THE WILLIAM DAVIDSON INSTITUTE
AT THE UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

China's State-Owned Enterprises in the First Reform Decade: An Analysis of a Declining Monopsony

by Xiao-Yuan Dong and Louis Putterman

Working Paper Number 93
October 1997

Comments Welcome

China's State-Owned Enterprises in the First Reform Decade:

An Analysis of a Declining Monopsony

Xiao-Yuan Dong* and Louis Putterman**

Abstract

We study the evolution of employment and wage outcomes in Chinese SOEs during the first decade of economic reforms, studying a panel of data for almost 1000 enterprises covering the years 1980-90. Despite the consensus on the persistence of labor redundancy in the SOE sector, we find that capital-intensity remained so extreme that workers' marginal products exceeded their full wages, just as in a classical monopsony outcome. Consistent with expectations about the reform process, we find that the degree of monopsony declined during the 1980s, although it was not eliminated, and that monopsony was weakest where the state sector's shares of industrial output and enterprises were lowest, and for smaller enterprises and enterprises managed by lower levels of government. Our analysis also supports Xu and Zhuang's finding that bonus payments increased enterprises' revenues by more than it did their costs.

* Department of Economics, University of Winnipeg. ** Department of Economics, Brown University. We would like to thank Gary Jefferson for making available to us the data used in this study, and to express our appreciation for research assistance from Stefan Dodds. The financial support of the Social Science and Humanities Research Council (Canada) for this project is gratefully acknowledged. The second author also wishes to thank the American Council of Learned Societies and the Chiang Ching-kuo Foundation for support of a Fellowship funded by the Chiang Ching-kuo Foundation. Please send comments to dong@io.uwinnipeg.ca and louis_putterman@brown.edu.

1. Introduction

Prior to 1978, the state was the sole employer of urban industrial labour in the People's Republic of China. The development strategy of the Chinese government was to industrialize the economy at the fastest possible rate, in part by keeping consumption at a low level and allocating a large amount of national income to industrial capital formation. While this strategy enjoyed some successes (with China greatly expanding its industrial base and achieving a growth rate of per capita output at least equal to that of the developing world as a whole), it had a number of disadvantages. One of these was that despite the rapid expansion of industry's share of output and investment, industrial employment growth was relatively low, so that structural change with respect to employment was far more modest than that with respect to output and the capital stock. The economy was thus markedly dualistic, with high capital-labor ratios and labor productivity in the industrial sector, but low capital-labor ratios and labor productivity in that part of the economy in which the lion's share of the population remained employed. A second problem was that the sacrifice of current consumption on the part of Chinese urban and rural residents undermined work incentives of both SOE workers and collective farmers.

The discrepancy between (a) structural change on the output and investment sides, and (b) structural change on the employment side in the China of 1949 to 1978, has been a well-known "stylized fact" among scholars for a long time, and some insights into this discrepancy have been garnered by economists approaching China's economic path using the conceptual apparatus of the "development strategy" idea.[1] However, a firm analytical understanding of the nature of employment and wage determination in pre-reform China may have been lacking in earlier research. In particular, analyses of China's state sector often assume, like those of

other reforming centrally-planned economies, that China's SOEs have by nature been employment padders--that they have played a politically assigned role of creating jobs that are unwarranted by narrower economic considerations. An inherent tension, at an analytical level, between the stylized fact of discrepant structural change, on the one hand, and that of artificial employment generation, on the other, was not appreciated by earlier authors.

In Dong and Putterman (1997), we proposed a new explanation of China's slow industrial employment growth during the pre-reform era based on the proposition that the state acted as a monopsonist facing an upward-sloping supply curve of labor. Whereas previously, economists seemed to have implicitly worked with a notion of China's industrial economy as facing an unlimited supply of labor at some modest increment over the agricultural subsistence wage (as in the "labor surplus economy" models of the 1960s), we argued there that the supply price of labour to state industry was *increasing* in the number employed, for two main reasons. First, under the institutional conditions of Chinese agriculture in the collective period, it proved difficult to increase the marketing rate of the rural sector and to reduce the proportion of rural workers engaged in agricultural work without raising procurement prices and, accordingly, the wage bill of the state in terms of manufactured goods. Over and above any incentive effects of higher procurement prices, the government had to increase procurement prices to defray the costs of inputs provided by the state sector, such as electricity and diesel fuel, irrigation pumps, and chemical fertilizer. Second, for ideological reasons, the government committed itself to provide urban industrial workers with subsidized housing, education, health care, and pensions. The costs of these benefits were likely to rise disproportionately as the number of urban residents grew, both because of standard congestion effects and because many benefits to the

extant population could draw upon pre-existing infrastructures. In our paper, we found statistical evidence that increases in industrial employment led to increased prices for farm products during the period from 1952 to 1984.

If the state sought to maximize industrial profits (so as in turn to maximize investment) subject to an upward-sloping labour supply curve, then assuming that it approached this problem in a rational manner, it would have instructed SOEs to employ workers only to the point at which the marginal product of labour was equal to the marginal cost of employment, a cost lying above the level of the full wage and benefit package of an individual worker. In other words, state industry would have employed fewer workers than would a sector composed of competitive firms. After providing a formal model of the Chinese economy which generates this result, we found empirical evidence that marginal products of labor in China's state industry were persistently higher than SOE workers' full compensation, based both on national aggregate data for the years 1952-1984, and on a panel of enterprise-level data for the early 1980s (1980-85), years in which reform may as yet have had little influence on the economic behavior of the SOEs. We also noted that evidence of a positive gap between marginal products and wages had been provided by other studies including ones by Jefferson and co-authors (for instance Jefferson *et al.*, 1994) and that of Hay *et al.* (1994), although those authors failed to suggest a monopsony interpretation.

China's industry, like the rest of its economy, has undergone a series of reforms since the early 1980s. The ownership structure of industry has now become increasingly diversified. The importance of state firms has decreased significantly during the reform period with the output share of SOEs plunging from 78 percent in 1978 to less than 50 percent in the early

1990s. In their place, enterprises with a variety of new ownership forms have arisen. The managers of SOEs were given greater autonomy and more incentives to adjust the size and composition of labour force according to product demand and factor prices. Measures were also taken to break away from the egalitarian wage structure carried over from the pre-reform era and to introduce more monetary incentives into the compensation system of SOEs. Performance-linked bonus payments became widespread in the early 1980s.

Scholarly analysis of the evolution of wages and employment in China's state sector during the reform era has heretofore been limited. The existing studies, even where methodologically rigorous, work from conventional frameworks or build essentially *ad hoc* models. Evidence of state-sector monopsony has been uncovered, but the issue has not been addressed. Non-technical discussion, meanwhile, often focuses on two issues: (1) the concern that "capture" of enterprises by their personnel in the context of a "soft budget constraint" or a setting of state "coddling" of SOEs may have led to excessive rent-sharing, and thus to the declining financial performance of the SOEs (Woo et al.,1994 and Sicular, 1994); and (2) the concern that SOEs employ large numbers of redundant workers, and that their overall reform has been slowed by the state's concern that it would lead to the release of these workers into urban unemployment (see, for instance, Broadman, ed., 1996). The obvious tension between concern (2) and the historical fact that job creation in China's state sector has been quite slow, compared to output and capital stock growth, has not been commented upon. If we are correct that the SOEs of the pre-reform period were social under-employers, not over-employers of labor, then it is difficult to see how their main problem could have become one of uneconomic employment padding at any very early point in the reform process.[2] Even if SOEs did employ

some redundant workers--for instance, workers in sectors for which there was insufficient market demand following reform, or workers paired with technologically backward equipment, or individuals who had been improperly placed in firms by administratively-oriented municipal labor bureaus--we think it important to investigate employment in the SOE sector with an openness to the possibility that they were falling short of their potential as job-creators. In particular, evidence of monopsony in the pre-reform period suggests that the evolution of SOE employment under reform could be studied by investigating the degree to which SOEs have moved from their past history of excessive capital intensity and socially sub-optimal employment creation during the reform era. The main task of this paper is to examine whether the monopsonistic labor under-employment found in our study of pre-reform period SOEs gave way to more socially optimal employment and wage-setting policies during the first decade of the reform era.

The reform measures implemented during the 1980s can be expected to have affected the employment and wage-setting behaviour of SOEs in a number of ways. First, the rise of non-state firms and the increased autonomy of individual SOEs have created competition in industrial labour markets that may have begun to erode the state's monopsony position. Based on standard microeconomic reasoning, this should have led to more industrial employment and higher industrial wages.[3] Secondly, the decentralization of decision-making from government officials to enterprise managers opens up the possibility that the latter may act in the interest of workers' at the expense of the capital owners (the state) in exchange for workers' support (See Walder, 1989). The rising bargaining power of workers over enterprise rents could conceivably have raised wages above the supply price of industrial labour and thereby worsened the financial

performance of enterprises (concern (1), above), countervailing those competitive forces tending towards the correction of the monopsonist employment outcomes. Thirdly, if bonus payments succeeded in increasing the work motivation and thus the productivity of SOE employees, they may have reduced the number of workers demanded, again countervailing the employment-expanding implications of a decline in monopsony power. Thus, the effectiveness of bonus schemes could have reduced the SOEs' contributions to changes in China's employment structure and/or contributed to the existence of redundancy on the job, which has been estimated to affect some 20-30 percent of the SOE workforce in the late 80s and early 90s (Broadman, 1996). The possibility that redundancies co-exist with untapped employment creating capacity in SOEs, due to latent monopsony or other sources of bias towards capital intensity, is thus a matter of considerable policy relevance.

In the next section, we begin our theoretical and empirical analysis of employment and wage-setting behavior in China's SOEs by presenting a simple theoretical model in which the SOE is permitted to pursue a set of objectives ranging from pure profit-maximization to a weighted average of profit and bonus maximization, and does so in an environment characterized by either an upward-sloping or a perfectly elastic labor supply curve. Here, we show that the enterprise which faces an upward-sloping labor supply curve and which does not place too much weight on bonuses will exhibit a gap between labor's marginal product and its compensation. We also show that the interest of profit-maximization only may lead to the use of bonuses as an effort-elicitation device, and that giving weight to bonuses as objectives in their own right could lead to setting of bonuses in excess of profit-maximizing levels, with a consequent decline in the marginal product--wage gap. In section 3, we introduce the data on a panel of 967 SOEs from

26 provinces observed over the eleven years 1980-90, which forms the basis for our empirical analysis. In section 4, we report our estimates of the production technologies used by these enterprises, and we confirm that the enterprises exhibited a large gap between marginal products and wages in the early years of this period, and that as anticipated, the size of the average gap fell over time as the reform process progressed. In section 5, we investigate the determinants of monopsony behavior and confirm that monopsony, as measured by the percentage gap between marginal product and wage, was falling over time, was negatively related to the share of nonstate industry in a province, and was more persistent in larger enterprises and in enterprises reporting to higher levels of government. We also investigate and do not find support for the hypothesis that "rent-sharing" was taken to financially deleterious levels, finding instead that bonuses raised output by more than they raised compensation, although the degree to which the increments to output were captured by enterprises rather than workers was falling over time. We provide further discussion of our findings in section 6, and conclude the paper in section 7.

2. The Theoretical Framework

In this section, we present a simple model of employment and wage determination in a post-reform SOE.[4] We begin our analysis by dividing the full wage received by a worker, W, into two components: (1) regular wage, W, and (2) bonus payment, B. Regular wages, consisting of time and piece-rate wages and welfare benefits, are assumed to be the supply price of labour at which a worker is willing to work for the enterprise but only at a low level of labour intensity, e^*.[5] While having been reformed gradually, the low and egalitarian wage policies carried over from the pre-reform years continue to be an important determinant of

regular wages. Bonus payments are, however, introduced to improve work incentives. The enterprise has greater autonomy over bonus payments than regular wages.

