From State to Market: Monopsony, Employment Goals, and Non-Neutral Productivity in Chinese Manufacturing*

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Abstract

This paper jointly estimates the labor wedge and non-neutral productivity for Chinese manufacturing, and the effects of ownership transitions on each. I model the wedge as monopsony power net of the political cost of unemployment that employment goals impose on public owners. At the same county employment share and size, state-owned enterprises (SOEs) carry a lower wedge than private firms. On average, SOEs' larger county shares and employment give them more monopsony power, which the political cost roughly offsets, so the two wedges are close. SOEs' higher labor share and employment reflect lower labor-augmenting productivity and the political cost. Privatization raises labor-augmenting productivity and the labor wedge, and each rise explains about half of the labor share's fall.

Keywords: Labor Market Power; Monopsony; Labor Wedge; Employment Goal; Labor-Augmenting Productivity; Privatization; State-Owned Enterprise
JEL Codes: J42; D24; L33; P31; O33; L11

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1 Introduction

Beginning in the late 1990s, China privatized or closed most of its state-owned and collective manufacturing firms (Hsieh and Song, 2015; Chen et al., 2021). State-owned enterprises (SOEs), once the "iron rice bowl" of secure employment, remained under political pressure to hire excess labor (Berkowitz et al., 2017). Such employment goals raise the wage relative to the marginal revenue product of labor, while a firm's monopsony power works the other way. A private owner faces less of this pressure, so privatization can lower the wage relative to the marginal revenue product of labor, and it can also make labor more productive through stronger managerial incentives. Both changes lower the firm's labor share of variable cost, so a model that leaves out either one attributes the fall to the other. How do monopsony power and employment goals shape the labor wedge, and how does the move from state to private ownership change the wedge and labor-augmenting productivity?

This paper jointly estimates the labor wedge, labor-augmenting productivity and Hicks-neutral productivity for domestic Chinese manufacturing firms from 1998 to 2008, and the effect of privatization on each. The labor wedge is the proportion by which the marginal revenue product of labor exceeds the wage. I model it as the firm's monopsony power net of its owner's political cost of unemployment. The political cost comes from the employment goals of public owners and depends on the firm's ownership, and monopsony power depends on its county employment share and its size. I find that, at the same county employment share and size, SOEs carry a lower wedge than private firms. I read the gap as a higher political cost of unemployment to state owners. SOEs' larger county shares and employment give them more monopsony power on average, so their average wedge is close to that of private firms. SOEs have lower labor-augmenting but higher Hicks-neutral productivity than private firms. Privatization raises both the labor wedge and labor-augmenting productivity. I read the rise in the wedge as a fall in the political cost of unemployment.

To separate the wedge from labor-augmenting productivity, I estimate a translog produc-

tion function with a labor-augmenting and a Hicks-neutral productivity. The firm minimizes cost over labor and materials. Dividing the first-order conditions for labor and materials removes the markup and the output price, and writes labor-augmenting productivity as a function of observed inputs, the labor share and the wedge. Labor-augmenting productivity shifts the ratio of materials to labor by the same amount whatever the labor share, while the wedge shifts it by an amount that varies with the labor share. Both productivities follow controlled Markov processes shifted by ownership, and I estimate the resulting equations by dynamic panel GMM (Arellano and Bond, 1991; Blundell and Bond, 2000).

To estimate the ownership-level and privatization effects on the wedge, I model the county labor market so that a firm employing a larger share of county manufacturing employment faces a less elastic residual supply of labor. When owners bear no political cost of unemployment, the model is one of monopsony, in which the wage lies below the marginal revenue product of labor. In China that cost depends on ownership. State firms share the interests of the government that owns them, and unemployment is politically costly to the government, so the government sets employment goals for its firms and has them bear this cost. Without independent institutions for social safety, it charges them with providing social welfare and maintaining employment (Bai et al., 2000). An owner who bears a higher political cost of unemployment hires more workers than would maximize profit, so the political cost can explain why SOEs hire excess labor. The additional hiring lowers the wedge and can make it negative.[1] I let the political cost differ across ownership states, with separate states for the firms that have completed each transition. Each privatized group is compared with the group it left.

Ownership can also change the elasticity of the residual supply of labor that a firm faces, for example when applicants queue for jobs in public firms, so a difference in the wedge between ownership states can reflect either. Under two assumptions, the gap between the wedge of private firms and that of an ownership state at the same share and size is the

[1]Section 3.4 explains why I attribute this hiring to the employment goals of the government and not to efficient bargaining with a union.

political cost of unemployment to its owners. The first is that ownership moves workers' reservation wages only in proportion, so that at the same share and size it does not change the elasticity of the residual supply of labor. The second is that the owners of firms that are private throughout bear no political cost of unemployment, as Berkowitz et al. (2017) assume for private firms. The rise in the wedge at privatization is then the part of the former owners' political cost that privatization removes.

The results show that the wedge rises with the firm's county employment share, as monopsony predicts, and with its size. At the same share and size, the wedge of private firms lies significantly above that of SOEs, by 1.231. Under the two assumptions, an unemployed worker costs a state owner 1.231 times the wage. On average the gap is smaller, because SOEs hold larger county shares and employ more workers, which raises their monopsony power. At the same share and size, privatization significantly raises the wedge, by 0.269 at the state-to-private transition and by 0.165 at the collective-to-private transition. In the state-to-private group, an unemployed worker therefore still costs the new owners about four fifths of what it costs a state owner. Most privatized state firms were bought by their own managers and retained most of their workers (Chen et al., 2021). The political cost of unemployment to a collective owner is far smaller, and neither it nor that of the collective-to-private group can be distinguished from zero.

In the productivity laws of motion, private firms' labor-augmenting shifter is 0.065 log points above that of SOEs, while their Hicks-neutral shifter is lower. Privatization raises the labor-augmenting shifter by 0.066 log points at the state-to-private transition and by 0.026 at the collective-to-private transition, and at the state-to-private transition it lowers the Hicks-neutral shifter. All these differences are significant.

