# Skill Differentials, Return to Schooling, and Market Segmentation in a Transition Economy: The Case of Mainland China

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Abstract

We address the puzzle of persistent low private returns to schooling in China's transition to a market economy. Whereas existing research attributes underpayment of workers in both urban and rural enterprises to the persistence or of labor-market monopsony, we find that both urban and rural enterprises overpay production workers relative to a profit-maximizing standard (under monopsony for rural enterprises) and that underpayment is far more extreme for skilled workers. This relatively large "exploitation" of skilled workers explains, in a proximate sense, the low private return to schooling. The circumstances of factor payments in rural enterprises are further complicated by the existence of unexploited scale economies which preclude paying all inputs the value of their marginal products. We show that both production and technical/managerial workers in rural collectives act as *de facto* residual claimants. That is, the gap between their production value and their pay is positively related to estimated economies of scale. We attribute the existence of unexploited scale economies and the residual underpayment of labor to segmented product and factor markets and to investable-funds constraints.

Keywords: Wages, Return to Schooling, Market Segmentation, Productivity, Return to Scale, Residual Claimant, Transition Economies, Chinese Economy

JEL-Codes: P23, J24, J31, D33, O15

# 1 Introduction

A persistent puzzle in China's economic evolution since reform is that wage differences by level of skill, occupation, and/or schooling remain very narrow and returns to higher education remain low in comparison with those in other countries[1], both industrialized and industrializing, and when compared to those in some smaller transition economies, including for example the Czech Republic (Munich, Svejnar, and Terrell, 2000), Slovenia (Orazem and Vodopivec, 1995), and Bulgaria (Jones and Ilayperuma, 1994). Although returns to higher education in the Russian Republic are among the lowest in the world, this can in large part be attributed to the extraordinarily high proportion of college graduates in Russia (over 20% of individuals aged 25 to 64 in 1995), which is nearly equal to that in the United States and higher than the average for OECD countries. (Sheidvasser and Benítez-Silva, 2000). It is difficult to attribute the low return to higher education in China to a super-abundance of college graduates, because the proportion of graduates of 4-year universities in China in the population 16 years of age and older was less than 1% in 1997 (Statistical Yearbook of China, 1998).

It is extremely unlikely that low private returns to education in China reflect a low marginal product of labor. Although the return to schooling in the agricultural sector when measured in terms of productivity or the profit of family enterprises does appear to be relatively low (Yang and An, 1997; Yang, 2000), this is not the case in Chinese industry, and low private returns to schooling are found in both sectors. Not only have significant gaps between wages and the estimated marginal product of labor been reported in a number of studies[2], but also, and of critical importance to the the main focus in this paper, the ratio of the marginal product of highly educated workers to that of other workers appears to be much higher than the ratio of their rates of pay or earnings. (Previous research showing this inequality is reported in Fleisher, Dong, and Liu, 1996 and Fleisher and Chen, 1997.)

In this paper, we address the puzzle of this differential wage gap and attempt to learn why, in a society where educated labor is relatively very scarce, its remuneration remained far below its contribution to productivity, even a decade after reforms began. The paradigm of labor-market monopsony provides a useful organizing framework for our research. Monopsony in China may arise from relatively immobile urban workers being tied to stated-owned enterprise (SOE)-provided housing, medical, food, and other benefits (Parker, 1999; Dong and Putterman, 2000a and 2000b) and from rural workers being located in small labor markets dominated by one or a very few rural enterprises (Dong and Putterman, 1996). We extend existing research by tying the monopsony approach to skill- or schooling-based earnings differentials .

In section 2 we provide evidence on the gap between the marginal product of labor and wages. We first estimate marginal products of two classes of workers: (1) production workers and (2) technical, administrative, and staff (TAS) workers in the context of a production function that allows for effort-enhancing wage payments. We find that the wage gap (marginal product minus wages) tends to be much greater for TAS workers than for production workers, and it is negative (i.e. wages exceed marginal products) for production workers in the urban SOEs in our data. This differential wage gap "explains" in a proximate sense observed low returns to schooling.

Next we explore alternative explanations of the estimated wage gaps. We note that unexploited scale economies among rural enterprises preclude all factors' being paid an amount equal to the value of their marginal products. We find that the estimated wage gaps cannot be explained in terms of profit maximization under monopsony but that some form of worker-mobility restrictions must be invoked to explain the continued "exploitation" of both production and TAS workers, particularly in the non-State sector.

Section 3 concludes and derives implications for economic reforms and the effects of institutional rigidities on economic growth and the distribution of wages and incomes.