The regular wage, W, is assumed to be increasing in the number of workers employed, N, for two main reasons. First, regular wages are largely determined by the government, which at least in the early reform period may be assumed to have continued to face an upward-sloping curve of aggregate labour supply to industry for the reasons given by Dong and Putterman (1997). Secondly, most of welfare benefits, including subsided housing, the benefits for health care, death, maternity, disability and retirement pension, etc., are provided by individual enterprises. The enterprise-based welfare system makes it costly for workers to switch job from one enterprise to another. High labour mobility costs create monopsony power on the part of individual enterprises, in the sense that they could lower their regular wages without losing all of their work force. For the sake of simplicity, we assume that the regular wage rises linearly with the number employed, and that on a per worker basis, bonus payments are independent of the number of employed.[6] The full wage is thus written as

$$W = B + \overline{W}(N) \quad with \ \overline{W}' > 0 \ , \ \overline{W}'' = 0 . \tag{1}$$

The revenue of the enterprise is defined as

$$R = R(L) = R(e(B)N) \tag{2}$$

where L is the labour supply which is the product of effort, e and the number of workers, N. R is increasing and strictly concave in L. Work effort, e, is equal to e^*, the low level of effort, for $B = 0$, and increasing and strictly concave in B for $B > 0$. The profit function is written as

$$\pi = R(e(B)N) - (B + \bar{W}(N))N. \qquad (3)$$

The enterprise chooses employment and bonus payment to maximize the interest of both workers and the state capital owner. The workers are interested in bonus payments and jobs, whereas the state owner is interested in profits. Cooperation between workers and the state makes both parties better off by paying workers positive bonuses and the state positive profits. The action that workers can take to bargain for what they want is to shirk (they cannot credibly threaten to quit, because of high labour mobility costs). To simplify the matter, we assume that the state earns zero profits when workers perform at the low level of labour intensity, e^*. Due to political and ideological reasons, the threat of the state to workers is to reduce bonus to zero but not to shut-down the factory and/or to lay-off workers if the workers fail to provide more effort than e^*, and consequently profits fall to zero. Thus, the enforcement mechanism for the bargaining solution is that without cooperation between the two parties, workers will receive regular wages only but work with a low level of intensity, while the state earn zero profits. The enterprise's optimization program is thus written as

$$Max_{N,B} \ \gamma \log(NB) + (1-\gamma)\log(R(e(B)N) - (B + \bar{W}(N))N) \qquad (4)$$

where NB is the total bonus payment and strictly increasing in both N and B, γ represents the bargaining power of workers, and $(1-\gamma)$ is that of the state.[7] The first order conditions of this program are

$$N: \quad \frac{\gamma}{N} + \frac{(1-\gamma)(R'(L)e(B) - B - \bar{W}(N) - \bar{W}'(N)N)}{R(L) - (B + \bar{W}(N))N} = 0 \qquad (5)$$

and

$$B: \quad \frac{\gamma}{B} + \frac{(1-\gamma)\,(R'(L)\,Ne'(B) - N)}{R(L) - (B + \overline{W}(N))\,N} = 0. \qquad (6)$$

If the enterprise values profits but attaches no value to income generation, in other words, the workers have no bargaining power, i.e., $\gamma = 0$, equations (5) and (6) are reduced to

$$R'(L)\,e(B) = B + \overline{W}(N) + \overline{W}'(N)\,N, \qquad (7)$$

and

$$R'(L)\,e'(B) = 1 \qquad (8)$$

The left-hand side of (7) is the marginal revenue product (MRP) of an extra worker, and the sum of the terms on the right-hand side is the marginal cost (MC) of employing the extra worker. The left-hand side of (8) is the marginal revenue of an extra unit of bonus. Equation (7) and (8) state that the profits are maximized by employing workers to the point at which MRP=MC, and paying bonuses to the point at which the marginal revenue of the last unit (*yuan*) of bonus is equal to one (*yuan*). If the firm faces an upward-sloping supply curve of labour, then W'(N) is strictly positive, so the equilibrium employment level is one at which the MRP is above the full wage, W, the standard monopsony solution.

Differentiating (7), we obtain the employment response to bonus payment when the enterprise value profits only:

$$\frac{dN}{dB} = \frac{1 - \frac{\partial R}{\partial L}e'(B) - \frac{\partial^2 R}{\partial L^2}Le'(B)}{\frac{\partial^2 R}{\partial L^2}e^2 - 2\frac{\partial \overline{W}}{\partial N}}. \qquad (9)$$

At the equilibrium, $(\partial R/\partial L)e'(B) = 1$, so the numerator is strictly positive, but the denominator is strictly negative. Hence, $dN/dB < 0$. An increase in bonus payments will reduce the enterprise's demand for labour. Intuitively, a rise in bonus payment shifts the full wage curve and consequently the MC curve to the left and shifts the MRP curve to the right by raising effort supply. A right-ward shift of the MRP curve expands employment, whereas a left-ward shift of the MC curve reduces employment. The negative employment effect outweighs the positive one due to the diminishing returns to labour supply and consequently to bonus payment. If prior to the reform, despite the fact that workers received only the regular wage and worked with a low level of labour intensity, the marginal revenue product of SOE workers was still substantially higher than that of the rural labour force, and if from a social standpoint too few industrial jobs were created due to the state's monopsonistic position or its bias towards capital-intensive industry, then the impact of bonuses on profit-maximizing employment could mean that the reform policies aiming at improving incentives of industrial workers might actually worsen the situation (widen the labour productivity gap between the industrial and agricultural sectors and worsen the job creation record of SOEs). Given the historical distortions created by state monopsony in industry, the reformers may thus have faced a short-run conflict between their goal of raising the technical efficiency and profitability of SOEs and their goal of improving the allocative efficiency of labour resources.[8]

Return, now, to the case in which $\gamma > 0$. Since at the bargaining equilibrium, profits

are strictly positive, equations (5) and (6) hold only if the enterprise hires workers at the level where MRP < MC, and pays bonuses to the point at which the marginal revenue of the last unit of bonus is less than one. Thus, the employment and bonus outcomes of the enterprise which has a non-standard objective function are both too high to be justified by the principle of profit maximization, although they may very well remain below the socially efficient level (since they are likely to only partially countervail against the monopsonistic tendency of a profit-maximizing firm). Nor does this necessarily mean that the level of bonus payment made by a non-standard enterprise would be higher than that of a profit-maximizing firm. Equations (5) and (6) can be satisfied when the enterprise pays the same level of bonuses as a profit-maximizing firm, but hires workers beyond the point at which MRP=MC. This is because the marginal revenue of bonus payment is decreasing in employment. A given level of bonuses may be optimal by the standard of profit maximization for the profit-maximizing employment outcome, but becomes "excessive" as workers are employed beyond the level where MRP=MC.

Combining equations (5) and (6), we have

$$\frac{\partial R}{\partial L} e = B + \overline{W}(N) + \overline{W}'(N) N + \left(\frac{\partial R}{\partial L} e'(B) - 1\right) B \qquad (10)$$

where the last term on the right-hand side, measuring the net marginal revenue of a given level of bonuses, is strictly negative at a bargaining equilibrium (where workers prevail in pushing bonuses past the profit-maximizing level). This term can countervail the change in the regular wage bill resultant from an upward sloping labour supply curve, W'(N)N. The "competitive" outcomes based on the rule of the MRP being equal to the full wage can be obtained when In the situation where $0 < -((\partial R/\partial L)e'(B) - 1)B < W'(N)N$ (i.e., where employment remains

$$\overline{W}'(N)\,N = -\left(\frac{\partial R}{\partial L}e'(B) - 1\right)B. \qquad (11)$$

below the social optimum due to monopsony), one may find a paradox that the enterprise pays workers below their MRPs, but claims that it employs too many workers to make adequate profits.

Differentiating (10) yields the following result:

$$\frac{dN}{dB} = \frac{B\frac{\partial Q}{\partial L}e''(B) + B\frac{\partial^2 Q}{\partial L^2}N(e')^2 - \frac{\partial^2 Q}{\partial L^2}Le'(B)}{\frac{\partial^2 Q}{\partial L^2} - 2\overline{W}'(N) - \frac{\partial^2 Q}{\partial L^2}ee'(B)B}. \qquad (12)$$

The sign of dN/dB is ambiguous. Unlike the profit-maximizing outcomes, an increase in bonus payment at the bargaining equilibrium may or may not reduce employment.[9] There is, however, no ambiguity that the enterprise would earn less profits at the bargaining equilibrium than it would by acting as a profit-maximizing firm, because it hires "too many" workers and pays them "too much" bonus. Whether SOEs have actually carried bonus payments beyond the profit-maximizing level is something that we investigate empirically in Section 5.

Rearranging (10) gives the following results:

$$\begin{aligned}\frac{\frac{\partial R}{\partial L}e - B - \overline{W}}{B + \overline{W}} &= \overline{W}'(N)\frac{N}{(B+\overline{W})} + \left(\frac{\partial R}{\partial L}e'(B) - 1\right)\frac{B}{(B+\overline{W})} \\ &= \frac{\partial(B+\overline{W})}{\partial N}\frac{N}{(B+\overline{W})} + \left(\frac{\partial R}{\partial L}e'(B) - 1\right)\frac{B}{(B+\overline{W})}\end{aligned} \qquad (13)$$

where the term on the left-hand side is the percentage gap between the MRP and the full wage, the first term on the right-hand side is the inverse elasticity of labour supply with respect to the full wage, and the second term is the product of the net marginal revenue from bonus payments

and the ratio of the bonus payment to the full wage. The percentage gap between the MRP and the full wage measures the exercise of monopsony power by the enterprise. The inverse elasticity of labour supply measures the potential for monopsony, since it is equal to zero in a competitive labour market where firms hire labour at a market-determined wage, but is greater than zero when the firm faces an upward-sloping labour supply curve. The term incorporating the net marginal revenue of bonuses measures the degree of deviation from the profit-maximizing outcomes. It is equal to zero if $\gamma = 0$ and consequently $((\partial R/\partial L)e'(B)-1) = 0$, and less than zero if $\gamma > 0$ and consequently $((\partial R/\partial L)e'(B)-1) < 0$.

Equation (13) provides a theoretical framework for empirical investigation. According to this equation, the percentage gap between the MRP and the wage is greater than zero if the firm faces an upward-sloping supply curve of labour, value profits, and either places no value on total bonus payment or pays "excess" bonuses, but not enough to close the monopsony gap. The MRP-wage gap is positively related to the monopsony potential measured by the inverse elasticity of labour supply. The response of MRP-wage gaps to the ratio of bonus to the full wage, however, depends upon whether the enterprise complies with the principle of profit maximization. If the bonus paid by the enterprise is below the profit-maximizing level, the bonus ratio increases the size of the gap; if it is equal to the profit-maximizing level, the bonus ratio has no effect on the gap; and if it is higher than the profit-maximizing level (as occurs in our model when $\gamma > 0$), the bonus ratio reduces the size of the gap. Economic reforms are expected to reduce the state's monopsony power and narrow the MRP-wage gaps by increasing competition in industrial labour markets. They could also lead to a narrowing of the gaps by opening up the possibility for individual SOEs to pursue the interest of workers at the expense

of state capital owners. Fortunately, equation (13) paves the way to an empirical strategy for distinguishing between declines in the observed monopsony gap due to the first factor, and those due to the second one. The next three sections test the hypotheses concerning market structure and SOE employment and wage behaviour by examining (1) whether there is a positive gap between the MRP and the full wage in SOEs, (2) whether the MRP-wage gaps are correlated in predictable ways with variables proxying for market environments, and (3) what role bonus payment plays in reducing the MRP-wage gaps.

3. Data and Variables

The empirical investigation of this paper is based on panel data on 967 SOEs for 11 years, from 1980 to 1990. These enterprises are located in 26 out of 30 Chinese provinces and province-level entities and distributed among 10 broadly defined industrial branches. The data were collected by the Chinese Economic System Reform Commission (CESRC) and the World Bank. Detailed description of this data set is given by Xu et al. (1993).

The estimation of the production function, the first step of our analysis, requires information on output, labour, capital, and intermediate inputs. Gross value of industrial output at 1980 prices, which is directly available in the data set, is used to measure the output. Labour input is taken to be the total number of year-end employees. Capital input is measured by real net value of fixed assets used in production; the panel data contain the information that permits us to exclude the assets associated with nonindustrial services (following Chen et al., 1988). The Chinese capital stock deflators at 1980 prices, which include a separate series for each industry, were used.[10] Intermediate input is measured by the real value of purchased materials,

fuel, and power at 1980 prices. The value of intermediate input was deflated by the industrial product price indices at the industry level published in the 1994 China's Statistical Yearbook. The descriptive statistics for these variables are presented in Table 1.