The materials condition recovers the product-market markup. Leaving the wedge out overstates the markup. Its mean is 1.080 when I recover it with the estimated wedge and 1.171 when I recover it without the wedge. Across firms, the markup recovered without the wedge is significantly higher in both privatized groups than in the groups they left, while,

with the estimated wedge, the markup of the collective-to-private group does not differ significantly from that of the collective group.

At the same output and capital, SOEs employ 0.76 log points more workers than private firms in the same industry and year. The lower labor-augmenting productivity of SOEs accounts for more than the whole gap, and their higher Hicks-neutral productivity narrows it. Under the two assumptions, the political cost of unemployment also raises their employment. In the years after the state-to-private transition, employment at a given output is on average lower than it would be at the wedge of the group the firm left and without the productivity differences accumulated since the transition. The higher wedge accounts for more than the whole difference, since the effects of the two productivities nearly offset and together raise employment slightly. For most privatized firms the rise in the wedge also widens the gap between the wage and the marginal revenue product of labor.

In the same industry and year, the labor share of variable cost of SOEs is twice that of private firms. More than four fifths of the difference between the two comes from the lower labor-augmenting productivity of SOEs. As with employment, the political cost of unemployment raises their labor share. In the years after the state-to-private transition, the labor share of variable cost is on average 1.7 percentage points lower than it would be at the wedge of the group the firm left and without the difference in labor-augmenting productivity accumulated since the transition. The higher labor-augmenting productivity and the higher wedge each account for about half of this fall.

This paper contributes to several lines of literature. First, it contributes to the estimation of labor market power and labor-augmenting productivity from production data. A large literature estimates labor-augmenting and other non-neutral productivity from firm data under the assumption that firms take the wage as given (Doraszelski and Jaumandreu, 2018; Raval, 2019; Zhang, 2019; Demirer, 2026; Zhao et al., 2026; Wang, 2026). The monopsony literature in labor economics finds that firms face an upward-sloping supply of labor and pay less than the marginal revenue product of labor (Manning, 2003, 2011; Card et al., 2018; Kroft

et al., 2025). The supply slopes upward because of search frictions, workers' preferences over jobs, or few competing employers, and it is less elastic for a firm that employs a larger share of its local labor market (Berger et al., 2022; Azar and Marinescu, 2024). The production approach to labor market power has assumed that productivity is Hicks-neutral (Dobbelaere and Mairesse, 2013; Mertens, 2020; Yeh et al., 2022). A Hicks-neutral model reads labor-augmenting productivity as labor market power (Doraszelski and Jaumandreu, 2019; Rubens et al., 2026) and yields biased output elasticities and markups (Demirer, 2026). A model without labor market power reads a change in the wedge as a change in labor-augmenting productivity (Rubens et al., 2026).

Recent work estimates the two together. Since both enter the ratio of the first-order conditions, separating them requires structure beyond that ratio (Rubens et al., 2026). Azzam et al. (2026) let the wage markdown of US meatpacking plants depend on the plant's size and its share of county meatpacking employment, without estimating the supply of labor. They control for labor-augmenting productivity through the ratio of the first-order conditions, within a semiparametric production function (Jaumandreu, 2026). I extend their model with an owner's political cost of unemployment, which differs by ownership state, and estimate the model across Chinese manufacturing. I use a homogeneous translog. It restricts how the elasticity of substitution varies with the labor share, and in return the ratio of the first-order conditions gives labor-augmenting productivity exactly.

Rubens et al. (2026) separate the two for Chinese nonferrous metal producers by estimating a nested-logit model of labor supply with shifters of labor demand and assuming Nash–Bertrand oligopsony. I complement their analysis by allowing for labor market conduct other than monopsony power. I model the political cost of unemployment that an owner bears, which Berkowitz et al. (2017) write for state firms as a political benefit of hiring. The political cost offsets monopsony power in the first-order condition for labor, differs by

ownership, and can push the wage above the marginal revenue product of labor.[2] Rubens et al. (2026) compare labor-augmenting productivity and markdowns across firms grouped by their current ownership. I further estimate the effect of privatization on the labor wedge and product market power and on labor-augmenting and Hicks-neutral productivity.

Second, the paper contributes to the literature on estimating product market power (De Loecker and Warzynski, 2012; Doraszelski and Jaumandreu, 2019; Raval, 2023; Demirer, 2026). When productivity is labor-augmenting, cost minimization identifies it, together with the output elasticities, from the labor share of variable cost (Doraszelski and Jaumandreu, 2019; Demirer, 2026). I show that markups recovered this way without a labor wedge are biased, because with a wedge the labor share of variable cost no longer measures the output elasticity of labor.

Third, the paper contributes to the literature on endogenous productivity, in which R&D, exporting or a change of ownership shifts the law of motion of productivity (Doraszelski and Jaumandreu, 2013; De Loecker, 2013; Braguinsky et al., 2015; Chen et al., 2021; Wang, 2026). I let the ownership states enter the labor wedge and the laws of motion of both Hicks-neutral and labor-augmenting productivity. I show that firms that have left public ownership carry both a higher wedge and higher labor-augmenting productivity than the groups they left.

Lastly, the paper adds to the evidence on China's reform of state and collective firms. Berkowitz et al. (2017) estimate the political benefit of hiring in state firms under a competitive labor market and Hicks-neutral productivity. Hsieh and Song (2015), Chen et al. (2021) and Wang (2026) measure what privatization does to productivity without labor market power. Brooks et al. (2021) estimate monopsony power across Chinese manufacturing with Hicks-neutral productivity. This paper provides new evidence on the labor wedge, the markup and both productivities together, and on how each changes at privatization. I also show that lower labor-augmenting productivity accounts for most of the gap in the labor

[2] Dobbelaere and Mairesse (2013) and Mertens (2020) also allow a wedge of either sign, but under Hicks neutrality. A wedge of either sign accommodates several kinds of labor market conduct, such as monopsony, efficient bargaining, or the political cost of unemployment in China. A model with monopsony power alone absorbs the political cost into weaker monopsony power or into lower labor-augmenting productivity.

share of variable cost between SOEs and private firms.