## 2 Production, Labor, Schooling, and Wages

In order to derive estimates of the marginal product of two classes of workers we estimate the following augmented Cobb-Douglas production function.

$$Y = K^{\alpha}(\prod_{j}(e_j L_j)^{\beta_j})exp(\phi Z + \epsilon) \tag{1}$$

where:

$$\begin{aligned} Y &= \text{Gross output or value added} \\ K &= \text{Net Capital Stock} \\ L_j &= \text{Labor of the } j_{th} \text{ group; j=1, 2} \\ e_j &= \text{Effort function for the } j_{th} \text{ group of employees.} \\ Z &= \text{Vector of enterprise characteristics} \\ \epsilon &= \text{an } iid \text{ disturbance.} \end{aligned}$$

The effort function is defined as:

$$e_j = B_j(\frac{W_j}{W_{aj}})^{\eta_j Z} \tag{2}$$

Where B and $\eta$ are parameters, $W_j$ is the observed wage of the $j_{th}$ group of employees, and $W_{aj}$ the estimated spot-market competitive wage.[3]

We use two data sets, one which we call the Urban Sample and one which we call the Rural Sample, to estimate equation (1). The estimation results for the Urban sample are reported in table 1.[4] The dependent variable is gross output, because data on intermediate inputs are not reported in the Urban Sample.[5] Column (1) shows estimated coefficients for the simplest specification of the production function, with both labor and the efficiency-wage variable pooled over both production and TAS workers. The production elasticity of labor is estimated to equal 0.33 with considerable precision, and although low by comparison with estimates for most industrial economies, it is within

the bounds of several studies of the Chinese economy (e.g., Chow, 1994; Dollar, 1990; Fleisher, Dong, and Liu, 1996). The null of constant returns to scale is easily rejected in favor of diminishing returns, with p-value (not shown in the table) less than than 1%. When labor is disaggregated into production workers (PW) and technical and administrative staff (TAS), the estimated production elasticity of production workers is very small and statistically insignificant, while that of TAS workers is somewhat larger than the estimated elasticity for aggregate labor reported in column (1). The estimated coefficient of the efficiency-wage variable is highly significant in the results reported in both columns (1) and (2).[6]

Another data set, which we call the Rural Sample, is a panel survey of 200 large rural enterprises (mostly TVE's) for the years 1984 to 1990.[7] The survey covers 20 enterprises in each of 10 provinces. The 10 provinces are: Anhui, Hubei, Guangdong, Jiangsu, Zhejiang, Sichuan, Hebei, Liaoning, Shanxi, and Gansu. We define Hebei, Guangdong, Liaoning, Jiangsu and Zhejiang as coastal provinces and the rest as non-coastal provinces. The survey not only includes quantitative statistics about the individual firms, but also provides important environmental statistics describing the markets in which the firms operates. For example, not only is there data on an enterprise's employment, but there is also information on total employment in the village where the firm is located. This allows us to test hypotheses on the impact of market structure on the behavior of the firm. Table 2 shows the results of estimating equation (1) using the Rural Sample. The estimated production elasticities for aggregate labor are larger than those for the urban sample, and both the estimated labor and capital elasticities reported in table 2 are close to the ordinary least-squares (OLS) results reported by Pitt and Putterman (1999) and to the GLS estimates reported by Dong and Putterman (1996) using the same data set. Compared to the results for the Urban Sample reported in table 1, there is evidence of unexploited scale economies. The estimated coefficient

of the efficiency-wage variable is highly significant for all workers and for production and TAS workers separately , although smaller in magnitude than in the production functions estimated on the Urban Sample. [8]

## 2.1 Does Monopsony Power Affect Wage Gaps?

We now turn our attention to the question of monopsony and whether limitations to worker mobility can help us understand the wage structure in China. In table 3 (Urban Sample), the marginal product of aggregate labor is about 7.7 times average earnings including in-kind housing allocations. This wage gap is not only surprising for its magnitude, but also because it implies substantial *underemployment* of labor. Although this contradicts the conventional wisdom of overemployment in Chinese industry, it is consistent with empirical results in other studies. (Pitt and Putterman, 1999; Xu, 1995, Chapter 5)

The evidence on underemployment looks quite different, though, when the labor force is disaggregated into production workers and TAS workers. We estimate that the excess of marginal product over earnings is extremely large for TAS workers, with a magnitude in ratio terms of about 43. This large excess of MPL over earnings for TAS is consistent with results reported in Fleisher, Dong, and Liu (1996) for the Chinese paper industry. However, the ratio of the marginal product of production labor to annual wage (inclusive of housing in kind) is 0.8 for SOE's, 0.6 for collectives, and 0.9 for joint ventures. This is consistent with the hypothesis that employment decisions for production workers are politically driven with the motive of avoiding political disruption, especially for collectives, where dissatisfaction and political unrest would affect local employers directly and immediately. Even joint ventures are probably affected by this motive, through the need to obtain permission to enter Chinese markets and in order to achieve cooperation with Chinese business partners, especially local governments.

