloping demand with the marginal revenue product of labour equal to the firm’s wage rate. Considering China has no unemployment insurance program, SOEs may serve the same function that a social security system does in the market economy. Moreover, increasing managers’ autonomy in personnel decisions and the use of contract workers seem to have minimal effect on the flexibility of the traditional “iron rice bowl” employment. The speed of labour adjustment in response to demand shocks was constant between 1980 and 1994.

In conclusion, decentralization in China’s labour market remained far from complete at least until the mid-1990s. Enterprise autonomy on labour issues was heavily skewed towards wage determination. The government maintained tight control over employment decisions. From a public policy perspective, wages and employment are separate instruments to maintain a balance between efficiency and equality during transitions. The aim of introducing group incentive payment schemes is for enhanced productivity, while the rigidity of employment stabilizes income inequality by controlling the urban unemployment rate.
### Appendix

#### A. Descriptions of Variables in Wage and Employment Estimations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate output ((\text{gdp}_t))</td>
<td>Provincial aggregate industry output</td>
</tr>
<tr>
<td>Alternative wage ((\text{altw}_t))</td>
<td>Provincial average nominal wage in collective-owned units</td>
</tr>
<tr>
<td>Average nominal wage ((\text{w}_t))</td>
<td>Total wage bill/Total number of workers</td>
</tr>
<tr>
<td>Economic cycle ((\text{f}_t))</td>
<td>((\text{gdp}<em>t - \text{gdp}</em>{t-1}) \times 100 / \text{gdp}_{t-1})</td>
</tr>
<tr>
<td>Employment ((\text{n}_t))</td>
<td>Total number of workers at the year end</td>
</tr>
<tr>
<td>Enterprise total output ((\text{y}_t))</td>
<td>Gross nominal output</td>
</tr>
<tr>
<td>Provincial price index ((\text{cpi}_t))</td>
<td>Urban provincial consumer price index ((1980 = 100))</td>
</tr>
</tbody>
</table>

#### Dummies

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<thead>
<tr>
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<tbody>
<tr>
<td>C. Sectors (10)</td>
<td>1. Mining  2. Food &amp; Beverage  3. Clothing</td>
</tr>
<tr>
<td></td>
<td>7. Chemicals  8. Metals &amp; Building materials</td>
</tr>
<tr>
<td>D. Size (3)</td>
<td>1. Big  2. Medium  3. Small</td>
</tr>
</tbody>
</table>


B. Derivation of the Reduced Form Dynamic Employment Equation

Following Sargent (1978), forecasting equation (15a) can be written as

\[ z_t = A z_{t-1} + \epsilon_t^a, \]

where

\[ z_t = \begin{bmatrix} \log y_t \\ \log y_{t-1} \end{bmatrix}, \quad A = \begin{bmatrix} \phi_1 & \phi_2 \\ 1 & 0 \end{bmatrix}, \quad \epsilon_t^a = \begin{bmatrix} \zeta_{yt} \\ 0 \end{bmatrix} \]

Therefore, \( z_{t+1} = A z_t + \epsilon_{t+1}^a \)

\[ z_{t+j} = A^j z_t + \epsilon_{t+j}^a + \epsilon_{t+j-1}^a + \cdots + A^j \epsilon_{t+1}^a \]

Since \( E \epsilon_{i+k} = 0 \) for \( k \geq 1 \), \( E z_{t+j} = A^j z_t \).

\[ \therefore \ E_i \left( \log y_{t+j} \right) = E_i \left( h z_{t+j} \right) = h A^j z_t, \text{ where } h = (1 \ 0). \]

Assuming \( A \) has distinct eigenvalues, \( l_1 \) and \( l_2 \) with the corresponding eigenvectors \( t_1 \) and \( t_2 \),

\[ A = P \Lambda P^{-1} = \begin{bmatrix} t_{11} & t_{21} \\ t_{12} & t_{22} \end{bmatrix} \begin{bmatrix} l_1 & 0 \\ 0 & l_2 \end{bmatrix} \begin{bmatrix} t_{11} & t_{21} \\ t_{12} & t_{22} \end{bmatrix}^{-1} \]

\[ \therefore \ (1 - \eta \delta) \sum (\eta \delta)^j E_i \left( \epsilon_t \log y_{t+j} \right) \]

\[ = \ e_i (1 - \eta \delta) \sum (\eta \delta)^j h A^j z_t \]

\[ = \ e_i (1 - \eta \delta) \sum (\eta \delta)^j h P \Lambda P^{-1} z_t \]

\[ = \ e_i (1 - \eta \delta) h P \sum (\eta \delta \Lambda)^j P^{-1} z_t \]

\[ = \ e_i (1 - \eta \delta) h P \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 - \eta \delta l_1 \\ 1 - \eta \delta l_2 \end{bmatrix} P^{-1} z_t \]

\[ = \ e_i (1 - \eta \delta) \frac{1}{|P|} \left\{ \frac{t_{11} t_{22} - t_{21} t_{12}}{1 - \eta \delta l_1} \log y_t + \frac{-t_{11} t_{21} + t_{21} t_{12}}{1 - \eta \delta l_2} \log y_{t-1} \right\} \]

\[ = \ e_i^a \log y_t + e_i^b \log y_{t-1} \]