The rest of the paper proceeds as follows. Section 2 describes the data, the ownership classification and the reform transitions. Section 3 develops the structural framework. Section 4 reports the estimates and the political cost of unemployment they imply. Section 5 recovers the product-market markup. Section 6 turns to the gap between the wage and the marginal revenue product of labor, employment and the labor share. Section 7 concludes.

2 Chinese Manufacturing and Reform Transitions

By the mid-1990s, state firms had become unprofitable and a burden on local government budgets (Berkowitz et al., 2017). The central government then allowed them to lay off workers and thereby to treat labor as a variable input (Chen et al., 2021). The "grasp the large, let go of the small" reform began in the late 1990s. Under the reform, small state firms were privatized or closed and large ones were merged into industrial groups controlled by the central or local governments (Hsieh and Song, 2015). The government, not the managers, decided which state firms to let go. Many local state firms and township enterprises were sold to private owners (Chen et al., 2021). Collective firms such as township enterprises nominally belonged to their workers and local communities, but the governments of cities, counties, towns and villages oversaw them and appointed their managers (Chen et al., 2021). I therefore let the owners of state and collective firms bear a political cost of unemployment (Section 3.4).

2.1 Data Source

The data are the Annual Survey of Industrial Enterprises conducted by China's National Bureau of Statistics. The survey covers all state-owned industrial firms and the non-state industrial firms with annual sales above 5 million RMB. From 2007 the sales threshold also applies to state-owned firms. I use the manufacturing firms. The cleaned panel spans 1998–

2008 and contains 1,659,599 firm-years on 372,811 firms.[3] These years cover the reform. A trim on the labor share, the sector restriction, the ownership-history screens of Section 2.3, the requirement of a county code and the exclusion of foreign-owned firms (Section 2.2) leave 1,177,388 firm-years on 286,894 firms, the sample of Tables 1 and 2. The estimation sample further requires the lags of the instruments and contains 606,735 firm-years on 200,669 firms (Appendix A.5).

2.2 Ownership Classification

Two definitions of ownership coexist in the literature on Chinese manufacturing. The registration-based definition, used by Yu (2015) and in the baseline of Chen et al. (2021), takes the legal category recorded in the firm's business license. The shareholder-based definition uses the composition of the firm's capital. Chen et al. (2021) also report results under a shareholder-based definition on direct capital shares. Their estimate of the productivity gap between private firms and SOEs has the same sign under both definitions. I classify firms by the direct shares of paid-in capital, following the capital criterion of Hsieh and Song (2015).

At each firm-year I compute the shares of paid-in capital held by the state, by collectives and by foreign investors. I classify the firm-year as state-owned, collective or foreign when the corresponding share is at least one half and as private otherwise, so that

$$d_{it} \in \{\, S \text{ (SOE)},\ C \text{ (Collective)},\ P \text{ (Private)},\ F \text{ (Foreign)} \,\}.$$

Following Chen et al. (2021), I study domestic firms and drop the 16,108 firms that are foreign throughout. Of the 24,334 firms that would otherwise enter the sample and move from state or collective to private or foreign ownership, only 744, or 3.1 percent, are majority foreign in a post-transition year, and I drop them as well. Both samples then contain SOEs,

[3] Cleaning and variable construction follow Jaumandreu and Yin (2018) and Wang (2026). Appendix A.1 defines the variables and the county identifier.

collective and private firms. Moves between private and foreign ownership are not reform transitions, and the trajectory screen of Appendix A.4 drops the firms that are never state or collective and make such moves.

2.3 The Three Reform Transitions

I study three reform transitions: SOE to private ownership, collective to private ownership, and SOE to collective ownership. I date transitions by year-over-year changes in the ownership classification d_{it} and require every transition to be durable, following Wang (2026). For each transition $c \in \{S \to P,\ C \to P,\ S \to C\}$ with origin type $o(c)$, let T_i^c be the first year in which firm i moves from $o(c)$ to the destination type. The transition is durable if the firm never returns to $o(c)$ at or after T_i^c. A first crossing that is later reversed leaves T_i^c undefined. The post-transition indicator is

$$\text{Post}_{it}^c = \mathbf{1}\{T_i^c \text{ defined},\ t \geq T_i^c\},$$

which is absorbing. Appendix A.3 writes the indicators out by transition and counts them in the estimation sample.

A first downcrossing of the 50 percent threshold is not by itself evidence that a state firm was privatized. The durability rule checks for a return to the origin type only at or after T_i^c, so I screen firms on their full ownership histories before estimation. Three screens drop the firms that cross the state threshold more than once, that return to their origin type, or that occupy more than one of the ownership states of Section 2.4 beyond a single transition. They keep the firms whose ownership never changes and the firms that make exactly one of the three transitions. Appendix A.4 gives the reasons and the counts for each screen, and Appendix A.5 the construction of the estimation sample.

The SOE share of firm-years falls from 27.8 percent in 1998 to 0.9 percent in 2008, and the collective share from 36.6 to 1.5 percent (Table 1, Panel A). Transitions from collective to

Table 1: Ownership composition

	SOE	Collective	Private	Total
Panel A: Share of firm-years by ownership type in selected years, percent				
1998	27.8	36.6	35.6	50,314
2003	6.9	9.0	84.1	85,568
2008	0.9	1.5	97.6	163,166
Panel B: Firms by ownership history, 1998–2008				
State-owned throughout				15,991
Collective throughout				17,524
Private throughout				229,149
SOE → private				6,332
Collective → private				17,258
SOE → collective				640

Notes: The last column is firm-years in Panel A and firms in Panel B.

private ownership are 2.7 times as numerous as transitions from state to private ownership (Table 1, Panel B). Table 8 in Appendix A.2 reports firm-year means of the production variables by ownership type.

2.4 Ownership States in the Data

I sort firm-years into six ownership states and let the wedge of each state differ at the same share and size (Section 3). Three states hold firms by current ownership. I assign the years before a transition to the type the firm then held, so the state group contains the firms that are state-owned throughout and the pre-transition years of the firms that leave state ownership. The three post-transition states hold the years from each transition on. Table 2 reports, for each ownership state, the number of firm-years and firms, the two variables that enter the wedge (the county employment share and employment), output and compensation per worker, and the labor share of variable cost. The county employment share is the firm's employment over the employment of all surveyed manufacturing firms in its county and year (Appendix A.1). It is the size of the firm divided by the size of the county in which it hires.