As noted above, an important hypothesis that has been proposed to explain a positive MPL-wage gap in Chinese industry is monopsony power of Chinese nonagricultural employers. Dong and Putterman (1996) argue that monopsony power of rural employers in the presence of restrictions on inter-community migration can explain the wage gap in rural industry. Parker (1999) and Dong and Putterman (2000a and 2000b) both argue that Chinese State Industry (SOE's) consciously exploited monopsony power in the pre-reform era, but find evidence that SOE monopsony power declined in the years following reform. The hypothesis that SOE monopsony power is diminishing under reform is consistent with our finding a non-positive MPL-wage gap for production workers in the 1991 Urban Sample. It appears plausible to us that the supply of TAS workers is less elastic than that of production workers, because there is surely a smaller pool of educated workers from which to attract new hires.

Given the pre-reform official wage grid, restrictions on wage and employment policies of collectives, and persisting limits on geographic mobility, it is plausible that wage compression by skill or schooling level has diminished only slowly under reform, particularly among urban SOEs. It is more puzzling, though, that positive wage gaps permeated rural collectives into the early 1990s.

In order to search for explanations of the rural wage gaps, we use as a benchmark the degree of monopsonistic "exploitation" that would occur under profit maximizing behavior. An obvious direct test of the joint hypotheses that the wage gaps we and others have estimated reflect profit-maximizing monopsony requires knowledge of labor-supply elasticities from which profit-maximizing wage gaps can be derived.[9] Estimated labor-supply elasteicities for the Rural Sample are reported in table 4.[10] We assume that any exogenous shifts in communities' labor-supply functions are captured by year dummy variables and their interaction with the wage regressor. A single estimated elasticity for each class of workers is reported in table 4. The highly significant elasticities

imply profit-maximizing wage-gap ratios of approximately 6.3 and 4.3 for production workers and TAS workers, respectively. Our estimation results with the complete set of year-interaction terms imply that there was no statistically significant trend in the labor-supply elasticities over time, but that there is a statistically significant difference between the labor-supply elasticity of TAS workers and that of production workers.

Comparisons of profit-maximizing with estimated wage gaps are shown in table 5 for each year, 1985-1990, except 1987 . (The magnitudes of the wage gaps reported in table 5 are very close in magnitude to those reported by Xu (1995, p. 36), where the marginal product estimates are based on provincial aggregate data for TVE's during about the same period as the data in our rural sample.) In five of the six years for production workers, the estimated profit-maximizing wage gap is larger than the observed wage gap, implying that enterprises place a positive value on employment in addition to profit. Thus, the conventional wisdom that overemployment is the rule in Chinese enterprises is supported against the standard implied by the joint hypotheses of monopsony and profit maximization.[11] On the other hand, the estimated profit-maximizing wage gap is uniformly lower than the observed wage gap for TAS, implying underemployment of this class of workers. This is consistent with the discussion of the econometric results for TAS reported in table 1. Bearing in mind that the annual differences in the estimated profit-maximizing gaps are highly insignificant, it is interesting to note that the observed gaps tend to drift upward, implying perhaps a reduced tendency over time to "overemploy" production workers and an increased tendency to "underemploy" TAS workers.

### 2.1.1 Scale Economies and the Division of Output

The difference between the wage gaps of production and TAS workers cannot be explained in terms of simple profit-maximization under monopsony. Perhaps production workers tend to benefit from political favoritism, but we have no independent evidence that this is true. A possibly important additional consideration is suggested by the

estimated production functions for rural enterprises reported in table 2, which indicate that the typical rural collective operates in the range of increasing returns to scale. An implication is that in the absence of a subsidy or an entrepreneur with deep pockets, it is impossible for all factors to be paid the value of their marginal products. "Underpayment" of at least some factors is a mathematical necessity. It is intriguing, therefore, to explore the extent to which the wage gaps we have estimated in the rural sample are associated with the severity of this "adding-up" problem.

To do this, we respecify the rural-enterprise production function in terms of gross output, with intermediate inputs included among the right-hand variables, as follows:

$$\ln GY = Const. + \eta_K \ln K + \eta_P \ln PW + \eta_T \ln TAS + \eta_R \ln RM \tag{3}$$

where $GY$ is gross output, $K$ is net value of fixed capital, $PW$ is number of production workers, $TAS$ is number of technical workers, and $RM$ is raw materials. The $\eta$s are corresponding parameters. We then derive the ratios of marginal products to factor payments as

$$\frac{MP_i}{WAGE_i} = \frac{\eta_i}{S_i} \tag{4}$$

where $i$ indexes each of the four groups of factors of production, $S_i$ is the share of payment to this group in $GY$.[12] (The return to capital is defined to be the gross value of output less payments for intermediate inputs and wages. Thus return to capital includes all reported accounting profits, taxes, and interest.) The estimated gaps are then regressed on estimated returns to scale ($\widehat{RTS}$).[13] In order to obtain large enough samples to estimate reliable production-function parameters, we group the data by province and year, obtaining sixty samples within which equation (3) is estimated, yielding 60 estimates of each production-function parameter, which are the basis for estimating second-stage equations in which factor-payment–marginal product gaps are regressed on estimated returns to scale.