Derivation is similar for parameters \( e_{21}^b \), \( e_{22}^b \), \( e_{31}^c \) and \( e_{32}^c \).
References


### Table 1
Summary Measures of the Sampling Distribution of Enterprise Average Real Wage and Employment

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Real Wage</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Deviation</td>
</tr>
<tr>
<td></td>
<td>757.62</td>
<td>126.02</td>
</tr>
<tr>
<td>1980</td>
<td>755.60</td>
<td>127.42</td>
</tr>
<tr>
<td>1983</td>
<td>1002.36</td>
<td>203.84</td>
</tr>
<tr>
<td>1986</td>
<td>1041.12</td>
<td>269.92</td>
</tr>
<tr>
<td>1989</td>
<td>1190.23</td>
<td>342.89</td>
</tr>
<tr>
<td>1990</td>
<td>1120.44</td>
<td>453.27</td>
</tr>
<tr>
<td>1994</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>1604.53</td>
<td>3334.10</td>
<td>2.0779</td>
</tr>
<tr>
<td>1983</td>
<td>1765.56</td>
<td>3492.14</td>
<td>1.9779</td>
</tr>
<tr>
<td>1986</td>
<td>1837.90</td>
<td>3514.82</td>
<td>1.9124</td>
</tr>
<tr>
<td>1989</td>
<td>1952.15</td>
<td>3718.82</td>
<td>1.9050</td>
</tr>
<tr>
<td>1990</td>
<td>1956.68</td>
<td>3456.01</td>
<td>1.7663</td>
</tr>
<tr>
<td>1994</td>
<td>1997.93</td>
<td>3614.46</td>
<td>1.8091</td>
</tr>
</tbody>
</table>
## Table 2
Link between Wage and Performance:
Fixed Effects Estimates
(standard error in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>82-94</th>
<th>82-85</th>
<th>86-89</th>
<th>90-93</th>
</tr>
</thead>
<tbody>
<tr>
<td>( w_{i,t-1} (\beta_1) )</td>
<td>0.7034</td>
<td>-0.0825</td>
<td>0.1665</td>
<td>0.2554</td>
</tr>
<tr>
<td></td>
<td>(0.0097)</td>
<td>(0.0266)</td>
<td>(0.0251)</td>
<td>(0.0189)</td>
</tr>
<tr>
<td>( p_{i,t} (\lambda_0) )</td>
<td>0.1361</td>
<td>0.1366</td>
<td>0.2295</td>
<td>0.0990</td>
</tr>
<tr>
<td></td>
<td>(0.0069)</td>
<td>(0.0116)</td>
<td>(0.0123)</td>
<td>(0.0124)</td>
</tr>
<tr>
<td>( p_{i,t-1} (\lambda_1) )</td>
<td>-0.1031</td>
<td>-0.0305</td>
<td>-0.0319</td>
<td>-0.0096</td>
</tr>
<tr>
<td></td>
<td>(0.0083)</td>
<td>(0.0123)</td>
<td>(0.0139)</td>
<td>(0.0134)</td>
</tr>
<tr>
<td>( p_{i,t-2} (\lambda_2) )</td>
<td>-0.0002</td>
<td>-0.0129</td>
<td>0.0120</td>
<td>0.0073</td>
</tr>
<tr>
<td></td>
<td>(0.0059)</td>
<td>(0.0096)</td>
<td>(0.0114)</td>
<td>(0.0105)</td>
</tr>
<tr>
<td>( \text{cpi}_i )</td>
<td>0.8884</td>
<td>-1.5244</td>
<td>0.7194</td>
<td>2.9360</td>
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<tr>
<td></td>
<td>(0.1214)</td>
<td>(0.2324)</td>
<td>(0.3239)</td>
<td>(0.3140)</td>
</tr>
<tr>
<td>( \text{gdp}_i )</td>
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<td>-0.3837</td>
<td>0.1105</td>
<td>1.0152</td>
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<tr>
<td></td>
<td>(0.0299)</td>
<td>(0.1017)</td>
<td>(0.0609)</td>
<td>(0.0687)</td>
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<tr>
<td>( \text{altw}_i )</td>
<td>0.3932</td>
<td>0.8006</td>
<td>0.3553</td>
<td>-0.3854</td>
</tr>
<tr>
<td></td>
<td>(0.0443)</td>
<td>(0.0732)</td>
<td>(0.1478)</td>
<td>(0.1220)</td>
</tr>
<tr>
<td>SR Elasticity</td>
<td>0.1361</td>
<td>0.1366</td>
<td>0.2295</td>
<td>0.0990</td>
</tr>
<tr>
<td>LR Elasticity</td>
<td>0.1104</td>
<td>0.0859</td>
<td>0.2515</td>
<td>0.1300</td>
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</table>
Table 3
Link between Compensation and Performance:
Fixed Effects Estimates with Economic Cycle and Trend, 1982-94
(standard error in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>$w_{i,t-1} (\theta=\beta_1)$</th>
<th>$p_{i,t} (\theta=\lambda_0)$</th>
<th>$p_{i,t-1} (\theta=\lambda_1)$</th>