The state group and the state-to-private group hold the largest county shares (Table 2). The median county share of the state group is five times that of private firms, while its median employment is only 1.6 times theirs. In means of logs, two thirds of the gap in the

county share comes from the smaller counties in which the state group hires. Within an ownership state the share varies far more than it does between ownership states. Within a year, its 10th to 90th percentile range is at least 3.9 log points in every ownership state, against a gap in means of logs of 1.5 log points between the state group and private firms.

The labor share of variable cost, the wage bill over the wage bill plus the cost of materials, separates the state group from the rest. Its mean is 0.207 in the state group, against 0.106 for private firms. Every other ownership state lies between the two except the collective-to-private group, which sits at the private level. The median output per worker of the state group is 55 percent of that of private firms, and that of the state-to-private group lies between the two. The median compensation per worker of the state group is about that of private firms, so its higher labor share comes mostly from lower output per worker, not from higher pay. Lower output per worker can come from an owner who bears a political cost of unemployment and hires more workers or from lower labor-augmenting productivity, and the framework of Section 3 separates the two.

Table 2: Ownership states

	Firm-years	Firms	County share (%)	Employment	Output per worker	Compensation per worker	S^L
State group	79,648	22,904	1.50	159	97.4	12.1	0.207
Collective	104,180	34,506	0.38	102	162.7	10.9	0.114
Private	907,358	229,149	0.29	97	177.8	11.7	0.106
Post S→P	22,025	6,294	1.57	215	149.1	14.0	0.159
Post C→P	62,819	17,011	0.41	127	193.7	11.9	0.100
Post S→C	1,358	632	1.12	156	118.2	11.8	0.163

Notes: Medians are taken within each year, and the table reports their geometric mean over 1998–2008, or over 1999–2008 for the post-transition states. S^L is the mean labor share of variable cost, averaged over the same years. Output per worker (revenue deflated to 1998 prices) and compensation per worker (the wage bill over employment) are in thousand RMB. A switching firm counts in each state in which it has firm-years.

3 Empirical Framework

The technology is translog with two unobserved productivities, one Hicks-neutral and one labor-augmenting. The firm minimizes cost against an upward-sloping residual supply of

labor, and its owner bears a political cost of unemployment. The shadow price of labor therefore differs from the wage by a wedge of either sign. The wedge varies with the firm's county employment share and size, and it shifts with its ownership state. The ratio of the first-order conditions for labor and materials gives labor-augmenting productivity as a function of observables and the wedge. Both productivities follow Markov processes shifted by ownership. I estimate the share equation and then the output equation, each by two-step GMM.

3.1 Translog Production Function

Firm i produces gross output in year t with a translog technology, separable in capital and homogeneous of degree ν in labor and materials (Doraszelski and Jaumandreu, 2019),

$$y_{it} = \alpha_0 + \alpha_K k_{it} + \alpha_L\big(\omega^L_{it} + \ell_{it}\big) + \alpha_M m_{it} - \frac{\alpha}{2}\big(m_{it} - \ell_{it} - \omega^L_{it}\big)^2 + \omega^H_{it} + \varepsilon_{it}, \tag{1}$$

where y_{it} is log deflated revenue and $k_{it}, \ell_{it}, m_{it}$ are logs of deflated capital, employment and deflated materials. Homogeneity of degree $\nu \equiv \alpha_L + \alpha_M$ imposes $-\alpha_{LL} = -\alpha_{MM} = \alpha_{LM} \equiv \alpha$, which collapses the three second-order terms into the single quadratic in (1). Returns to scale are $\alpha_K + \nu$.

Labor-augmenting productivity ω^L_{it} enters multiplicatively with labor, so $e^{\omega^L_{it}} L_{it}$ is labor in efficiency units. Hicks-neutral productivity ω^H_{it} shifts output whatever the input mix. Since y_{it} is revenue, ω^H_{it} is revenue productivity (TFPR), not physical productivity (TFPQ; Foster et al., 2008). The disturbance ε_{it} collects measurement error in revenue and shocks that cannot be anticipated when inputs are chosen.

The output elasticities of the two variable inputs are

$$\varepsilon_{L,it} = \alpha_L + \alpha\big(m_{it} - \ell_{it} - \omega^L_{it}\big), \qquad \varepsilon_{M,it} = \nu - \varepsilon_{L,it}, \tag{2}$$

and the elasticity of substitution between them is

$$\sigma_{it} = \frac{\theta\, \varepsilon_{L,it}\, \varepsilon_{M,it}}{\nu^2 + \theta\, \varepsilon_{L,it}\, \varepsilon_{M,it}}, \qquad \theta \equiv \frac{\nu}{\alpha}. \tag{3}$$

The translog lets σ_{it} vary across firms with how labor and materials divide their combined output elasticity ν. When the firm minimizes cost and the wage equals the shadow price of labor, $\varepsilon_{L,it}/\nu$ equals the labor share of variable cost, $S^L_{it} = W_{it}L_{it}/(W_{it}L_{it} + P^M_{it}M_{it})$, where W_{it} is compensation per worker and P^M_{it} is the price of materials.

3.2 Cost Minimization and the Labor Wedge

The firm chooses labor and materials to minimize the cost of its output. It buys materials at the price P^M_{it} and hires labor along an upward-sloping residual supply of labor, $W_{it}(L)$. Its owner bears a political cost of unemployment, $\Phi_{it}(L)$, which does not depend on materials. I let the political cost come from an employment goal: a pool of $\bar{L}_{it}$ workers whom the owner answers for and from whom the firm hires, more than the firm employs. A worker of the pool whom the firm does not employ is unemployed, and the government bears the cost of supporting that worker and of the unrest that unemployment can cause. A state firm shares the interests of the government that owns it, so the government has the firm bear this cost. As Bai et al. (2000) argue, without independent institutions for social safety the government charges the firms it owns with providing social welfare and maintaining employment.