The results of the second-stage estimates are reported in table 6. They are consistent with the following interpretation. The payment gap for intermediate inputs is not associated with estimated returns to scale. Intermediate-input providers must be paid market prices and do not receive lower payments from unprofitable enterprises. The payment gap we attribute to "capital" is weakly and negatively correlated with returns to scale. Thus the hypothesis that providers of non-labor inputs act as residual claimants as a group can be rejected. In contrast, the payment gaps for production and technical workers are both positively and significantly correlated with returns to scale, with the regression coefficient for technical workers being about eight times larger than that for production workers. This is consistent with the hypothesis that both groups, particularly technical workers, are *de facto* residual claimants in the presence of unexploited scale economies. The socio-political forces that lead to this division of output are not obvious, but it is clear that this "exploitation" of labor would be impossible in the absence of restrictions on worker mobility. In other words, it is consistent with a form of monopsony wage-setting.

### 2.1.2 Monopsony, Scale Economics, and Wages

To gain further insight into determinants of the wage gaps for production and TAS workers, we regress the mean wage gap for production and TAS workers, respectively, on the following variables: estimated returns to scale, local employer-concentration ratios and available land per worker; provincial measures of foreign direct investment per worker, and unemployment.[14] We hypothesize that under monopsony, the estimated coefficients of estimated returns to scale and employer concentration will be positive and that of unemployment will be negative. The rationale is that increasing returns to scale preclude "full" payment to all factors, with labor being "exploited" under monopsony; employer concentration is an indirect measure of monopsony power; while higher unemployment will increase the elasticity of labor supply. The estimated coefficient of the land-labor

ratio is uncertain under the profit-maximization-monopsony joint hypothesis, because, while more land per person should increase agricultural labor productivity, the effect on the elasticity of marginal product with respect to labor (and hence on the elasticity of labor supply) is ambiguous.[15] The foreign-investment variable is included to represent funds available in an environment of very imperfect financial markets. Given that estimated returns to scale is included in the regression, the estimated net relationship between FDI and the wage gap may be interpreted as the effect of "ability to pay" on wages. We take a negative coefficient for the foreign-investment variable to be consistent with the hypothesis that capital constraints increase wage pressure in the presence of excess labor supply and monopsony power.

Table 7 presents the results, which are based on the same 60 observations as used for the regression reported in table 6 . The adjusted $R^2$ equal 0.13 in both the production workers and TAS regressions. The estimated regression coefficient of the concentration ratio is statistically insignificant for both production and TAS workers, which is inconsistent with the joint hypotheses of monopsony and profit maximization. The coefficient of land per worker is negative and marginally significant for production workers, but positive with little significance for TAS workers. Unless increased land per worker lowers the elasticity of supply of production workers, it is difficult to see how the estimated coefficients of the land-labor variable support the joint hypotheses of monopsony and profit maximization. The coefficient of foreign direct investment is negative, which is consistent with the hypothesis that a higher level of FDI allows firms to pay wages more closely approximating marginal product, although its $t$ value is not large for production workers and is very low indeed for TAS. The coefficient of unemployment is negative and insignificant for production workers and positive and marginally significant for TAS.

The coefficient of estimated returns to scale is the most significant among all the results reported in table 7, is positive for both classes of workers, and about 5 times

larger for TAS than for production workers. This is consistent with the hypothesis that rural TVE's cannot fully exploit scale economies and thus cannot "afford" to pay employees the value of their marginal products. Workers are forced to act as residual claimants in the presence of increasing returns to scale and employer monopsony power, with the brunt of the burden borne by TAS workers. Both labor and product markets are restrained from approaching full national scope by various forms of domestic protection and regulation at the local and provincial levels. Evidence on this is widespread and is documented carefully in a recent article by Alwyn Young (2000).

# 3 Conclusion and Outline for Further Work

We conclude that compression of wage differentials and low returns to schooling in China did not disappear during the first decade of transition to a market economy. Even though we reject profit maximization under monopsony as the sole, or principal determinant of wage and employment outcomes in both urban and rural labor markets (as do other researchers), we believe that skill-wage compression and low returns to schooling can only be understood in terms of restrictions on worker mobility along with (in rural collectives) unexploited economies of scale in production. Our analysis of rural enterprises implies that both production workers and TAS workers (the latter to a far greater degree) are *de facto* residual claimants. This implies that regionalism has a double impact on worker incomes; not only does it restrict freedom to seek out the highest-paying jobs wherever they may be, but it also restricts product markets, thus contributing to unexploited increasing returns to scale.