To calculate the MRP-wage gap, we begin with MRP estimates computed from the variables already mentioned and the estimated parameters of the production function, then subtract a series on the full wage and divide the difference by the full wage which is constructed as follows. The regular wage is defined as the sum of basic monetary compensation, implicit price subsidies, welfare and benefits, and housing subsidies. The basic monetary compensation, obtained directly from the data set, is derived as the total wage bill net of bonus payment divided by the enterprise level of employment. It includes piece-rate and hour-rate wages, over-time compensation, direct subsidies for food and fuels, and allowances. The implicit price subsidies per worker are estimated by dividing the state's budget spent on price subsidies (mainly covering essential foodstuffs) by total urban labour force. These variables are obtained from the 1994 China's Statistical Yearbook. The welfare and benefits, including health care, retirement pension, disability and maternity, and death and emergency aid, etc, are estimated as the ratio of welfare and benefit payment to basic wage and bonus compensation multiplied by the basic wage and bonus bill. The national annual average of this ratio, obtained from p. 189 of China's Labour and Wage Statistics: 1949-1985, was applied for 1980-85, and the information for 1986-90 was derived, from the panel data, as the annual average rates of welfare benefits and pensions to the basic wage and bonus bill.[11] The housing subsidies are estimated based on the expenses of sampled SOEs on depreciation, maintenance, repairs, and interest payments for nonproductive capital assets. The information on the items other than depreciation is, however, available only

for 1986-1990. For this period, depreciation, on average, accounted for 41.9 percent of the total capital expenses. Thus, the total capital expenses for the 1980-85 period were estimated as depreciation divided by 0.419. Bonus payment is measured by total bonus bill divided by the number of year-end employees. Both regular wages and bonus payments are deflated by the Chinese urban consumer price index with 1980 as base year. The full wage is the sum of regular wages and bonus payments.[12]

Variables that are introduced to explain the percentage gaps between the MRP and the full wage include dummy variables for the level of government that an enterprise was affiliated with and for the (officially designated) scale of the enterprise, the shares of SOEs in the industry of a province in terms of output and in terms of number of firms, and time trend. The affiliation and scale dummy variables are generated based on the information provided by the data set. The shares of SOEs in the industry of a province are calculated as the output or number of industrial SOEs in a province divided by the total industrial output or number of industrial enterprises at township level or above in that province. These data are obtained from various issues of China's Statistical Yearbook. The mean values of the full wage, the share of each of its components, and the shares of SOEs for each year from 1980 to 1990, and the means and standard deviations of these variables for the entire sample are presented in Table 4.

4. Production Technology and Marginal Products

The Cobb-Douglas production function with multiplicative disturbance was estimated either as a fixed-effects model using the least squares dummy variable (LSDV) method or as a random-effects model using the generalized least squares (GLS) technique (see Table 2).[13] The

choice between the two models was made based on the Hausman tests reported near the bottom of Table 2. We first fit the production function with the entire sample, assuming that the technological differences between industries shift the intercept of the production function but do not alter factor elasticities. Then relaxing the assumption of constant slop coefficients across industries, we estimated the production function for each of ten industries separately. The F statistics reported at the bottom of Table 2 reject the null hypothesis that the output elasticities of a specific industry do not differ from those of other industries at the 1% level of significance for all industries except coal mining industry.

Judging by the adjusted R^2s reported at the bottom of Table 2, the data fit the Cobb-Douglas production function quite well. The estimates of time trends show that the total factor productivity of SOEs in the full sample grew steadily at a rate of one percent per year from 1980 to 1990, although the growth was uneven across industries. Except for the capital elasticity of the chemical industry, the factor coefficients are all significant at the 5 percent level or better. The estimates of returns to scale range from 0.753 to 1.153. The estimated output elasticity of labour for each industry, ranging from 0.073 to 0.389, was used to calculate the marginal revenue products of labour and the MRP-wage gaps. These results are presented in Table 3.

As shown in Table 3, the estimated MRPs are, on average, substantially higher than the full wages for the full sample and for most industries. The mean MRP-wage gap for the combined sample was 288.4% with a standard deviation of 503.2%.[14] This large standard deviation suggests that the data are quite noisy. When the sample contains outliers, the median is often a more reliable estimate of the average tendency than the sample mean. The median gap is 129.1% for all industries combined, and varies across industries with a range from -54.6%

in coal mining industry to 553.1% in food, beverage and tobacco industry. Table 3 also present the quartile distribution of the MRP-wage gaps. The workers in more than three quarters of the enterprises in coal mining industry, in more than a half of the enterprises in building materials, and in less than a half of the enterprises in metallurgy and pharmaceutical industries received wages higher than their marginal revenue products. For the rest of the industries, more than three quarters ot the enterprises paid their workers wages below their estimated MRPs. Overall, a positive MRP-wage gap was observed for more than 75 percent of observations in the sample. The last column of Table 3 displays the t-statistics for the difference in the population means between the estimated MRP and the full wage using paired sample. The t-test rejects the null hypothesis that a typical SOE employed workers to the point where the MRP equals its wage rate with a p-value approaching zero for all industries combined and all individual industries except for coal mining and building materials. For the coal mining industry, the MRPs are significantly lower than the full wages, whereas for the building material industry, the MRPs are not significantly different from the full wages.

Table 4 displays the time series of mean MRPs, full wages and MRP-wage gaps for all industries combined. As shown in Table 4, the average estimated MRP grew at an annual rate of 3.7%, whereas the average full wage grew at a rate of 5.1% from 1980 to 1990. As a result, the estimated MRP-wage gap fell from 323.6% in 1980 to 222.9% in 1990, at an average rate of 3.2% per year during this period. Figure 1 plots the trends of the average MRP-wage gap for each industry and for the full sample. Following the trend in the full sample, the MRP-wage gap was on a steady decline in all industries except for machinery from 1980 to 1990.

5. Marginal Product-Wage Gap Analysis

Equation (13) shows the percentage gap between the marginal product of labour and the full wage (including bonus) that exists at the employment level that maximizes the objectives of a profit-seeking enterprise which also attaches positive (possibly small) value to total bonuses, when bonuses increase revenues but not necessarily profits. As has been stated, the MRP-wage gap will be positive provided that the enterprise faces an upward sloping supply curve of labour ($W'(N) > 0$) and that bonuses are not pursued too far past the profit-maximizing level. In this section, we examine whether the observed gaps are correlated with proxies for labour market monopsony (standing in for the first term of the RHS of (13)), and with bonuses, in the predicted fashion. Proxy variables are required since the elasticity of labour supply facing the enterprises cannot be computed directly from available data. The main proxies are dummy variables for the level of government that an enterprise was affiliated with and for the (officially designated) scale of the enterprise, the shares of SOEs in the industry of the province in which the enterprise was situated, in terms of output and in terms of number of firms, and time trend.

It is hypothesized that the MRP-wage gap of a larger enterprise or an enterprise affiliated with the central government is larger than that of a medium- or a small- scale enterprise, or an enterprise affiliated with a lower level of government, since the former type of enterprise enjoys less autonomy and faces less competition with other enterprises in labour markets than the latter types of enterprise. The percentage gap between the MRP and the full wage is expected to be positively correlated with the shares of SOEs in the industry of a province, since these may be taken as measures of the potential competition in the market for industrial labour.[15] Time trend is expected to pick up other factors that may affect the MRP-wage gaps but that cannot be

properly measured here. In particular, the coefficient of time trend is expected to have a negative sign, since economic reforms were generally intensifying during the period studied, and the reforms should have tended to weaken the state's monopsony power and consequently narrow the MRP-wage gaps. We also add dummy variables for the years 1989 and 1990, to control for a possible break in the reform process as well as for the effects of the economic slow-down and restrictive macroeconomic policies of those years. Finally, we use additional dummy variables to control for time-invariant differences between provinces and among industries.

Some observers argue that reforms weakened the financial positions of SOEs in part by granting their personnel the power to redistribute rents from the enterprise or state to themselves. Rising rent-sharing and declining monopsony would both lead to a smaller observed MRP-wage gap. As mentioned above, equation (13) and its empirical implementation provide a method for distinguishing between the effects upon the gap of increasing bonus payments versus those of declining monopsony. These effects have different allocative implications: a decline in monopsony power moves employment toward the socially optimal level, whereas an increase in rent-sharing by employees benefits employees but is potentially deleterious to enterprise viability. Based on the equation, a significant negative (positive) coefficient on the bonus share of total worker compensation would imply that bonuses were carried beyond (not as far as) the profit-maximizing point, their marginal impact on revenue being smaller (larger) than that on compensation. (Recall that bonuses may either increase or reduce the size of the gap since they can have incentive as well as rent-sharing effects.) The estimating equation will include both a term for the bonus share itself and one in which the bonus share is interacted with a time trend, permitting testing of the hypothesis that rent-sharing was increasing as the reform

progressed. An alternative test using bonus per worker instead of the bonus share of compensation will also be reported. By estimating the response of the MRP-wage gaps to the ratio of bonus payment to the full wage while controlling other factors that may affect the gaps and properly addressing simultaneity problems, the impact of bonuses on the gaps can be separated from that of other factors.

Table 5 reports the regression equations which attempt to explain the percentage gap between the estimated MRP and the full wage. For the sake of comparison, we first examine the sources of variation in the MRP-wage gaps ignoring the effects of bonus payment in regression (1). This equation was estimated by the GLS method, because the Hausman test indicates that the random-effects model is preferred to the fixed-effects model. The results are presented in the first column of Table 5.

The value of the adjusted R^2 indicates that this regression equation explains 82.5 percent of the variation in the MRP-wage gaps. As expected, the time trend has a negative sign and is statistically significant at the 1% level. The estimate of time trend indicates that the MRP-wage gap fell at an average rate of 3.4% per year from 1980 to 1990, other things being equal. The estimates of SOE shares in the number of firms and in industrial output all have the expected sign and are significant at the 5% level or higher. According to these estimates, a one-percent decline in the share of SOEs in a province in number of firms or in output would reduce the MRP-wage gap, respectively, by 1.8 and 2.9 percent. This result is consistent with the conjecture that rising competition between SOEs and other types of firms weakens the monopsony power of SOEs over their workers. Compared with the benchmark of a large-scale enterprise or an enterprise affiliated with the central government, the estimates of the scale and

affiliation dummy variables are also as expected. These estimates show that the MRP-wage gap is smaller for a medium- or a small-scale enterprise than for a large-scale one, whereas the gap is bigger for an enterprise affiliated with the central government than for those affiliated with provincial, municipal and district governments. Evidently, the monopsony power of SOEs is negatively correlated with the degree of autonomy that an individual SOE enjoys.[16]

The two dummy variables for 1989 and 1990 have negative sign, but only the 1990 dummy is statistically significant. The estimate of the 1990 dummy variable shows that in 1990 alone, the MRP-wage gap fell by 33.6 percent. This is not surprising, because despite the fall in the marginal productivity of labour following the austerity program introduced in late 1988, the real wage of SOE workers was increased sharply in 1990, perhaps to win support for the government from SOE workers in the wake of 1989 Tiananmen incident. SOEs' abilities to reduce employment in response to the temporary profits squeeze, on the other hand, were also almost certainly curtailed due to the political pressures of that period. According to the estimates of industry and province dummy variables, the mean gaps between MRP and wage differ significantly across industries and regions. In particular, the mean gaps in food, beverage and tobacco, textile, garments, paper and printing, chemicals and machinery industries were wider than those in coal mining (the benchmark), metallurgy, building materials and pharmaceutical industries. The mean gaps in Shanghai, Tianjin, Hubei, Guangdong, Shandong, Zhejiang, Anhuei, Jiangsu, Fujian, Yunnan and Guangxi were significantly larger than those in Beijing, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Henan, Hubei, Sichuan, Guizhou and Shaanxi, the provinces in the benchmark group, whereas the MRP-wage gaps in Heilongjiang, Gansu and Qinghai were smaller than those in the benchmark group.[17]

In regression equations (2) and (3), we attempt to examine whether the rise of enterprise autonomy played a role in closing the MRP-wage gap by making it possible for individual SOEs to pay bonuses beyond the level of profit maximization. For this analysis, we add to the list of explanatory variables used in regression (1) the ratio of bonuses to full wages, following the form in equation (13), and this ratio interacted with time trend in regression (2). As an alternative form, we add bonus per worker instead of the bonus ratio, and the bonus variable interacted with time trend in regression (3). Regressions (2) and (3) suffer from a serious statistical problem, because of the possibility of reverse causality between the MRP-wage gaps and the bonus variable. Specifically, for a given level of wages, higher productivity or higher product prices lead both to a large MRP-wage gap and to higher profits, and bonus payments could be higher as a direct consequence of this. The potentially simultaneous relationship between the MRP-wage gaps and the bonus variables could result in biased and inconsistent estimates. To address this problem, firm fixed production effects, which contain information on the efficiency of each enterprise, and the enterprise's capital-labour ratio in the current year were introduced to control for the positive correlation between the gaps and profits. In addition, the bonus variables were instrumented by their lagged values. The firm fixed effects were derived from the residuals of the production function regression for each industry reported in Table 2, and computed as a period-specific average of residuals which, for each period t, is based on the enterprise's data for all years except t. The current residual was excluded to avoid the potential reverse causality between the MRP and firm fixed effects.[18]

The Hausman test based on the OLS and IV estimates rejects the null hypothesis that the bonus variable is uncorrelated with the error terms for regression (2), but fails to reject this

hypothesis for regression (3). Thus, for regression (2), the IV estimates are consistent, whereas the GLS estimates are biased and inconsistent. For regression (3), however, the GLS estimates are consistent and more efficient than the IV estimates. Both the GLS and IV estimates are reported for regression (2) for the sake of comparison.