The firm solves

$$\min_{L,\,M}\; W_{it}(L)\, L + P^M_{it} M + \Phi_{it}(L) \quad \text{subject to} \quad Y_{it}(L, M) \geq \bar{Y}_{it}, \tag{4}$$

where $Y_{it}(L, M)$ is the technology of Section 3.1 at the firm's capital and productivities and $\bar{Y}_{it}$ is its output. For the owner of a firm in ownership state g, one of the six of Table 2, the political cost is κ_g times the wage at which the firm would hire each unemployed worker of

the pool,

$$\Phi_{it}(L) = \kappa_g \int_{L}^{\bar{L}_{it}} W_{it}(x)\, dx, \qquad \kappa_g \geq 0. \tag{5}$$

With marginal cost MC_{it} as the multiplier on the output constraint, the first-order conditions are

$$MC_{it}\, \frac{\partial Y_{it}}{\partial M_{it}} = P^M_{it}, \qquad MC_{it}\, \frac{\partial Y_{it}}{\partial L_{it}} = W_{it} + W'_{it}(L_{it})\, L_{it} + \Phi'_{it}(L_{it}) \equiv (1 + \tau_{it})\, W_{it}, \tag{6}$$

with the labor wedge

$$1 + \tau_{it} = 1 + \eta_{it} - \kappa_{it}, \qquad \eta_{it} \equiv \frac{\partial \ln W_{it}}{\partial \ln L_{it}} \geq 0, \qquad \kappa_{it} \equiv -\frac{\Phi'_{it}(L_{it})}{W_{it}} \geq 0. \tag{7}$$

Here η_{it}, the inverse elasticity of the residual supply of labor, measures the firm's monopsony power, and κ_{it} is the political cost of unemployment, per unemployed worker and in units of the wage. One more worker raises the wage bill by $W_{it}(1 + \eta_{it})$, the wage of the new worker plus the increase in the wage bill of those already employed, and lowers the political cost of the owner by $\kappa_{it} W_{it}$. I assume the materials market is perfectly competitive, so the wedge sits on labor alone.

By (5), $-\Phi'_{it}(L) = \kappa_g W_{it}(L)$, so $\kappa_{it} = \kappa_g$. The size of the pool does not enter the first-order conditions, because each worker the firm hires lowers the political cost by the same multiple of that worker's wage, however many workers of the pool remain unemployed. The political cost attaches to the job, not to the raise the firm must give the workers already employed to hire one more, so it does not scale with $1 + \eta_{it}$.

Neither first-order condition restricts how the firm sets its output price. Marginal cost cancels from their ratio, so the wedge and labor-augmenting productivity are robust to product market power (Doraszelski and Jaumandreu, 2019; Jaumandreu, 2024). The level of the markup implied by the materials condition on its own is a different object, and Section 5 reports it.

The wedge is the difference of two nonnegative terms, so its sign is not restricted and says which of the two is larger. A positive τ_{it} is a wage markdown, where monopsony power η_{it} exceeds the political cost κ_{it}. A negative τ_{it} means that κ_{it} is the larger. The firm then pays labor more than its marginal revenue product, which I call a wage markup. At the output at which marginal revenue equals marginal cost, the left side of the labor condition in (6) is the marginal revenue product of labor, $MRPL_{it}$, so the wage gap implied by the wedge is

$$1 - \frac{W_{it}}{MRPL_{it}} = \frac{\tau_{it}}{1 + \tau_{it}}. \tag{8}$$

A firm whose owner bears no political cost has $\kappa_{it} = 0$, and a firm in a competitive labor market has $\eta_{it} = 0$. Berkowitz et al. (2017) model the pressure on state firms to hire as a political benefit of hiring. Their state firm is the case $\eta_{it} = 0$, in which this benefit enters the first-order conditions as the political cost (5) does.[4]

3.3 The County Labor Market

Firm i hires in the labor market of its county. As in Azzam et al. (2026), workers in the county differ in their reservation wage, the lowest wage at which they take a job at the firm. The share of county manufacturing employment that the firm can employ therefore rises with the wage it pays,

$$\text{share}_{it} \equiv \frac{L_{it}}{L_{c(i)t}} = G\big(W_{it}, \text{size}_{it}\big), \tag{9}$$

where $L_{c(i)t}$ is manufacturing employment in the firm's county and size_{it} is the size of the firm. The distribution of reservation wages can differ with size because large firms set wages differently (Manning, 2011). As in the Cournot model of oligopsony (Azar and Marinescu, 2024), firms choose employment taking the employment of the other firms in the county as

[4]Their state firm gains $1 - 1/\phi_t$ times the wage from one more worker, where $\phi_t \geq 1$ measures the political pressure to hire. Their objective, profit plus $1 - 1/\phi_t$ times the wage bill, gives this gain at a given wage. Along an upward-sloping $W_{it}(L)$, the wage-bill objective gives $\kappa_{it} = (1 - 1/\phi_t)(1 + \eta_{it})$ and $1 + \tau_{it} = (1 + \eta_{it})/\phi_t$.

given.[5] Inverting (9) at the employment of the other firms gives the residual supply of labor that the firm faces in (4),

$$W_{it}(L) = G^{-1}\big(L/(L + L_{c(i)t} - L_{it}), \text{size}_{it}(L)\big), \tag{10}$$

so its inverse elasticity η_{it} is a function of the firm's county share and size. When workers move between the firms of a county more easily than into or out of its manufacturing employment, η_{it} is a constant plus a term that rises with the share (Berger et al., 2022). The term rises because a firm with a larger county share moves the wage of the county more with its own hiring.

3.4 Wages and Employment by Ownership

Ownership enters the wedge through the political cost of the owner and may also shift the distribution of reservation wages in (9). The non-wage attributes of a job, such as its security, can differ across ownership states (Rubens et al., 2026), so the wage at which a firm attracts a given share of county employment may depend on its ownership state. A shift that scales the reservation wage of every worker by the same factor moves the level of G^{-1} but not its elasticity η_{it}, so it changes the wage the firm pays and not the wedge. A shift that scales some reservation wages more than others can change η_{it} as well. My first assumption is that ownership shifts the distribution of reservation wages only in proportion, so that η_{it} is the same function of the county share and size in every ownership state. It rules out, for example, applicants who queue for the jobs of one ownership state. The employers of that state would then face a more elastic residual supply of labor at the same share and size, and its wedge would be lower through η even if κ_g were the same in every state.