On a more positive note, our empirical results so far indicate not only the "bad news" of immense labor-market disequilibrium (relative to a profit-maximization criterion), but also the "good news" of tremendous potential continued economic growth from exploitation of scale economies and the reallocation of resources toward more schooling

and training of skilled workers. When these workers begin to be paid anywhere near what they seem to be worth, incentives to acquire further education will be greatly enhanced, and those with lower levels of schooling should perceive much greater incentives to advance themselves by remaining in school longer whenever economically feasible.[16] Thus, all levels of society should benefit, although the short-term impact may be to widen inequality of living standards. Exploiting these growth opportunities should be one of the greatest challenges to Chinese policy makers.

# Notes

[1]See, for example, Jamison and Van Der Gaag, 1987, Dessi, 1991, Byron and Manaloto, 1990, Fleisher, Dong, and Liu, 1996; Gregory and Xin, 1995; Maurer-Fazio, 1997; Maurer-Fazio, Rawski, and Zhang, 1999; Psacharopoulos, 1985; Wang, Zhu, and Stromsdorfer,1995; Knight and Li, 1996; Li and Zhang, 1998; Zax, 1994; Yang and An, 1997.

[2]Examples include Dong and Putterman, 1996,; Xu, 1991 and 1995; Dong and Putterman, 2000a and 2000b; Parker, 1999; Pitt and Putterman, 1998; and Yang and Zhou, 1999. See also, Svejnar (1990), Hay, *et al.* (1994) and Jefferson and Rawski (1994). Jefferson, Rawski, and Zheng (1992) report estimated nominal marginal products of labor in 1988 to be 2,974 and 1,648 *yuan* for enterprises and collectives (urban and TVE's), respectively. The China Statistical Yearbook 1991 reports average annual wages of staff and workers in state-owned enterprises in 1988 to be 1,853 *yuan* and in urban collectives to be 1,426 *yuan*.

[3]To obtain an estimate of the alternative wage, we estimate a wage-schooling equation, using the estimated residuals as the efficiency-wage argument in the production function. Full details are reported in Fleisher and Wang (2001).

[4]The Urban Sample was collected in the second half of 1992 in a survey funded in part by the Ford Foundation in a grant to the Institute of Economics of the Chinese Academy of Social Sciences and the Labor Science Research Institute of the Ministry of Labor of the People's Republic of China. We are grateful to Ernst Stromsdorfer, Elizabeth Li, and Jun Cao for making us aware of these data and for their help in using them. The survey is a stratified random sample of enterprises within a randomly selected sample of locales. All major regions of China are represented, but provincial capitals are not necessarily included. Of the major self-governing cities, only Guangdong is included in the sample. Two survey instruments were administered, one to an official of each enterprise, and another to a random sample of employees of the enterprise.

[5]We experimented with alternate corrections for this defect, including using provincial-level estimates of intermediate inputs. The resulting estimates are insensitive to these alternative specifications.

[6]The calculated effort-efficiency wage elasticity in column (1) is more than 3, implying that the impact of paying an efficiency wage on profit is not being fully exploited. (Solow, 1974 and Stiglitz, 1976) A similar result is reported by Zhuang and Xu (1996) and by Dong and Putterman (2000a). In column (2) we find that the implied effort-efficiency wage elasticity for production workers is over 20 (although the production elasticity of production workers is VERY imprecisely estimated). The corresponding elasticity for technical/administrative workers is about 1.4, which although greater than the profit-maximizing value, is rather close.

[7]We are grateful to Dennis Yang, Yaohui Zhao, Xiao-yuan Dong, Isabelle Perrigne, and Gary Jefferson for their help in obtaining and using these data.

[8]The efficiency-wage variable for the Rural Sample is, of necessity, constructed differently than for the Urban Sample. The Rural Sample does not provide measures of individual-worker levels of schooling. Therefore, we have defined the efficiency wage for this sample to be the deviation (in ratio form) of the worker's actual wage to the average wage paid to that type of worker (production worker or technical and administrative staff worker) in the same province.In contrast to the results for the Urban Sample, the ratio of the estimated efficiency-wage coefficients to their respective production-labor elasticities is much smaller than unity, and this is true for all workers taken together as well as for production and TAS workers separately. Taken at face value, these coefficients suggests that wage rates are set higher than their profit-maximizing level under an efficiency-wage scenario.

[9]The profit-maximizing wage gap is $1 + 1/\eta$, where $\eta$ is the elasticity of supply. A wage gap of 43.6, the average for TAS workers in the Urban Sample, implies a supply elasticity of only 0.02.

[10]The panel nature of the Rural Sample makes it easier to estimate labor-supply elasticities. Only cross-section estimates would be possible in the Urban Sample.