Noting that most of the results for the variables included in regression (1) are qualitatively similar in these new estimates, we begin our discussion by focusing on the coefficients of the bonus variables. First, note that both the level and time-interacted bonus measures have statistically significant coefficients in all three equations. There is also a consistent sign pattern: the uninteracted bonus measures have positive coefficients, while the time-interacted terms have negative coefficients. In a given year, say t, the overall impact of bonuses on the MRP-wage gap is the sum of the coefficient on the uninteracted bonus term and of (t-1979) times the coefficient on the time-interacted term. All three sets of estimates imply that the SOEs in the panel distributed less bonuses in 1980 than would have been profit-maximizing, but raised bonus payment towards the optimum over time. However, calculations based on both the GLS and the IV estimates of regression (2) show that the impact of bonuses on the MRP-wage gap (and accordingly, on profits) was still positive in 1990. Calculations using the coefficients of regression (3) indicate that the impact of raising the average bonus per worker was positive until 1987, roughly zero in 1988, and negative in 1989 and 1990, suggesting that bonuses were below profit-maximizing levels until 1987 but above them in the final two years. Of the three estimates, then, only one supports the idea that the SOEs attached value to bonuses over and above their usefulness in stimulating productivity, and that one does so only for the last two years of the period covered. While all of the negative interaction terms

might be taken as suggestive of a tendency in the direction of "rent sharing", only for those two years, and only for the per capital bonus variant of the estimating equation, is there an indication that rents were in fact shared.

Turning to the other variables in regression equations (2) and (3), the coefficient on the time trend variable remains negative in the GLS estimates of both equations, but not in the preferred IV estimate of (2), and it is significant at a conventional level for (3) only. By comparison, the SOE share variables are more robust in sign and significance, providing stronger support for the idea that the declining gap is indeed a reflection of declining monopsony power. The magnitudes of the estimated effects of both variables are largest in the IV estimate of (2), according to which a one-percent decrease in the share of SOEs in a province in number of firms or in output would reduce the MRP-wage gap, respectively, by 4.0 and 3.2 percent. Given that from 1980 to 1990 the average share of SOEs in number of firms and in output fell, respectively, by 3.6 and 7.0 percent, the shrinking shares of SOEs in industry would reduce the mean gap between the MRP and the full wage by 36.8 percent, which accounts for over a third (or 36.5 percent) of the total decline in the mean gap during the period.

The coefficients on the affiliation variables and their significance levels also show little qualitative change. The scale variables also perform much as in regression (1) except in the IV estimate of (2), where the medium firm dummy has an insignificant coefficient and that on small firms is unexpectedly positive and significant. The two year dummies are likewise similar except in the IV estimate, where both are insignificant. The variables introduced to help control for the possibly simultaneous relationship between productivity and bonuses are the technical efficiency scores for each firm based on the production function analysis (firm fixed effects) and

the capital-labour ratio. All have significant coefficients, supporting the appropriateness of these controls, and these are positive, as is to be expected. The industry coefficients still show no pattern that we are able to interpret, though we may take note of their high significance levels especially in the IV version of (2).[19] The province dummies still exhibit a tendency to be higher in the richer coastal provinces, which could again reflect administrative rather than market-driven processes. The one notable exception is the sign reversal for Guangdong in the IV estimate of (2). This result for Guangdong may well be explained by the fact that this particular province supported a far greater inflow of labour from other regions, and has had labour markets that are well developed relative to other regions owing to the unusual degree of autonomy it has enjoyed during much of the reform period. If so, it too provides support for the idea that the dependent variable is measuring the exercise of monopsony power.[20]

6. Discussion

From 1949 to 1978, China's economy industrialized, but structural change with respect to employment was considerably slower than that displayed by output and investment. In our previous paper, we hypothesized that this pattern was at least in part the consequence of the concentration of control over industry in the hands of the country's political authorities, and of the fact that those authorities sought a high rate of industrial growth through rapid accumulation of industrial capital. Contrary to the view that those authorities faced an effectively unlimited supply of potential industrial workers, we provided reasons why the Chinese state faced an upward-sloping supply curve of industrial labor, a phenomenon that would have led a state seeking maximum profits for industrial investment to behave as a monopsonist in its industrial employment decisions. Given the evidence in that paper that a large gap between the marginal

product and the full wage of SOE workers continued to exist as late as 1985, we proposed to investigate in the present paper the extent to which SOE employment and wage-setting behavior under the country's market-oriented reforms have evolved away from the monopsonistic pattern.

The main hypothesis investigated in this paper is that with the decentralization of decision-making to individual SOEs and with increasing competition between SOEs and nonstate enterprises, the degree of monopsony power that a given SOE could exercise declined, so that on average employment should be found to be moving towards the socially optimal level where labor's marginal product and compensation are equal. This hypothesis was seen to be supported by the trend in the percentage gap between MRP and wage before additional controls are introduced (Figure 1). It was likewise supported by the significant negative coefficient on the free-standing time trend in regressions (1) and (3), by the positive coefficients on the SOE share variables, and by the appearance of the predicted coefficients on the affiliation and scale variables in regressions (1) and (3).

Despite the declining trend in the MRP--wage gap during the 1980s, it is worth noting that our MRP estimates imply that a significant gap remained for the majority of SOEs in 1990. If our evidence for the gap's existence in 1980 is accepted and if we are familiar with the aggregate employment and investment records of the sector, of course, then this fact may not strike us as too surprising. SOE employment did not grow particularly vigorously in the 1980s, as compared with earlier decades. The 3.0% employment growth rate achieved by the SOE sector for the 1980-90 period lags behind the record of a 5.9% rate between 1952 and 1979. By contrast, SOE capital accumulation proceeded at a rate of 8.7% per year during 1980-90.

The persistence of monopsony (or at least of monopsony-like behavior) in the SOEs to

the end of the 1990s nevertheless confronts us with an analytical challenge. While a prediction of monopsony makes reasonable sense in the pre-reform setting where the state was the predominant industrial employer and enterprises lacked autonomy on major decisions, it is more difficult to say why monopsony should have continued to prevail after the SOEs had been given greater autonomy and faced increasing competition from other industrial enterprises. The fact that the pay and benefits offered by SOEs continued to exceed those of enterprises in some other sectors throughout the 1980s also presents an analytical challenge,[21] for one may ask why, under such circumstances, SOEs could not simply hire as many new employees as they wished at wages well below those that they were already paying.

We suggest some tentative answers to these questions. First, increases in the autonomy of SOEs and the degree of competition by nonstate enterprises were still quite limited as late as 1984, and the transition from one employment equilibrium to another can be expected to take some time. Second, the extent of the independence that individual SOEs could exercise even in the late 1980s, with respect to the twin decision parameters of wages and employment, may well have remained limited enough that some coordination of these policies by supervisory organs at provincial and national levels was still taking place, with effective decision-makers thus having a more monopsonistic perspective than would smaller individual enterprises. Third, by the end of the 1980s, little progress had been made in developing socially provided pension schemes, health insurance, transportation facilities and housing services in Chinese cities. As a result, enterprises remained the main provider of these essential services. The high costs of labour mobility to the worker under this working-unit-based welfare system could make the labour supply to individual enterprises somewhat inelastic, as mentioned earlier. The factors that

caused the cost of providing housing and other benefits to be increasing in the number of workers hired could also have made the per worker cost of employment a rising function of employment for SOEs throughout the 1980s. Lastly, while many nonemployees of the SOEs might have been willing to take jobs with those enterprises at less than their prevailing full wages, it is not very clear whether those job seekers would have had the required skills and/or be willing to supply adequate effort at lower wages. Efficiency wage considerations could also account for some of the gap between SOE and non-SOE wage levels.

Given the comparatively modest growth of SOE employment that occurred in the early post-reform period, some of that closing of the MRP--wage gap that our figures suggest occurred may be attributed to rising wages, rather than increasing employment. Concerns about potentially excessive wage growth in the SOEs has focused on the use of bonus payments. If enterprises earn rents from monopoly positions, from operation in imperfectly competitive markets, or from the financial indiscipline or largesse of the state, then grants of autonomy in wage-setting might lead to rent-sharing with workers, especially in a situation in which political and other pressures make it difficult for managers to increase their own earnings without increasing those of the workers. In the context of a situation of monopsony, however, some enterprise rents are properly viewed as profits from monopsony itself, and their payment to workers is not formally rent-sharing, but rather the return of monopsony rents to the workers. As we have pointed out, moreover, it is incorrect to view bonuses as allocations from a fixed financial pool, because their payment may affect the size of the pool, and indeed an extra dollar worth of bonuses may increase production by more than a dollar, raising both worker earnings and enterprise profits. The optimal bonus level for a profit-maximizing firm is the one at which

all such opportunities have been exhausted and the marginal dollar of bonuses yields only a dollar of increased output. This being the case, we cannot call bonus payments "rent sharing" until they are carried beyond this point and into the range of the bonus-effort relationship at which the extra dollar of bonuses yields less than a dollar of added output.

Our empirical results match those of Xu and Zhuang (1996) in suggesting that bonuses paid to SOE workers generated at least as much new revenue (from increased productivity) as they cost to pay out. Indeed, like Xu and Zhuang's findings, our results suggest that bonuses remained too *low* from the standpoint of simple profit-maximization, let alone any additional goal of earnings enhancement. Only for 1989 and 1990 is there an indication in one set of estimates that the marginal *yuan* of bonuses raised marginal product by less than a *yuan*. For the 1980-90 period as a whole, increasing bonuses are not a factor contributing to the closing of the MRP--wage gap. The finding for the last two years is not surprising in view of their crisis nature for the SOE sector and much of the rest of the economy. Whether the movement into negative territory continued into the 1990s is something that only research using more recent data will be able to determine.

While the empirical results seem to strongly reject claims that bonuses were excessive, they raise a logical problem in the context of our formal model. Strictly speaking, the model rules out a positive relationship between bonuses and the gap in equilibrium, since a profit-maximizing enterprise would seek a zero effect while an enterprise that values both profits and wage payments would find equilibrium at a negative one. Thus, our results suggest that the model does not capture one or more factors actually impinging on the outcome. For instance, enterprise managers may not have understood well the relationship between bonuses and output,

and they may have been inclined to err on the side of conservatism in setting bonuses, perhaps because of the concerns of supervisory bodies.

It is in fact well known that government officials were concerned that bonuses might grow too rapidly, and that accordingly they implemented regulations to control their rate of growth. In 1983, for example, the sum of bonuses and welfare payments was limited by regulation to no more than 40% of retained profits. In 1985, the bonus ceiling was abolished, but to prevent excessive bonus payments, a bonus tax was introduced. Although Walder's concern that managers might be "hostage" to incumbent workers might retain some validity, the great majority of SOE managers continued to rely for their appointments on state supervisory departments, adding to the government's leverage in the enforcement of such regulations. Crude selection of bonus regulations with imperfect information on the bonus--profit relationship could have left chosen bonuses below even the profit-maximizing level, let alone the level that would be pursued by an enterprise valuing bonuses for the workers' sakes. A positive equilibrium relationship between bonuses and the gap could exist in our model if modified by the imposition of a binding constraint on the level of bonuses or by explicit introduction of a tax on bonuses.

7. Conclusion

China's economic reforms have gone some distance towards eliminating allocative inefficiencies associated with the pre-reform economy, including those related to the sharp discrepancy in labour productivity between agricultural and industrial sectors. The share of the country's output due to industry fell slightly from 49.0 to 43.6% between 1980 and 1990, whereas the share of the workforce engaged in industrial work rose from 18.3 to 21.4%,

reversing the previous pattern wherein structural change in employment lagged behind that in output. The SOE sector, which produced 75.9% of industrial output at the beginning of this period and 54.6% at the end, contributed to industrial job creation with a net increase of more than 10 million jobs (more than a third of industrial employment created during the period). This contribution of the SOEs to China's reform-era structural transition is consistent with the declining state monopsony found by this paper.