Under the first assumption, ownership shifts labor supply as firm-specific amenities do in the constant-elasticity case of Card et al. (2018) and in Kroft et al. (2025). In the dataset I

[5] With workers who differ only in their reservation wage, competition in wages would bid the wage up to the marginal revenue product.

use, the compensation per worker W_{it} includes the benefits that the firm pays in addition to wages, such as welfare payments, pension and medical contributions and the housing fund (Appendix A.1). The amenities through which ownership shifts labor supply are therefore the attributes of a job that lie outside compensation.

Every firm chooses its labor and materials by (6) and pays the wage that its residual supply of labor (10) gives at its employment.

Private firms. I refer to firms that are private throughout as private firms. My second assumption is that the owners of private firms answer only for the workers they employ, so they bear no political cost of unemployment, $\kappa_{\text{Pri}} = 0$, as Berkowitz et al. (2017) assume for private firms. The second assumption makes the wedge of private firms their monopsony power alone, $\tau_{it} = \eta_{it}$.

State and collective firms. The owners of state firms bear the political cost of Section 3.2. Collective firms nominally belong to local communities such as villages and are overseen by local governments (Chen et al., 2021). Their jobs are part of the stable employment those communities provide, so collective owners can bear such a cost as well. State and collective firms hire from the same county workers as private firms and, by the first assumption, face the same η_{it} at the same share and size. The political cost of their owners lowers their wedge to $\tau_{it} = \eta_{it} - \kappa_g$ and can make it negative. A higher κ_g raises the employment of a firm, its county share and, along its residual supply of labor, its wage.[6] Efficient bargaining with a union would also lead a firm to hire more workers than would maximize profit and to pay a wage above the marginal revenue product of labor (McDonald and Solow, 1981). I let the pressure on state and collective firms to hire come from their public owners, not from bargaining with unions, because in China unions are not independent of the government and collective bargaining was little developed (Dobbelaere and Wiersma, 2025).

[6]These effects hold when the marginal revenue product of labor falls with employment, η rises with employment, and $1 + \tau_{it} > 0$. A higher κ_g then also raises η and lowers the wedge by less than the increase in κ_g.

Firms in the reform transitions. A firm that changes ownership stays in the labor market of its county and, by the first assumption, faces the same η_{it} at the same share and size before and after. In each year its owners bear the political cost κ_g of the ownership state g that the data record for that year, so its wedge in that year is $\tau_{it} = \eta_{it} - \kappa_g$. Most privatized state firms were bought by their own managers and retained most of their workers (Chen et al., 2021), so I do not extend the second assumption to their new owners. Neither assumption restricts the political cost of the three post-transition states.

3.5 Parameterizing the Wedge

I take η_{it} to be linear in the log county employment share and in log employment ℓ_{it}, the measure of size,

$$\eta_{it} = \eta_0 + \tau_{\text{share}} \widetilde{\ln \text{share}}_{it} + \tau_\ell \, \tilde{\ell}_{it}, \tag{11}$$

where a tilde denotes the deviation from the sample mean, so that η_0 is the inverse elasticity at the sample means. Equation (11) summarizes how η_{it} varies with the county share and size and does not impose the form that η_{it} takes in the Cournot model or in its version with differentiated jobs.

Substituting (11) and $\kappa_{it} = \kappa_g$ into (7), with the indicator for SOE omitted, gives

$$\begin{gathered} \tau_{it} = \tau_0 + \tau_{\text{share}} \widetilde{\ln \text{share}}_{it} + \tau_\ell \, \tilde{\ell}_{it} + \sum_{g \neq \text{SOE}} d_g \, \mathbf{1}\{g(i,t) = g\}, \\ g \in \{\text{SOE}, \text{Coll}, \text{Pri}, \text{Post}^{SP}, \text{Post}^{CP}, \text{Post}^{SC}\}, \end{gathered} \tag{12}$$

with $\tau_0 \equiv \eta_0 - \kappa_{\text{SOE}}$ and the ownership deviations $d_g \equiv \kappa_{\text{SOE}} - \kappa_g$.

The omitted ownership state, SOE, is the state group of Table 2. The level τ_0 is the wedge of the state group at the sample means of $\ln \text{share}$ and ℓ. I leave τ_0 free, so no ownership state has its wedge held at zero and the wedge can take either sign. With $t_g \equiv \tau_0 + d_g$ as the wedge of state g at the sample means, each $d_g = t_g - t_{\text{SOE}}$ is the difference between state g and the state group. In particular, $d_{\text{Post}^{SP}}$ compares the state-to-private group with the

group it left. Omitting the indicator for a different state changes the parameterization but leaves the fitted wedge and every difference unchanged.

The wedge identifies six levels, τ_0 and the five d_g, and the model has seven, η_0 and the six κ_g. With $\kappa_{\text{Pri}} = 0$ from the second assumption,

$$\kappa_g = d_{\text{Pri}} - d_g = t_{\text{Pri}} - t_g, \qquad \eta_0 = \tau_0 + d_{\text{Pri}}, \tag{13}$$

so the two assumptions identify the political cost of unemployment in every ownership state. Under them, every difference in the wedge between ownership states at the same share and size is a difference in the political cost of unemployment. In particular, the rise in the wedge at the state-to-private transition is the part of that cost that this transition removes, $\kappa_{\text{SOE}} - \kappa_{\text{Post}^{SP}} = d_{\text{Post}^{SP}}$, and this reading needs no assumption on the political cost that the new owners bear. A group constant cannot separate a difference in the level of η from a difference in κ, so the reading rests on the first assumption.

By (13), the sign restriction $\kappa_g \geq 0$ requires the wedge of every ownership state to lie at or below that of private firms at the same share and size, and $\eta_{it} \geq 0$ requires $\eta_0 = \tau_0 + d_{\text{Pri}} \geq 0$ at the sample means. The linear form (11) approximates η_{it} and is not bounded below, so it can fall below zero where the county share or size is small.