[11]For another approach to analyzing Chinese enterprises' goals in choosing between profits, wages, and employment, see Svejnar (1990) and Pitt and Putterman (1998).

[12]This can be verified as follows. Take production workers as example. Multiply the numerator and denominator of the right hand side of equation (4) by $GY/PW$, then it becomes:

$$\frac{\eta \cdot \frac{GY}{PW}}{S \cdot \frac{GY}{PW}}$$

The numerator now has the interpretation of the marginal product of production workers, while the denominator is average wage paid to them.

[13]Estimated returns to scale are the predicted values from regression of returns to scale to a vector of instrument variables. These variables include: capital, two types of labor, raw material, five year dummies and nine province dummies.

[14]Land per worker is available in the local community data. Foreign investment per worker is obtained from the Statistical Yearbook of China. Unemployment estimates are reported in Liu (1997) and are based on an estimate of available labor force minus the sum of workers required to operate family farms and nonagricultural employment.

[15]Under the assumption of a Cobb-Douglas production function, an increase in the

labor-land ratio shifts the labor supply function to the nonagricultural sector upward, but leaves the elasticity unchanged.

[16]There is some limited, not to say anecdotal, evidence that private returns to schooling may be approaching levels in other economies. Wang, Maruyama, and Kikuchi (2000) report wage payments based on a small survey of workers in Harbin City that entry-level monthly wages of white-collar managers with college degrees earned 1,392 *yuan* monthly (not including in-kind payments), while team heads who had completed high- or vocational school earned 917 *yuan*. The implied marginal rate of return to a year of college is 13.8%, which would be an underestimate of the true private rate of return if managers receive a higher proportion of their total compensation in kind than do team heads (which the authors suggest they do).

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# 5 Tables

Table 1: Production Function : Urban Sample
(Dependent Variable: $\ln Y^*$)

| Variable | Description | (1) | (2) |
|---|---|---|---|
| $CONST.$ | | 7.3411 | 8.4293 |
| | | (14.238) | (14.169) |
| $K$ | ln net capital stock | 0.4761 | 0.3878 |
| | | (11.494) | (8.117) |
| $L$ | ln total employment | 0.3324 | - |
| | | (7.336) | |
| $PW$ | ln production workers | - | 0.0260 |
| | | | (0.614) |
| $TAS$ | ln technical/administrative staff | - | 0.467 |
| | | | (7.180) |
| $MT$ | efficiency wage** | 1.1497 | - |
| | | (7.541) | |
| $MPW$ | efficiency wage** for production workers | - | 0.4454 |
| | | | (2.221) |
| $MTAS$ | efficiency wage** for technical/administrative staff | - | 0.6587 |
| | | | (2.973) |
| No. of Obs. | | 319 | 262 |
| Adj. $R^2$ | | 0.69 | 0.73 |

*Note*: t-statistics are in parentheses for the top panel, and p-values for the bottom panel.

*$Y$ is gross output.

**See footnote 3

Table 2: Production Function : Rural Sample
(Dependent Variable: $\ln Y^*$)

| Variable | Description | (1) | (2)) |
|---|---|---|---|
| $CONST.$ | | -1.3289<br>(-6.346) | -0.7898<br>(-3.962) |
| $K$ | ln net capital stock | 0.4221<br>(13.728) | 0.3998<br>(12.677) |
| $L$ | ln total employment | 0.7376 -<br>(16.645) | - |
| $PW$ | ln production workers | - | 0.4934<br>(9.888) |
| $TAS$ | ln technical/administrative staff | - | 0.3024<br>(5.912) |
| $MT$ | efficiency wage** | 0.3636<br>(6.213) | - |
| $MPW$ | efficiency wage** for production workers | - | 0.2048<br>(3.168) |
| $MTAS$ | efficiency wage** for technical/administrative staff | - | 0.1724<br>(2.533) |
| $YR85$ | year 1985 dummy | 0.2383<br>(2.059) | 0.2540<br>(2.184) |
| $YR86$ | year 1986 dummy | 0.0288<br>(0.248) ) | 0.0545<br>(0.470) |
| $YR88$ | year 1988 dummy | 0.4875<br>(4.262) | 0.4893<br>(4.266) |
| $YR89$ | year 1989 dummy | 0.5178<br>(4.461) | 0.5081 1<br>(4.361) |
| $YR90$ | year 1990 dummy | 0.6322<br>(5.479) ) | 0.6328<br>(5.434) |
| No. of Obs.<br>Adj. $R^2$ | | 988<br>0.60 | 979<br>0.60 |

*Note*: t-statistics are in parentheses. 1987 observations are dropped due to inadequate data. So nominal number of observations should be 1200, and the discrepancies reflect missing values.