Despite the progress, China's economic structure remains markedly dualistic, and the productivity gap between industrial and agricultural labour is persistently large. A calculation based on sector shares of output and employment shows that this productivity gap fell from 6.92:1 in 1978 to 4.32:1 in 1984, but rose steadily to 5.40:1 in 1995. Thus, the contribution of industry as a whole to reducing the dualism of Chinese economy in the first decade of reforms was modest. The SOEs, which still owned about 70 percent of capital assets and employed about 68 percent of workers in the urban industrial sector in the early 1990s, remained social under-employers of labour, if the large gaps between the marginal revenue products of labour and the full wages in most branches of industry reported by this paper are any guide.

Nevertheless, there are persistent reports of overmanning in SOEs. Far from expanding their employment, observers see the necessary adjustment of SOEs towards efficiency as one entailing the laying off of redundant workers who are said to account for upwards of 30% of their workforces. Although we do not address the general question of SOE efficiency, the approach adopted in this paper suggests some complexities overlooked by this common view. We point out that there is a logical tension between the claim that SOEs have been excessively capital-intensive, and the belief that they have been overmanned. Excessive capital intensity is

consistent with our observation of an MRP--wage gap and with our explanation of that gap in terms of state monopsony in the pre-reform era. While there is no reason to challenge reports of redundant employees, given that many individual workers were administratively assigned to enterprises for whose productive activities they lacked appropriate skill or potential, and given past restrictions on laying off unwanted workers, such misassignment of workers could co-exist with net undermanning of SOEs. A more efficient outcome might (so long as the MRP--wage gaps of the 1980s persisted) have entailed the laying off or transfer of inappropriately placed workers, yet a net growth in overall SOE employment through recruiting of new workers. Indications of monopsony mean that managers' statements that they would prefer to lay off significant numbers of workers must be viewed with caution, since, as our own and even the traditional monopsony model make clear, it is always possible that an enterprise operates with more labor than is profit-maximizing, yet with less labor than is socially optimal.

Of course, even if we are correct in concluding that SOE employment has been below its potential (or, more specifically, what would be socially optimal), the best way to release this potential is not through administrative intervention to encourage to SOE managers to create more jobs. Instead, sound industrial policies should target the roots of labour market distortions. These policies may include the granting of full autonomy to enterprises while making them fully responsible for their decisions, reforming of the enterprise-based welfare system, developing housing markets, raising capital costs to market rates, and perhaps providing both public and private enterprises with wage subsidies that address the discrepancy between the labour costs to firms and the shadow price of labour in the economy. The reform of SOEs is now proceeding at a rapid pace. Without paying

proper attention to the economic, institutional and historical distortions in the industrial labour market, Chinese reformers might find their goals of improving the economic efficiency of SOEs in severe conflict with its goal of the effective deployment of the labour force and the reduction of economic dualism.

References

Broadman, harry, ed., 1996, "Policy Options for Reform of Chinese State-Owned Enterprises," World bank Discussion Paper No.335.

Chen, Kuan, Wang Hongchang, Zheng Yuxin, Gary Jefferson, and Thomas Rawski, 1988, "Productivity Change in Chinese Industry: 1953-1985," *Journal of Comparative Economics* 12: 570-91.

Cheng, Chu-yuan, *China's Economic Development*, Boulder: Westview Press, 1982.

Dong, Xiaoyuan, "Employment and Wage Determination in China's Rural Industry: Investigation Using 1984-90 Panel Data," working paper, Department of Economics, University of Winnipeg, 1997.

Dong, Xiaoyuan, and Louis Putterman, "China's Rural Industry and Monopsony: An Exploration," *Pacific Economic Review*, Vo.1, No. 1: 59-78, June 1996.

Dong, Xiaoyuan, and Louis Putterman, "Pre-Reform Industry and State Monopsony in China", working paper, Department of Economics, Brown University and University of Winnipeg, 1997.

Hausman, J.A. and W.E. Taylor, "Panel Data and Unobservable Individual Effects," *Econometrica*, 49, 1377-1399, 1981.

Hay, Donald, Derek Morris, Guy Liu and Shujie Yao, *Economic Reform and State-Owned Enterprises in China, 1979-1987.* Oxford: Clarendon Press, 1994.

Hussain Athar and Juzhong Zhuang, "Impact of Reforms on Wage and Employment Determination in Chinese State Enterprises, 1986-1991", STICERD, The Development Economics Research Programme, London School of Economics, November 1994.

Jefferson, Garry, Thomas Rawski and Yuxin Zheng, "Productivity Change in Chinese Industry: Comment," *China Economic Review* 5: 235-41, 1994.

Lin, Justin Yifu, Fang Cai and Zhou Li, *The China Miracle: Development Strategy and Economic Reform.* HongKong: Chinese University Press, 1996.

Manning, Alan, "How Do We Know That Real Wages Are Too High?" *Quarterly Journal of Economics*, 1110-1125, 1995.

Meng, Xin, 1990, "The Rural Labour market," in W. Byrd and Q. Lin eds, China's Rural Industry: Structure, Development and Reform, pp. 299-322, New York: Oxford University Press.

Pitt, M.M. and Louis Putterman, "Employment and Wages in Township, Village, and Other Rural Enterprises," in G.H. Jefferson and I.J. Singh (eds), *Reform, ownership and Perfromance in Chinese Industry*, World Bank, forthcoming.

SSB (State Statistical Bureau), 1984, 1985, 1993, and 1994, *China Statistical Yearbook*. Beijing: China Statistical Publishing House.

SSB (State Statistical Bureau), 1986, *China's Labour and Wages Statistics (zhongguo laodong he gongzi tongjiziliao): 1949-1985*. Beijing: China Statistical Publishing House.

Walder, Andrew, "Factory and Manager in an Era of Reform," *China Quarterly* 118: 242-64, 1989.

Whiting, Susan, 1994, "Contract Incentives and Market Discipline in China's Rural Industrial Sector," mimeo, University of Michigan.

Xu, Chenggang and Juzhong Zhuang, "Profit-Sharing and Enterprise Financial Performance in Chinese State Industry, 1986-1991," *Economics of Planning*, 1996.

Xu, Wenyi, G.Jefferson and D. Rathja, 1993, "China Data Documentation," Transition and Macro-Adjustment Division, World Bank.

Yang, Dennis Tao and Hao Zhou, 1997, "Rural-Urban Disparity and Sectoral Labour Allocation in China", Research papers in Asian/Pacific Studies, Duke University, Durham, North Carolina.

Table 1 Summary Statistics of the Variables (1980-1990)[1]

	Real GVIO[2]	Materials Inputs	Real Capital Assets	Employment	No.Obs.	No.Enterprises
	10,000 yuan	10,000 yuan	10,000 yuan	workers		
All Industries:						
Mean	6,000.9	3,545.8	2,158.5	3,229.5	9,326	907
Standard Deviation	18,014.4	9,619.6	13,289.2	11,047.2		
Coal Mining:						
Mean	7,042.8	2,735.1	7,440.8	13,704.9	453	44
Standard Deviation	15,978.4	5,059.2	18,285.5	27,119.5		
Metallurgy:						
Mean	17,729.4	9,642.8	9,241.9	8,441.4	919	92
Standard Deviation	51,110.3	25,471.9	39,079.2	27,204.8		
Building Materials:						
Mean	1,937.6	998.5	1,188.9	1,886.3	751	72
Standard Deviation	2,411.6	1,269.0	1,926.7	2,274.5		
Food, Beverage & Tobacco:						
Mean	6,333.9	3,015.0	706.3	1,241.6	852	86
Standard Deviation	9,720.1	3,931.7	750.7	963.9		
Textiles:						
Mean	8,581.3	5,747.8	1,672.4	3,694.6	862	83
Standard Deviation	6,878.1	4,795.9	2,969.3	2,685.7		
Garments:						
Mean	2,238.5	1,758.8	209.2	1,092.4	227	26
Standard Deviation	2,811.6	2,976.9	270.7	1,066.0		
Paper and Printing:						
Mean	1,820.5	1,057.0	727.9	1,266.3	893	85
Standard Deviation	2,177.6	1,289.1	1,180.7	1,065.7		
Chemicals:						
Mean	4,358.0	2,735.9	956.0	1,575.1	1,270	121
Standard Deviation	5,160.0	2,942.9	1,628.0	1,573.3		
Pharmaceutical:						
Mean	4,240.7	2,722.7	734.0	1,299.3	647	61
Standard Deviation	6,522.4	3,615.1	1,632.2	1,039.4		
Machinery:						
Mean	4,820.7	3,309.6	1,200.3	2,558.3	2,452	237
Standard Deviation	7,746.4	7,750.2	1,689.2	2,795.6		

Notes: (1) The data were collected by the CESRC in cooperation with the World Bank.
(2) GVIO is gross value of industrial output.

Table 2: Production Functions: 1980-1990 Panel Data[1]
Dependent Variable: Log Gross Value Products

	All Industries	Coal Mining	Metallurgy	Building Materials	Food, Bev. & Tobacco	Textiles
Models	LSDV[2]	GLS	LSDV	LSDV	LSDV	LSDV
Time trends	0.010 (12.717)	0.008 (2.537)	0.023 (11.070)	0.002 (1.14)	-0.004 (-1.297)	-0.005 (-1.988)
Labour	0.266 (17.654)	0.221 (5.131)	0.122 (3.352)	0.166 (3.798)	0.389 (7.509)	0.359 (6.832)
Capital	0.057 (9.874)	0.089 (3.849)	0.077 (5.284)	0.029 (1.688)	0.128 (7.120)	0.044 (2.632)
Materials	0.646 (114.510)	0.629 (22.919)	0.554 (30.325)	0.753 (34.370)	0.465 (27.831)	0.750 (29.531)
Returns to scale	0.969	0.939	0.753	0.948	0.982	1.153
Industry Dummies[3]	no	---	---	---	---	---
Regional Dummies[4]	no	yes	no	no	no	no
Constant	no	0.862	no	no	no	no
Hausman Test[5] p-value	125.17 (0.000)	7.711 (0.103)	119.98 (0.000)	14.001 (0.007)	43.795 (0.000)	15.324 (0.004)
F-statistics[6]	---	1.040 (0.374)	4.518 (0.003)	5.034 (0.002)	66.539 (0.000)	5.727 (0.000)
Adjusted R^2	0.988	0.986	0.992	0.986	0.975	0.963
No.Obs.	9,328	453	920	751	852	862

Table 2: Production Functions: 1980-1990 Panel Data (cont'd)

	Garments	Paper & Printing	Chemicals	Pharmaceutical Products	Machine Building
Models	LSDV	LSDV	LSDV	LSDV	LSDV
Time trends	0.007 (1.340)	0.007 (2.902)	0.011 (6.415)	0.001 (0.589)	0.019 (9.614)
Labour	0.219 (2.443)	0.264 (4.089)	0.357 (12.851)	0.073 (2.991)	0.255 (6.681)
Capital	0.062 (2.536)	0.099 (4.462)	-0.002 (-0.139)	0.035 (3.100)	0.066 (4.747)
Materials	0.488 (20.126)	0.403 (18.130)	0.696 (43.617)	0.858 (60.723)	0.679 (62.131)
Returns to scale	0.769	0.766	1.051	0.966	1.00
Regional Dummies	no	no	no	no	no
Constant	no	no	no	no	no
Hausman Test p-value	28.387 (0.000)	37.092 (0.000)	53.163 (0.000)	15.291 (0.004)	34.258 (0.000)
F-statistics	21.192 (0.000)	69.914 (0.000)	14.318 (0.000)	23.495 (0.000)	60.454 (0.000)
Adjusted R^2	0.986	0.961	0.984	0.993	0.973
No.Obs.	227	893	1,270	647	2,453

Notes: 1. The table represents regression coefficients. Number in parentheses are the t statistics.

2. GLS indicates that the production function was estimated as a random-effects model by the generalized least squares method, and LSDV shows that the production function was estimated as a fixed-effects model by the least squares dummy variable technique.

3. Industrial dummy variables are introduced for the all industries combined sample, but not reported here

4. Regional dummy variables are estimated for the random-effects model, but not reported here.

5. The Hausman test for each regression is performed based on the LSDV and GLS estimates by excluding time-invariant regressors.

6. F-statistics are the test values for the null hypothesis that the output elasticities of industry i do not significantly differ from that of all other industries.