The higher η_{it} of a firm with a larger county employment share is the monopsony reading of $\tau_{\text{share}} > 0$. The share and size terms hold fixed the rise in η_{it} that a higher κ_g brings about (Section 3.4), so d_g compares ownership states at the same share and size.

Because W_{it} is measured as compensation per worker, any part of compensation that does not rise with the marginal hire lowers the measured $1 + \tau_{it}$ with no political cost involved.[7] A fixed number of workers who add nothing to output do the same. Such workers multiply the measured $1 + \tau_{it}$ by the productive share of employment and shift ω_{it}^L by the log of that share. A difference across ownership states in that part of compensation or in the productive share of employment enters d_g much as a difference in κ_g would.

[7] Such a component scales the measured $1 + \tau_{it}$ by the ratio of marginal to average compensation.

I measure the effect of each reform transition by comparing the post-transition group with the group it left. The wedge is compared at the same share and size. As in Doraszelski and Jaumandreu (2013) and De Loecker (2013), each productivity is compared at the same level in the previous year (Section 3.7). When I write that privatization raises the wedge or productivity, I refer to these comparisons.

3.6 From the First-Order Conditions to the Output Equation

Dividing the labor condition in (6) by the materials condition eliminates marginal cost and the output price,

$$\frac{\varepsilon_{L,it}}{\varepsilon_{M,it}} = (1+\tau_{it})\,\frac{S^L_{it}}{1-S^L_{it}}, \tag{14}$$

and combining with (2) gives $\varepsilon_{L,it} = \nu B_{it}$ with the wedge-modified labor share

$$B_{it} \equiv \frac{(1+\tau_{it})\,S^L_{it}}{1+\tau_{it}\,S^L_{it}}. \tag{15}$$

With $\varepsilon_{L,it} = \nu B_{it}$ and $\varepsilon_{M,it} = \nu(1-B_{it})$, (3) becomes $\sigma_{it} = \theta B_{it}(1-B_{it})/[1+\theta B_{it}(1-B_{it})]$, so the elasticity of substitution depends on the observed labor share through B_{it}, which equals S^L_{it} at $\tau_{it} = 0$.[8]

Solving (14) for labor-augmenting productivity expresses it in terms of observables and the wedge,

$$\omega^L_{it} = \left(m_{it} - \ell_{it}\right) + \frac{\alpha_L}{\alpha} - \theta\, B_{it}. \tag{16}$$

Substituting (16) into (1) removes ω^L_{it}. The linear term in B_{it} cancels and α_L is absorbed into the constant, leaving

$$y_{it} = \tilde{\alpha}_0 + \alpha_K k_{it} + \nu\, m_{it} - \frac{\nu\theta}{2}\, B^2_{it} + \omega^H_{it} + \varepsilon_{it}. \tag{17}$$

[8]The share B_{it} lies below one, so the output elasticity of materials is positive, whenever $1+\tau_{it}S^L_{it} > 0$. This condition is weaker than the $1+\tau_{it} > 0$ that a constant elasticity of substitution specification requires through $\ln(1+\tau)$.

3.7 Two Productivity Processes

Each productivity depends on its own value in the previous year and on the firm's ownership state in the previous year. The ownership states are the six of (12), the three states defined by current ownership and the three post-transition states. Both productivities thus follow the controlled Markov process of Doraszelski and Jaumandreu (2013) and De Loecker (2013), with the ownership state in place of R&D or exporting,

$$\omega_{it}^{H} = \rho_H\, \omega_{i,t-1}^{H} + \sum_{g \neq \text{SOE}} a_g^H\, \mathbf{1}\{g(i,t-1) = g\} + \delta_{j(i)t}^{H} + \xi_{it}^{H}, \tag{18}$$

$$\omega_{it}^{L} = \rho_L\, \omega_{i,t-1}^{L} + \sum_{g \neq \text{SOE}} a_g^L\, \mathbf{1}\{g(i,t-1) = g\} + \delta_{j(i)t}^{L} + \xi_{it}^{L}, \tag{19}$$

where ρ_H and ρ_L measure persistence, $\delta_{j(i)t}^{H}$ and $\delta_{j(i)t}^{L}$ are effects of industry j (Appendix A.6) and year t, and $\mathbb{E}[\xi_{it}^{H} \mid \mathcal{I}_{i,t-1}] = \mathbb{E}[\xi_{it}^{L} \mid \mathcal{I}_{i,t-1}] = 0$, with $\mathcal{I}$ the firm's information set.

The industry-year effects absorb shocks common to an industry in a given year, including the aggregate productivity trend and demand shocks around WTO accession. Without them the persistence parameters absorb the trend and are biased toward unity.

The six indicators sum to one and the industry-year effects carry the constant, so, as in the wedge, I omit the state group. Each a_g^L is then the shift in the labor-augmenting productivity of a firm that was in state g in the previous year relative to a firm that was then in the state group, and likewise for a_g^H. The two firms are in the same industry and year and had the same value of that productivity in the previous year. In particular, $a^L_{\text{Post}^{SP}}$ compares the state-to-private group with the group it left, and $a^L_{\text{Post}^{CP}} - a^L_{\text{Coll}}$ compares the collective-to-private group with the collective group. A unit of a_g^H is a log point of output and a unit of a_g^L is a log point of labor in efficiency units, so the two shifters are not on the same scale.

Ownership enters the framework twice, once through the wedge (12) and once through the two laws of motion. The wedge measures how far the wage sits from the marginal

revenue product, and the shifters a_g^L and a_g^H measure how ownership shifts each productivity. Ownership can shift labor-augmenting productivity through the incentives that firms give their workers and the technology they use (Chen et al., 2021; Wang, 2026). With ownership in both the wedge and the laws of motion, the data apportion ownership differences between the price of labor and the productivity of labor. Section 3.8 describes the variation that separates them.