*$Y$ is value added.

**See footnote 8

Table 3: Comparison of Marginal Product of Labor and Average Wage: Urban Sample

(unit: yuan)

| Worker Group | Enterprise Character | MPL | Average Wage |
|---|---|---|---|
| *Total* | - | 21,082 | 2,729 |
| | | | (1,557) |
| | *StateOwned* | 19,503 | 2,633 |
| | | | (1,228) |
| | *Collective* | 14,853 | 2,463 |
| | | | (1,383) |
| | *JointVenture* | 33,282 | 3,362 |
| | | | (2,088) |
| | *Coastal* | 25,183 | 3,297 |
| | | | (1,910) |
| | $Non-Coastal$ | 17,333 | 2,268 |
| | | | (922) |
| *ProductionWorker* | - | 2,008 | 2,508 |
| | | | (1,408) |
| | *StateOwned* | 2,008 | 2,495 |
| | | | (1,219) |
| | *Collective* | 1,328 | 2,260 |
| | | | (1,252) |
| | *JointVenture* | 2,644 | 2,955 |
| | | | (1,732) |
| | *Coastal* | 2,417 | 2,986 |
| | | | (1,681) |
| | $Non-Coastal$ | 1,642 | 2,123 |
| | | | (904) |
| *Technical/AdministrativeStaff* | - | 131,970 | 2,946 |
| | | | (1,683) |
| | *StateOwned* | 117,645 | 2,762 |
| | | | (1,224) |
| | *Collective* | 103,041 | 2,677 |
| | | | (1,541) |
| | *JointVenture* | 213,824 | 3,699 |
| | | | (2,263) |
| | *Coastal* | 156,368 | 3,595 |
| | | | (2,059) |
| | $Non-Coastal$ | 109,517 | 2,386 |
| | | | (929 ) |

*Note*: Sample standard deviation in parentheses.

## Table 4: Elasticity of Labor Supply: Rural Sample

| | Elasticity | Profit-Maximizing Gap |
|---|---|---|
| *Production Workers* | 0.19<br>(4.10) | 6.26 |
| *TAS* | 0.30<br>(6.67) | 4.33 |

*Note*: t-statistic in parenthesis. Labor supply function is estimated by regressing log employment on log wage, year dummies, worker type dummies, and interaction terms between wage and type. On the basis of an F-test we cannot reject the hypothesis that labor-supplied elasticities are constant over time for both production and TAS workers. However, we can reject the hypothesis that the elasticity for production and TAS workers are equal with p-value equal to about 0.1.

Table 5: Observed and Profit-Maximizing Wage Gap: Rural Sample

| $MPL/WAGE$ | YEAR | $Observed^{*}$ | $Profit-Maximizing^{**}$ |
|---|---|---|---|
| $AllWorkers$ | 1984 | 2.56 | 5.75 |
| | 1985 | 2.51 | 7.25 |
| | 1986 | 2.72 | 3.04 |
| | 1988 | 3.50 | 3.86 |
| | 1989 | 3.78 | 3.08 |
| | 1990 | 4.84 | 11.00 |
| $Production$ | 1984 | 2.10 | 5.76 |
| $Workers$ | 1985 | 1.86 | 8.14 |
| | 1986 | 2.27 | 3.44 |
| | 1988 | 3.09 | 4.13 |
| | 1989 | 3.31 | 4.57 |
| | 1990 | 3.98 | 11.00 |
| $TAS$ | 1984 | 8.44 | 6.88 |
| | 1985 | 10.08 | 4.13 |
| | 1986 | 7.24 | 4.03 |
| | 1988 | 9.18 | 4.13 |
| | 1989 | 9.44 | 4.13 |
| | 1990 | 12.77 | 6.55 |

*: Observed gap is the ratio of calculated marginal product of labor using the estimates from the production function and wage rates.

**: Profit-Maximizing gap is one plus the inverse of the elasticity of labor supply. This is the "hypothetical" gap if the enterprise is indeed a profit-maximizing monopsony.

Table 6: Marginal Product-Wage Gap and Returns to Scale: Rural Sample

(N=60)

| | Marginal Product-Wage Gap | | | |
|---|---|---|---|---|
| | $K$ | $PW$ | $TAS$ | $RM$ |
| Const. | 1.154 | -2.728 | -31.054 | 0.684 |
| | (0.362) | (1.849) | (15.317) | (0.424) |
| $\widehat{RTS}$ | -0.553 | 5.103 | 45.050 | 0.100 |
| | (0.333) | (1.705) | (14.126) | (0.391) |
| Adj. $R^2$ | 0.03 | 0.12 | 0.13 | -0.02 |

*Note:* standard deviation in the parentheses. $\widehat{RTS}$ is predicted returns to scale from regression of returns to scale on a vector of instrument variables. See footnote 13 for details.