Table 3: Summary of MRPs, Wages, and the MRP-Wage Gaps of Industries[1]

	Mean	Std. Dev.	Median	Quartiles		t-test[2]
				1st Qrt.	3rd Qrt.	p-value
All Industries:						
MRPs (yuan)	5,991.4	7,845.6	3,403.8	1,660.7	7,097.2	54.936
Wages (yuan)	1,562.1	636.2	1,450.5	1,224.6	1,767.7	(0.000)
of which: Bonus	214.6	192.2	163.7	100.2	275.1	
Gaps (%)	288.4	503.2	129.1	0.14	364.2	
Coal Mining:						
MRPs (yuan)	1,496.6	2,096.7	796.0	515.1	1,548.8	-3.200
Wages (yuan)	1,806.6	414.7	1,756.4	1,522.0	2,049.3	(0.001)
of which: Bonus	178.4	131.9	141.1	91.2	235.7	
Gaps (%)	-17.0	118.7	-54.6	-69.2	-19.8	
Metallurgy:						
MRPs (yuan)	2,772.4	3,205.9	1,662.2	1,056.7	3,052.5	11.615
Wages (yuan)	1,614.1	789.6	1,494.6	1,264.2	1,826.1	(0.000)
of which: Bonus	213.3	232.3	172.2	103.7	270.7	
Gaps (%)	68.5	183.1	7.1	-22.8	84.5	
Building Materials:						
MRPs (yuan)	1,544.9	934.2	1,337.4	865.8	1,920.7	0.378
Wages (yuan)	1,533.2	390.9	1,483.8	1,244.7	1,744.3	(0.706)
of which: Bonus	175.8	141.3	144.8	89.2	234.9	
Gaps (%)	0.4	57.6	-9.9	-37.0	21.4	
Food, Beverage & Tobacco:						
MRPs (yuan)	16,316.6	14,995.1	10,398.9	6,501.2	21,041.5	28.995
Wages (yuan)	1,556.3	584.6	1,448.9	1,187.1	1,746.8	(0.000)
of which: Bonus	210.6	189.0	157.6	99.6	261.0	
Gaps (%)	984.6	959.6	553.1	340.7	1,353.9	
Textiles:						
MRPs (yuan)	10,017.6	9,308.2	6,769.4	5,125.2	10,103.8	27.178
Wages (yuan)	1,497.6	431.6	1,408.1	1,202.4	1,710.0	(0.000)
of which: Bonus	184.6	121.6	150.3	106.1	237.2	
Gaps (%)	584.3	668.5	369.4	242.0	588.6	
Garments:						
MRPs (yuan)	3,342.1	2,324.4	2,831.5	1,678.1	4,410.4	14.505
Wages (yuan)	1,358.3	506.7	1,215.2	1,052.9	1,534.3	(0.000)
of which: Bonus	130.3	132.5	101.8	39.7	172.5	
Gaps (%)	138.5	129.0	119.7	48.1	203.6	

Table 3: Summary of MRPs, Wages, and the MRP-Wage Gaps of Industries (cont'd)

	Mean	Std. Dev.	Median	Quartiles		t-test
				1st Qrt.	3rd Qrt.	p-value
Paper and Printing:						
MRPs (yuan)	3,393.1	2,110.7	3,077.0	2,085.3	4,159.0	28.215
Wages (yuan)	1,455.5	759.6	1,344.3	1,149.8	1,609.9	(0.000)
of which: Bonus	157.5	137.5	130.6	77.3	208.5	
Gaps (%)	135.3	124.8	122.7	58.6	183.9	
Chemicals:						
MRPs (yuan)	9,535.9	5,666.2	8,423.5	5,479.9	12,330.5	51.990
Wages (yuan)	1,588.5	538.5	1,457.8	1,238.1	1,805.7	(0.000)
of which: Bonus	218.6	172.7	167.8	107.8	288.3	
Gaps (%)	510.9	346.1	434.4	275.9	668.7	
Pharmaceutical:						
MRPs (yuan)	2,054.5	1,422.7	1,597.5	1,161.5	2,656.5	11.198
Wages (yuan)	1,516.2	562.4	1,379.6	1,190.9	1,700.7	(0.000)
of which: Bonus	199.4	189.1	148.8	96.3	250.0	
Gaps (%)	35.6	85.7	14.5	-20.0	63.8	
Machinery:						
MRPs (yuan)	4,702.4	5,461.3	2,967.4	1,810.9	5,078.9	29.212
Wages (yuan)	1,587.0	743.8	1,464.8	1,245.9	1,776.2	(0.000)
of which: Bonus	184.0	156.6	144.3	88.6	243.2	
Gaps (%)	186.1	276.9	85.1	26.2	221.6	

Notes: 1. The MRP and MRP-wage gap estimates are derived from the output elasticities of labour reported in Table 2.

2. The t-statistic is computed to test the null hypothesis that the SOEs employed workers to the point where the MRP was equal to the full wage.

Table 4: Average MRPs, Compensations, MRP-wage Gaps, and SOE shares
All Industries: 1980-90

Year	MRP[1] (yuan)	Full wages[2] (yuan)	% of full wages: Basic pay	Subsidies	Housing	Welfare	Bonus	Gap (%)	SOE share[3]: Output (%)	SOE share[3]: No. firms (%)
Mean value:										
1980	4,913.0	1,205.8	59.0	9.8	10.4	12.4	8.4	323.6	78.4	23.5
1981	4,977.6	1,237.4	56.4	11.9	10.2	13.2	8.3	316.0	78.9	23.9
1982	5,114.2	1,292.1	54.4	12.1	10.6	13.8	9.1	311.3	78.3	24.1
1983	5,336.9	1,301.1	52.9	12.2	10.7	14.9	9.3	319.8	77.7	24.0
1984	5,793.4	1,524.1	52.1	11.1	9.8	15.3	11.7	285.8	74.8	21.4
1985	6,210.1	1,532.2	51.8	11.4	10.6	14.6	11.6	308.8	72.7	22.5
1986	6,372.2	1,698.6	53.7	9.3	10.7	14.9	11.4	277.9	64.7	22.1
1987	6,672.2	1,767.1	52.1	9.0	11.5	14.5	12.9	275.6	72.3	22.1
1988	6,900.0	1,814.9	51.4	7.7	11.9	14.8	14.2	269.5	74.4	20.7
1989	6,626.8	1,787.0	51.1	7.9	11.9	14.8	14.3	254.8	71.3	19.8
1990	6,554.9	1,956.1	52.6	7.2	11.5	15.5	13.2	222.9	71.4	19.9
Annual rate of growth:										
	3.7%	5.1%	-----	-----	-----	-----	-----	-3.2%	-1.2%	-2.0%
1980-90:	yuan	yuan	yuan	yuan	yuan	yuan	yuan	%	%	%
Mean	5,970.1	1,562.1	817.2	142.8	184.8	227.9	190.4	287.2	74.0	22.2
St.dev.	7,848.3	636.2	345.1	15.8	271.2	103.5	167.5	503.5	10.7	7.1

Notes: 1. The MRP and MRP-wage gap estimates are derived from the output elasticities of labour reported in Table 2.

2. The full wage is the sum of basic pay, price subsidies, subsidized housing, welfare and benefits, and bonuses. The basic pay includes piece-rate and hour-rate wages, overtime compensation, direct subsidies for food and fuels, and allowances. The price subsidies are state's budget subsidies on food per urban employee. The housing expenses are estimated as the expenses on nonproductive capital assets per SOE employee. The welfare and benefits include health care, day care, retirement pension, disability and maternity, and death and emergency aid. Bonus is derived as total bonus payment divided by the number of year-end employees.

3. These are the shares of SOEs in a province in terms of industrial output or in terms of number of industrial enterprises.

Table 5: The MRP-Wage Gap Regression Models[1]

	Equation (1)[2]	Equation (2)		Equation (3)
	GLS[3]	GLS	IV	GLS
Time trend	-0.034	-0.008	0.028	-0.019
	(-3.044)	(-0.561)	(0.785)	(-1.628)
SOE share in no. firms	1.807	1.835	4.011	1.564
	(2.200)	(2.362)	(3.819)	(2.011)
SOE share in output	2.893	2.900	3.202	3.002
	(5.253)	(5.549)	(3.409)	(5.761)
Medium firm[4]	-0.728	-0.512	-0.065	-0.540
	(-2.573)	(-2.011)	(-0.629)	(-2.119)
Small firm	-1.258	-0.686	0.496	-0.752
	(-2.573)	(-2.245)	(4.379)	(-2.456)
Affiliation with provincial gov't[5]	-1.902	-1.747	-1.667	-1.743
	(-4.122)	(-4.227)	(-8.217)	(-4.209)
municipal gov't	-1.946	-1.641	-1.088	-1.665
	(-4.860)	(-4.534)	(-5.653)	(-4.593)
district gov't	-1.045	-0.788	-0.720	-0.796
	(-1.369)	(-1.153)	(-2.316)	(-1.163)
1989 dummy	-0.077	-0.027	0.042	-0.038
	(-0.894)	(-0.335)	(0.285)	(-0.458)
1990 dummy	-0.336	-0.277	-0.216	-0.296
	(-3.659)	(-3.130)	(-1.215)	(-3.222)
Firm-fixed effects	-----	1.256	5.973	1.182
		(3.788)	(22.148)	(3.569)
Capital-labour ratio	-----	0.851	0.833	0.874
		(9.792)	(4.652)	(9.932)
Bonus-wage ratio	-----	5.716	13.030	----
		(5.549)	(3.598)	
Time*bonus-wage ratio	-----	-0.504	-1.027	-----
		(-4.797)	(-2.657)	
Bonus	-----	-----	------	13.401
				(2.580)
Time*bonus	-----	-----	------	-1.738
				(-3.272)

Table 5: The MRP-Wage Gap Regression Models (cont'd)

	Equation (1)	Equation (2)		Equation (3)
	GLS	GLS	IV	GLS
Industry dummies:[6]				
Metallurgy	0.575	-1.143	-6.430	-1.002
	(0.882)	(-1.555)	(-18.639)	(-1.361)
Building materials	0.082	0.068	1.486	0.076
	(0.122)	(0.112)	(8.029)	(0.126)
Food, Bev.& tobacco	9.629	9.373	9.704	9.427
	(14.630)	(15.874)	(29.328)	(15.943)
Textile	5.435	7.466	16.314	7.371
	(7.995)	(9.183)	(28.237)	(9.051)
Garments	1.277	0.235	-3.672	0.302
	(1.489)	(0.280)	(-10.350)	(0.359)
Paper and printing	1.253	-0.010	-3.763	0.061
	(1.904)	(-0.014)	(-13.139)	(0.090)
Chemicals	4.948	5.995	11.123	5.977
	(7.853)	(9.564)	(31.634)	(9.520)
Pharmaceutical	0.379	0.555	2.735	0.585
	(0.533)	(0.868)	(12.599)	(0.913)
Machinery	1.375	2.226	6.284	2.189
	(2.323)	(3.956)	(23.003)	(3.885)
Province dummies:[7]				
Shanghai	2.004	1.654	0.489	1.773
	(3.299)	(3.025)	(1.883)	(3.237)
Tianjin	1.942	1.559	0.683	1.634
	(2.853)	(2.555)	(2.957)	(2.674)
Heilongjiang	-0.933	-0.857	-0.499	-0.924
	(-1.649)	(-1.695)	(-3.664)	(-1.824)
Hubei	1.201	1.119	0.618	1.101
	(2.219)	(2.311)	(2.854)	(2.269)
Guangdong	1.374	0.740	-0.665	1.009
	(2.328)	(1.379)	(-2.126)	(1.874)
Shandong	1.474	1.395	1.485	1.395
	(2.709)	(2.866)	(6.090)	(2.863)
Hunan	0.777	0.722	0.468	0.753
	(1.296)	(1.346)	(2.395)	(1.402)

Table 5: The MRP-Wage Gap Regression Models (cont'd)

	Equation (1)	Equation (2)		Equation (3)
	GLS	GLS	IV	GLS
Province dummies:				
Zhejiang	3.495	3.254	2.847	3.355
	(4.839)	(5.004)	(5.198)	(5.154)
Anhei	1.320	1.319	1.714	1.274
	(1.714)	(1.915)	(4.682)	(1.848)
Gansu	-0.547	-0.601	-0.454	-0.609
	(-2.159)	(-2.517)	(-2.214)	(-2.553)
Qinghai	-1.757	-1.578	-1.053	-1.649
	(-2.130)	(-2.132)	(-3.664)	(-2.226)
Jiangsu	2.070	1.959	1.786	2.012
	(4.163)	(4.378)	(5.597)	(4.492)
Fujian	1.289	1.362	1.358	1.377
	(1.750)	(2.065)	(6.741)	(2.086)
Yunnan	1.170	1.107	1.178	1.129
	(1.506)	(1.593)	(4.127)	(1.624)
Guangxi	1.732	1.412	0.599	1.453
	(2.183)	(1.987)	(1.654)	(2.042)
Constant	-0.386	-2.858	-10.593	-2.497
	(-0.491)	(-3.510)	(-11.745)	(-3.061)
Hausman test[8]	10.078	-----	-----	-----
p-value	0.184			
Hausman test[9]	-----	-----	1946.316	11.882
			0.000	0.999
Adjusted R^2	0.825	0.825	0.506	0.825
No. obs.	9,323	9,323	7,687	9,323

Notes: 1. The table represents regression coefficients. Number in parentheses are the t statistics. The dependent variable is the percentage gap between the MRP and the full wage.