<th>$p_{i,t-2} (\theta=\lambda_2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Dependent Variable = Wage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x cons ($a_0$)</td>
<td>0.4892</td>
<td>0.1376</td>
<td>-0.1247</td>
<td>0.0121</td>
</tr>
<tr>
<td></td>
<td>(0.0220)</td>
<td>(0.0167)</td>
<td>(0.0198)</td>
<td>(0.0133)</td>
</tr>
<tr>
<td>x f_t ($b_0$)</td>
<td>-0.00003</td>
<td>0.0020</td>
<td>-0.0008</td>
<td>-0.0011</td>
</tr>
<tr>
<td></td>
<td>(0.0002)</td>
<td>(0.0006)</td>
<td>(0.0008)</td>
<td>(0.0005)</td>
</tr>
<tr>
<td>x t ($c_0$)</td>
<td>0.0232</td>
<td>-0.0064</td>
<td>0.0062</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>(0.0021)</td>
<td>(0.0019)</td>
<td>(0.0023)</td>
<td>(0.0015)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>$h_{i,t-1} (\theta=\beta_1)$</th>
<th>$p_{i,t} (\theta=\lambda_0)$</th>
<th>$p_{i,t-1} (\theta=\lambda_1)$</th>
<th>$p_{i,t-2} (\theta=\lambda_2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Dependent Variable = Housing Subsidies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x cons ($a_0$)</td>
<td>0.5226</td>
<td>-0.0014</td>
<td>-0.0099</td>
<td>0.0111</td>
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<tr>
<td></td>
<td>(0.0177)</td>
<td>(0.0672)</td>
<td>(0.0790)</td>
<td>(0.0527)</td>
</tr>
<tr>
<td>x f_t ($b_0$)</td>
<td>0.0029</td>
<td>0.0053</td>
<td>-0.0031</td>
<td>-0.0041</td>
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<tr>
<td></td>
<td>(0.0006)</td>
<td>(0.0024)</td>
<td>(0.0033)</td>
<td>(0.0022)</td>
</tr>
<tr>
<td>x t ($c_0$)</td>
<td>0.0074</td>
<td>0.0002</td>
<td>0.0072</td>
<td>0.0071</td>
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<td></td>
<td>(0.0019)</td>
<td>(0.0077)</td>
<td>(0.0093)</td>
<td>(0.0060)</td>
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</table>
Table 4
Structural Estimates for Partial Adjustment Employment Equation
(standard errors in parentheses)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Labour</td>
<td>Strong</td>
<td>General</td>
</tr>
<tr>
<td>Labour Demand</td>
<td>0.7749</td>
<td>0.7757</td>
<td>0.7770</td>
</tr>
<tr>
<td></td>
<td>(0.0093)</td>
<td>(0.0092)</td>
<td>(0.0093)</td>
</tr>
<tr>
<td>Partial-Adjustment (η)</td>
<td>0.7749</td>
<td>0.7757</td>
<td>0.7770</td>
</tr>
<tr>
<td></td>
<td>(0.0093)</td>
<td>(0.0092)</td>
<td>(0.0093)</td>
</tr>
<tr>
<td>Output Elasticity (e₁)</td>
<td>0.3423</td>
<td>0.3488</td>
<td>0.3405</td>
</tr>
<tr>
<td></td>
<td>(0.0332)</td>
<td>(0.0329)</td>
<td>(0.0335)</td>
</tr>
<tr>
<td>Wage Elasticity (e₂)</td>
<td>0.0231</td>
<td>0</td>
<td>0.1538</td>
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<tr>
<td></td>
<td>(0.0760)</td>
<td>(0.0832)</td>
<td>(0.2244)</td>
</tr>
<tr>
<td>Alt. Wage Elasticity (e₃)</td>
<td>0</td>
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<td>-1.5183</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.2899)</td>
<td>(0.3164)</td>
</tr>
<tr>
<td>Serial Correlation (ρ)</td>
<td>0.0554</td>
<td>0.0514</td>
<td>0.0546</td>
</tr>
<tr>
<td></td>
<td>(0.0145)</td>
<td>(0.0144)</td>
<td>(0.0145)</td>
</tr>
</tbody>
</table>
Figure 1
Indexed Mean and Coefficient of Variation, 1980-94

A. Mean

B. Coefficient of Variation
Figure 2
Indexed Enterprise Average Real Wage and Employment by Percentile, 1980-94

A. Average Real Wage

B. Employment
Figure 3
Provincial Means of Log Average Real Wage, 1980-94
Figure 4
Output-per-worker Elasticities, 1982-94

Wage

Year

Housing Subsidies

Year
Figure 5
Output-per-worker Elasticities of Wages by Groups, 1982-94

A. Province

B. Size

C. Level of Administration