## Table 7: Augmented Monopsony Regression: Rural Sample

| Variable | Description | Production Workers | Tech./Admin. Staff |
|---|---|---|---|
| Const. | | -0.062<br>(-0.027) | -27.804<br>(-1.451) |
| MCR | ln Concentration Ratio*, group median | -2.099<br>(-0.283) | -47.131<br>(-0.758) |
| MMPC | ln acreage per person, group median | -0.405<br>(-1.510) | 2.409<br>(1.071) |
| MFDL_LF | Foreign direct investment per labor force, group median | -0.025<br>(-1.385) | -0.077<br>(-0.500) |
| MUNEM | Unemployment rate, group median | -4.816<br>(-0.806) | 73.476<br>(1.464) |
| $\widehat{RTS}$ | Predicted Returns to Scale | 4.977<br>(2.719) | 35.079<br>(2.282) |
| Number of Obs. | | 60 | 60 |
| Adjusted $R^2$ | | 0.13 | 0.13 |

*Note:* The dependent variable is the gap between marginal product of labor and wage rates. t-statistics in the parentheses.

$*$: This is the employment share of this enterprise among all industrial enterprises in the township or village.

Table 8: Sample Statistics For Employees: Urban Sample
(N=9397)

| Variable | Description | Mean | Std |
|---|---|---|---|
| *Age* | year | 34 | 10 |
| *Sex* | dummy, 1 if male | 0.55 | 0.50 |
| *Experience* | year | 15 | 10 |
| *Tenure* | year | 10 | 9 |
| Education | | | |
| $--HighSchool$ | dummy, 1 if only high school graduate | 0.44 | 0.50 |
| $--College$ | dummy, 1 if at least college graduate | 0.22 | 0.41 |
| Job Title | | | |
| $--ProductionWorker$ | dummy, 1 if production worker | 0.28 | 0.45 |
| $--Technical/AdministrativeStaff$ | dummy, 1 if tech./adm. staff | 0.48 | 0.50 |
| Location | | | |
| $--Coastal$ | dummy, 1 if coastal | 0.44 | 0.50 |
| $--Non-Coastal$ | dummy, 1 if non-coastal | 0.56 | 0.50 |
| Income and Benefits | | | |
| $--Wage$ | yuan/yr | 2470 | 1229 |
| $--Housing$ | dummy, 1 if public house | 0.91 | 0.29 |
| $--MedicalExpenses$ | dummy, 1 if public medic care | 0.84 | 0.36 |

Table 9: Sample Statistics For Enterprises: Urban Sample (N=422)

| Variable | Unit | Mean | Std |
|---|---|---|---|
| $GrossOutput$ | mil.yuan | 70.455 | 225.408 |
| $TotalEmployment$ | person | 1376 | 3733 |
| $NetCapital$ | mil. yuan | 29.300 | 110.520 |
| Ownership Classification | | | |
| $--State$ | percent | 0.40 | 0.49 |
| $--Collective$ | percent | 0.34 | 0.47 |
| $--JointVenture$ | percent | 0.25 | 0.43 |
| $--Private$ | percent | 0.01 | 0.11 |
| Location | | | |
| $--Coastal$ | percent | 0.47 | 0.50 |
| $--Non-Coastal$ | percent | 0.53 | 0.50 |

*Note:* Ownership Classification and Location are dummy variables. For example, the variable *State* has a mean of 0.40, which means that 40% of the surveyed firms are State-owned enterprises. Coastal provinces in the sample are: Hebei, Jiangsu, Shandong, Fujian, Guangdong, and Hainan. Non-coastal provinces in the sample are: Shanxi, Jilin, Anhui, Hunan, Henan and Sichuan.

Table 10: Sample Statistics For Enterprises: Rural Sample (N=200)

| | Gross Output | Net Capital | Employment |
|---|---|---|---|
| UNIT | 10,000 yuan | 10,000 yuan | person |
| 1984 | 336.139 | 65.183 | 298.475 |
| | (593.218) | (88.725) | (309.381) |
| 1985 | 486.576 | 96.718 | 369.968 |
| | (849.214) | (132.202) | (354.787) |
| 1986 | 532.570 | 162.001 | 419.590 |
| | (1025.870) | (289.581) | (472.879) |
| 1987 | 624.188 | 237.213* | 409.046 |
| | (1231.110) | (509.598) | (521.383) |
| 1988 | 631.756 | 171.432 | 387.355 |
| | (1018.180) | (277.068) | (439.702) |
| 1989 | 709.366 | 209.628 | 382.523 |
| | (1262.700) | (358.718) | (438.833) |
| 1990 | 757.204 | 214.514 | 374.410 |
| | (1317.700) | (353.842) | (481.779) |

*Note:* standard deviation in the parentheses.

$*$: original price of fixed capital.