2. Equation (1) ignores the bonus effects, equation (2) includes bonus-wage ratios in the explanatory variables, and equation (3) uses bonus payment as an explanatory variable.

3. GLS indicates that the equation was estimated as a random-effects model by the generalized least squares method. IV shows that the equation was estimated by the instrumental variable method. In the IV estimation, lagged bonus-wage ratio, lagged bonus payment, and lagged time interacting variables were used as instruments.

4. The benchmark for scale dummy variables is the large-scale enterprise.

5. The benchmark for affiliation dummy variables is the enterprises affiliated with the central government.

6. The benchmark for industry dummies is coal ming industry.

7. The benchmark group for province dummies includes Beijing, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Henan, Hubei, Sichuan, Guizhou, and Shaanxi.

8. The Hausman test for equation (1) is the test for the null hypothesis that the random-effects model is preferred to the fixed-effects model. This test was performed based on the LSDV and GLS estimates by excluding time-invariant regressors (for reference, see Hausman and Taylor, 1981). This test was not performed for equations (2) and (3). Since firm-fixed effects were used as a regressor in these equations, the coefficients of these equations cannot be precisely estimated by the LSDV method.

9. The Hausman test for equations (2) and (3) is designed to test the null hypothesis that the bonus variables are not correlated with the error terms of the gap equation. It was performed based on the OLS and IV estimates.

End Notes:

1. See, for example, Cheng, 1982; Lin et al., 1996.

2. No large jump in state-sector employment is observed during the years between the onset of reforms, in 1979, and the end of the first reform decade, in 1990. Indeed, while SOE employment grew at an average annual rate of 5.44% per year, between 1957-78, it grew by only 2.77% per year between 1978 and 1990.

3.It is less than a certainty that the presence of nonstate employers would have led to increased job creation or higher wages in the short run, because full SOE wages, including the value of subsidies and other benefits, remained above the earnings of workers in other sectors during the early years of reform. This gap existed in large part because the competing firms were not burdened by the same policy-imposed benefit obligations as were the SOEs. (The possibility that pre-reform SOEs created fewer jobs simply because their effective wages were "too high" is, however, inconsistent with the findings in Dong and Putterman, 1997.) Just when the entry of non-state competition, and the emergence of competition among SOEs, became sufficient to generate real competition for incumbent and potential SOE employees is a question which can only be resolved by empirical means.

4.The model presented here is inspired by Alan Manning (1995). In this study, Manning examines the employment effects of minimum wages in a monopsony labour market where a firm chooses efficiency wage and employment to maximize profits. Extending his work, our model explores the employment and wage behaviour of an enterprise that has multiple objectives in an efficiency wage and monopsony setting.

5. To be sure, it could be argued that when enterprises pay bonuses year after year, workers come to anticipate them, and that their willingness to work for an enterprise then reflects both the guaranteed wage and the anticipated bonus. Our approach may nonetheless be justified by several factors: (1) in the estimating version of our model, the wage includes all subsidies and other benefits aside from the bonus proper; (2) there is no straightforward way to distinguish between the anticipated and unanticipated portion of bonuses, and the actual bonus may be a reasonable proxy for the unanticipated component of the whole bonus; (3) studies including Hay et al.(forthcoming), Jefferson et al.(forthcoming), and Hussain and Zhuang (1994) show much higher correlations between SOE productivity and profits, on the one hand, and bonuses, on the other, than between the former and wages; (4) during the period studied, SOE employees typically earned considerably more than comparable workers in other sectors, making it reasonable to suppose that their "supply price" was indeed below

their full compensation; (5) in our enterprise panel, bonuses accounted for an average of only 8 to 14% of total worker compensation.

6. We ignore the issue of monitoring and the possibility that the monitoring cost may be increasing in the number employed and so is bonus payments to reduce the monitoring cost.

7.Note that with N variable, workers are formally indifferent between increasing bonuses by bringing more workers into the enterprise at a constant bonus, and doing so by raising the per worker bonus paid to a constant number of workers. Possible justifications include (a) that workers value increase in N due to the possibility of finding jobs for family members or friends, (b) that workers wish to benefit from the productivity gains resulting from bonuses, but not at the cost of the elimination of jobs that might thereby be made redundant, and (c) that preference for N derives from the managerial subset of the workforce, which may enjoy power in proportion to the number of workers managed, including patronage powers deriving from the ability to offer jobs. The salience of (b) may be seen from the fact that, as shown below, absent a countervailing concern for jobs by workers, the optimal response by the firm to an increase in bonuses entails a reduction in the size of the workforce ($dN/dB < 0$). It is also possible to argue that the state itself imposed upon its enterprises the constraint of not reducing N, thus preventing any overt expression of that outcome. While the real degree of concern with employment in the enterprises is debatable, it is reasonable to assume that at least come constituencies of the enterprise had this concern. Our model easily generalizes to the case in which the enterprise places varying degrees of emphasis on employment, relative to bonuses. That is, we could replace the objective function in (4) by $N^{\gamma 1}B^{\gamma 2}\pi^{1-\gamma 1-\gamma 2}$. This would lead only to the addition of γ_1/γ_2 as a multiplicative constant in the last term in the RHS of equation (13), which forms the basis for the analysis in Section 5. Since γ_1 can be arbitrary small, as long as it is positive, the estimating framework is thus shown to cover the case in which concern for employment is trivially small.

8. Using the national aggregate data for the 1987-92 period, Yang and Zhou (1997) estimate that the marginal productivity of labour in state industry was, on average, 10.9 times of that in rural industry and 16 times of that in agriculture. While agricultural reforms had themselves raised the productivity of rural workers, and overall growth of the economy, including export sector, was increasing the demand for industrial labour, the productivity gap between state industrial and rural labour force was persistently high. Despite the productivity gap, the productivity increase resulting from improved incentives had probably played a part in bringing about the labour redundancy within SOEs that was so widely reported by the late 1980s.

9.It is interesting to note that using panel data on 514 SOEs for the 1986-91 period, Hussain and Zhuang (1994) find that while the elasticity of employment with respect to the regular wage is negative and significant, the elasticity of employment with respect to bonus is insignificant.

10.The capital price indices for 1980-89 were developed by Professor Zheng Yuxin of the Institute of Quantitative Economics, Chinese Academy of Social Science, Beijing, and provided to us by Gary Jefferson and Wenyi Xu. The capital price indices for 1990 were computed by multiplying the 1989 figure for each industry by 1.018, the capital price index for 1990 at national level. This figure was provided by Thomas Rawski.

11.The national average ratios were used for the 1980-85 period, because the information on welfare and pension payments for this period is not available in the panel data. For the 1986-90 period, we computed the sample mean ratio instead of the ratio for each sample SOE because the information on welfare and pension payments is missing for an appreciable proportion of observations in the panel data set.

12.For an imputation of monopsony from a gap between MRP and the full wage to be convincing, it is clearly important that the elements of the wage be accounted for as completely as possible, and we have attempted to do this. The only missing element we can think of is a possible difference between the implicit market valuation of housing that is subsidized by the enterprise, and the explicit costs of housing to the enterprise (the appreciation, repairs, etc, which are accounted for). We are unable to construct estimates of this on the basis of available information. We note that the size of the gaps found in the next section is large enough to suggest employment levels that are socially suboptimal even if wages had been underestimated by a considerable margin--which we believe they have not been. The analysis of variation in gaps over time and among enterprises, in Section 5, would be unaffected by a systematic underestimation of wages provided that the pattern of variation itself was left effectively unchanged.

13.As is often the case for a large panel data set, the data analyzed here are fairly noisy. To examine the sensitivity of our estimates to data errors and outliers, we use the diagonal elements of the "hat" matrix and studentized residuals derived from the OLS estimates to detect influential observations. The dropping of these identified influential observations did not lead to any appreciable change in the estimates.

14.The statistics of the MRP for the full sample are also derived based on the estimates of labour coefficients of individual industries, because the F statistics reject the hypothesis of constant slop coefficients across industries for nine out of 10 industries.

15.As mentioned in an earlier note, it is conceivable that non-state enterprises provided compensation levels so much lower than those of the SOEs as to pose no real competition in their labour markets. However, this is an empirical question that we are unable to investigate more directly than by using the available data in the manner indicated. We use shares of output and of number of firms because data on the shares of industrial SOEs in provincial industrial *employment* were not available to us.

16.A possible alternative explanation is that the larger and more centrally affiliated SOEs were more productive (e.g. had more or better capital), while bureaucratic controls kept compensation relatively uniform, causing them accordingly to display a larger MRP-wage gap. While such a phenomenon seems worth bearing in mind as a caveat against unthinking acceptance of the monopsony conclusion, it is also worth noting that that explanation ignores the potential control of enterprises over the number of workers that they employ. That is, a large or centrally controlled SOE's advantage with respect to capital needn't translate into a higher marginal product of labour once the SOE's ability to increase the size of its workforce is taken into consideration.

17.One might have expected the richer coastal regions such as Shanghai, Tianjin, Guangdong, Zhejiang, and Jiangshu to exhibit smaller MRP-wage gaps, on supposition that their economies were "commercialized" at a faster pace. Failure of the results to line up with that expectation could accordingly be interpreted as evidence that the size of the MRP-wage gaps reflects differences between productivity, which vary across regions (and perhaps across industries, judging by the result for the notoriously low-profitability coal industry) as expected, and wages, which may have had a large uniform, administrative component. As before, however, this makes sense only if the enterprises failed to adjusted the marginal productivity of their labour forces by increasing employment when infra-marginal labour productivity was higher.

18.This measure follows the approach originally adopted by Pitt and Putterman (1996).

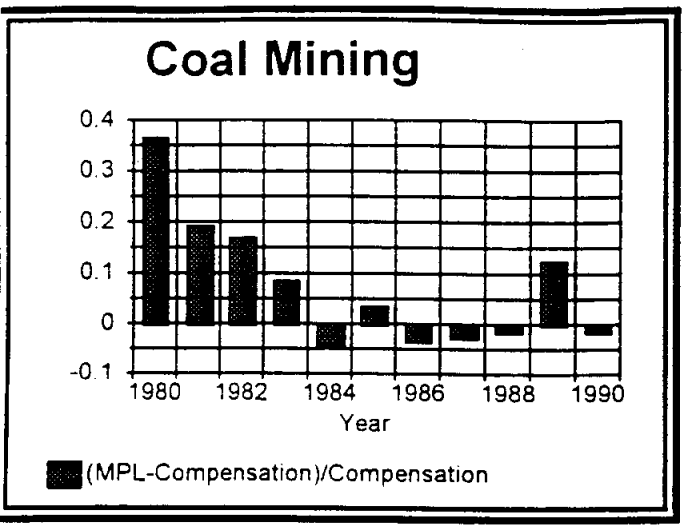
19.Recall that throughout the analysis of this section, the MRP estimates used in calculating the dependent variable are from production parameter estimates made for each industry separately. The coefficients on the industry dummies in Table 5 should not, therefore, reflect peculiarities of each industry's technology. Their significant impacts are perhaps suggestive of the effects of administrative planning, which retained considerable influence in the sector well into if not in fact throughout the period studied. Industries differed in profitability in part due to differences in state pricing and allocation of capital and other resources. Permission to expand employment may also have varied across industries based on government priorities, rather than financial criteria. Given a large administrative element in wage-setting,

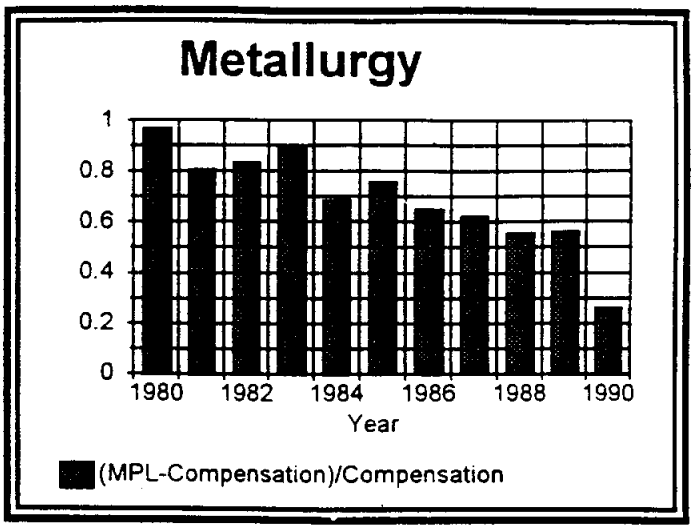
this could lead to inter-industry differences in the average gap between MRP and wage.

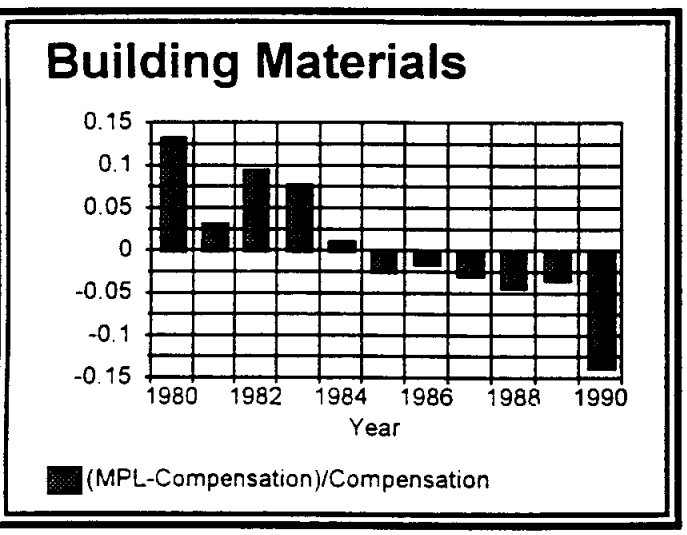
20.A similar exception is observed for Guangdong in our analysis of monopsony in rural industrial enterprises (Dong and Putterman, 1996).

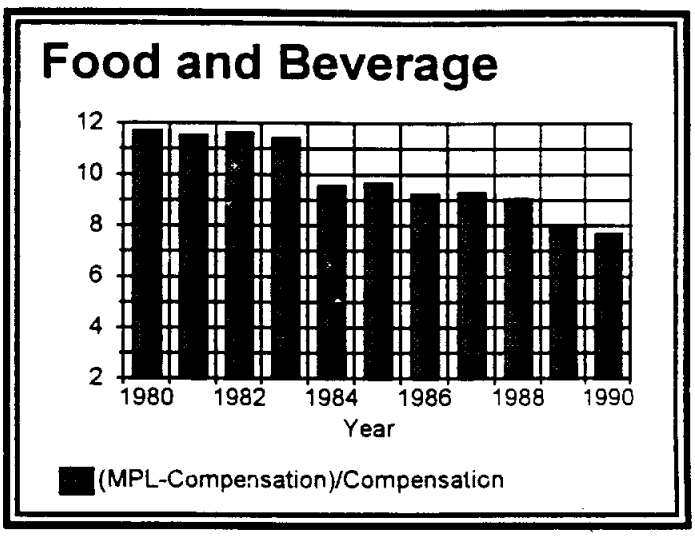
21. For instance, the average wage of SOEs was 25% higher than that of urban collective enterprises but 15.5% lower than that of private enterprises in 1985, and was 36% higher than urban collectives and 24% lower than urban private enterprises in 1990.

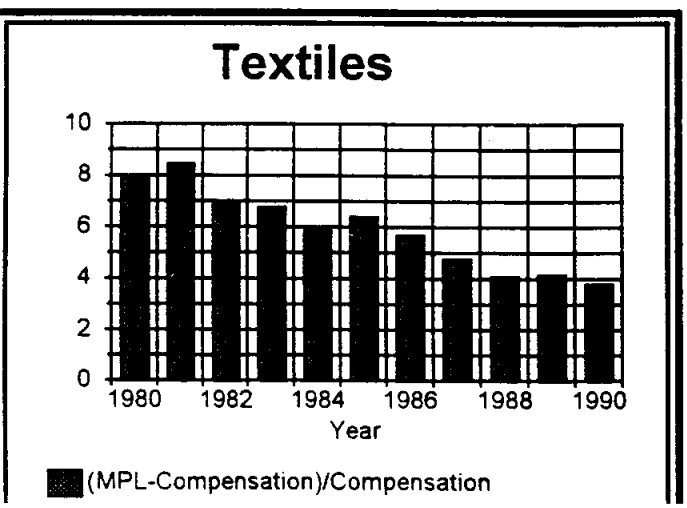
Monopsony-Power Estimates
(Preliminary)

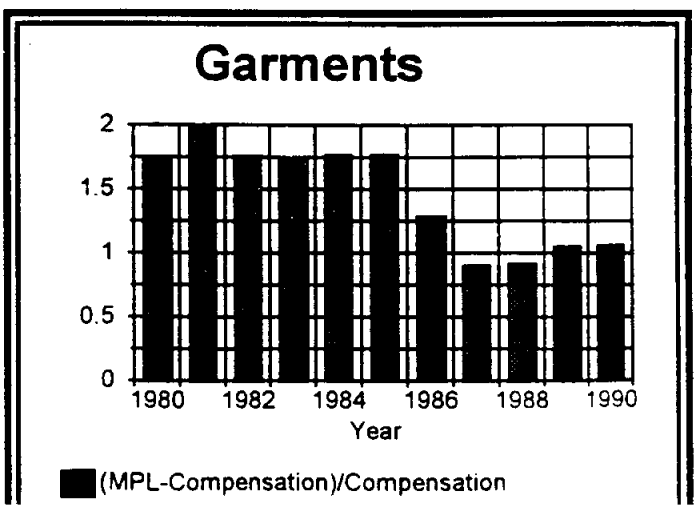


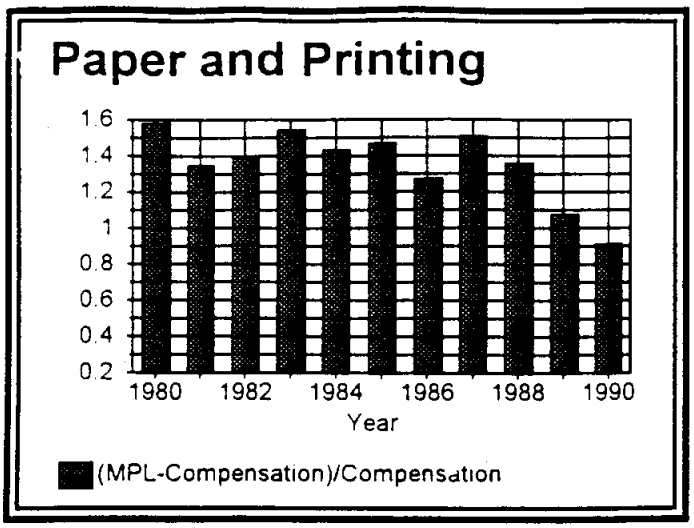


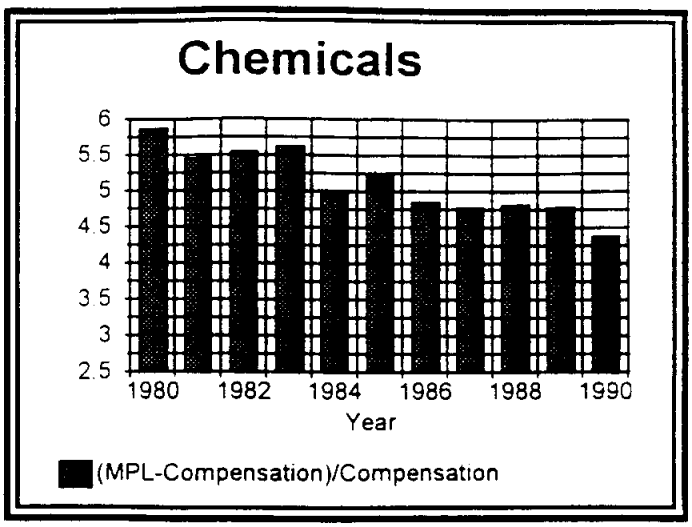


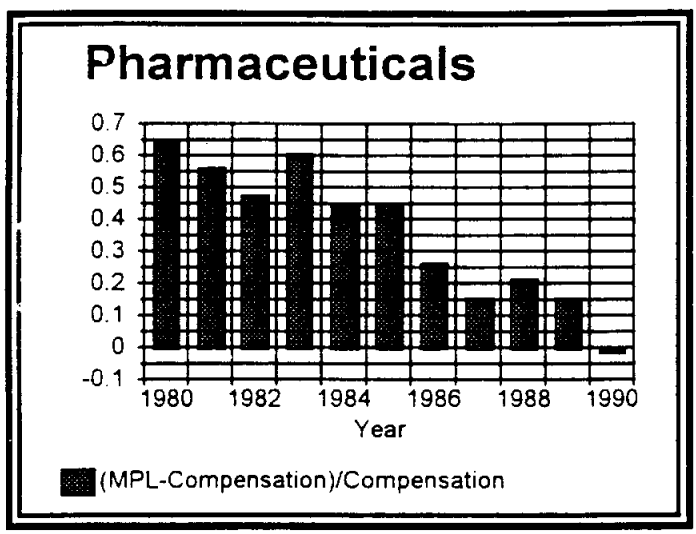


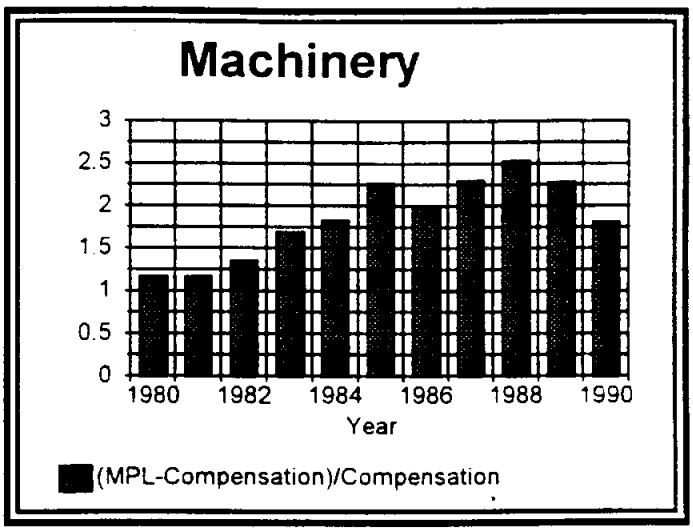


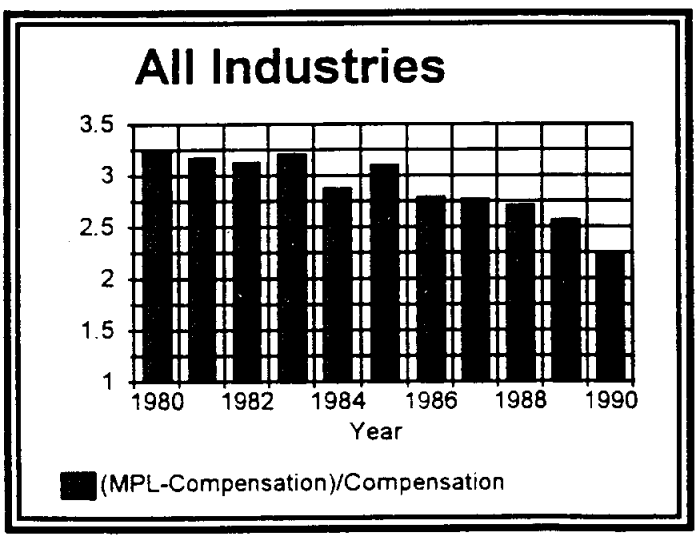



Paper and Printing
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
1980
1982
1984
1986
1988
1990
Year
(MPL-Compensation)/Compensation


Chemicals
6
5.5
5
4.5
4
3.5
3
2.5
1980
1982
1984
1986
1988
1990
Year
(MPL-Compensation)/Compensation


Pharmaceuticals
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
1980
1982
1984
1986
1988
1990
Year
(MPL-Compensation)/Compensation


Machinery
3
2.5
2
1.5
1
0.5
0
1980
1982
1984
1986
1988
1990
Year
(MPL-Compensation)/Compensation


All Industries
3.5
3
2.5
2
1.5
1
1980
1982
1984
1986
1988
1990
Year
(MPL-Compensation)/Compensation