3.8 Identification and Estimation

Quasi-differencing (16) with (19) and (17) with (18) yields two estimating equations,

$$\begin{aligned}
&\big(m_{it} - \ell_{it}\big) - \rho_L\big(m_{i,t-1} - \ell_{i,t-1}\big) - \theta\big(B_{it} - \rho_L B_{i,t-1}\big) \\
&\quad - \sum_{g \neq \text{SOE}} a_g^L \, \mathbf{1}\{g(i,t-1) = g\} - \delta^L_{j(i)t} = \xi^L_{it}, \qquad (20)
\end{aligned}$$

$$\begin{aligned}
&\big(y_{it} - \rho_H y_{i,t-1}\big) - \alpha_K\big(k_{it} - \rho_H k_{i,t-1}\big) - \nu\Big[\big(m_{it} - \rho_H m_{i,t-1}\big) - \frac{\theta}{2}\big(B_{it}^2 - \rho_H B_{i,t-1}^2\big)\Big] \\
&\quad - \sum_{g \neq \text{SOE}} a_g^H \, \mathbf{1}\{g(i,t-1) = g\} - \delta^H_{j(i)t} = \xi^H_{it} + \varepsilon_{it} - \rho_H \varepsilon_{i,t-1}. \qquad (21)
\end{aligned}$$

I call (20) the share equation and (21) the output equation. The wedge enters the share equation through B_{it}, at first order in the labor share, and the output equation through B_{it}^2, at second order. I therefore estimate the wedge in the share equation and impose it on the output equation.

The exclusion restrictions are on productivity innovations and not on productivity itself, so a variable may be correlated with $\omega^L_{i,t-1}$ or $\omega^H_{i,t-1}$ and remain a valid instrument (Blundell and Bond, 2000; Ackerberg et al., 2015). The firm chooses labor and materials after it observes current productivity (Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Ackerberg et al., 2015). Employment, materials, the wage, the labor share of variable cost and the county employment share dated t are correlated with ξ^L_{it} and ξ^H_{it}. The same variables dated $t-1$ and $t-2$ are not. Capital at t is installed with investment chosen at $t-1$, so it is

predetermined with respect to ξ^H_{it}. Chen et al. (2021) find that privatizing or liquidating a state firm takes 8 to 14 months from proposal to implementation and assume that ownership and exit in year t are decided in year $t-1$. I follow them, so the ownership state at t and whether the firm is present at t are also predetermined with respect to the innovations. As Chen et al. (2021) note, a selection correction for exit as in Olley and Pakes (1996) is then unnecessary.

The instruments are built from the lagged values of the variable inputs and shares, from lagged input prices, from capital dated t and $t-1$, and from the ownership states. Most share-equation instruments interact with the ownership state at t. Writing $\mathbf{1}\{g\}_{it}$ for the vector of ownership indicators and P^M/W for the price of materials relative to the wage, the two instrument vectors are

$$
\begin{aligned}
z^L_{it} = \big(\; & \ln(P^M/W)_{i,t-1}\cdot\mathbf{1}\{g\}_{it},\; S^L_{i,t-2}\cdot\mathbf{1}\{g\}_{it},\; (S^L_{i,t-2})^2\cdot\mathbf{1}\{g\}_{it},\; \operatorname{logit} S^L_{i,t-2}\cdot\mathbf{1}\{g\}_{it},\\
& (S^L_{i,t-2})^3,\; \big[\ln(P^M/W)_{i,t-1}\big]^2,\; \big[\ln(P^M/W)_{i,t-1}\big]^3,\\
& \text{share}^2_{i,t-1},\; \text{share}_{i,t-1}\,\ell_{i,t-1},\; \text{share}_{i,t-1}\cdot\mathbf{1}\{g\}_{it},\; \big(\mathbf{1}\{g\}_{i,t-1}\big)_{g\neq\text{SOE}}\big)',\\
z^H_{it} = \big(\; & k_{it},\; k_{i,t-1},\; \ell_{i,t-1},\; \ell^2_{i,t-1},\; m_{i,t-1},\; m^2_{i,t-1},\; \ln W_{i,t-1},\\
& S^L_{i,t-1}\cdot\mathbf{1}\{g\}_{i,t-1},\; \big(\mathbf{1}\{g\}_{i,t-1}\big)_{g\neq\text{SOE}}\big)',
\end{aligned}
$$

where $\operatorname{logit} x \equiv \ln[x/(1-x)]$ and the county employment share enters in levels. The industry-year effects are partialled out of both equations and both instrument sets.

The wedge and labor-augmenting productivity both enter the ratio of the first-order conditions (14). The wedge is a function of the ownership state, the county share and size (12), and labor-augmenting productivity follows the law of motion (19). The ownership deviations d_g enter the share equation through B_{it} and $B_{i,t-1}$, whose response to the wedge varies with the labor share, while the shifters a^L_g enter additively. Within an ownership state the two are separated by the dispersion of the labor share.

The share equation pins ratios of $1+\tau$ across ownership states more tightly than the scale

of the wedge. Expanding (15) in the labor share gives $B_{it} = (1+\tau_{it})S^L_{it} - \tau_{it}(1+\tau_{it})(S^L_{it})^2 + \ldots$, so at first order the share equation carries the wedge only through the product $\theta(1+\tau_{it})$. Scaling $1+\tau$ up and θ down in proportion leaves the first-order term unchanged and moves only the terms of second and higher order in S^L_{it}. Such a scaling multiplies $1+\tau_0$, τ_{share}, τ_ℓ and d_g by the same factor and leaves unchanged the ratios of $1+\tau$ across ownership states, the ratios among the d_g, and each d_g relative to $1+\tau$.

The interactions with ownership at t identify the ownership deviations d_g, because they predict the labor share within each ownership state, where its dispersion separates d_g from a^L_g. The powers of the relative price add variation in the labor–materials mix that does not run through the ownership indicators. The block in the lagged county share identifies the share and size terms. The square, cube and logit of $S^L_{i,t-2}$ supply the curvature in S^L that separates the scale of the wedge from θ. The logit is the form in which the labor share enters (14) in logarithms. The square and the logit enter interacted with the ownership state, so that this curvature is available within each group and not only on average. The share equation uses 40 instruments for 15 parameters and the output equation uses 18 for 8, so both equations are overidentified.

I estimate the model in two stages, each by two-step efficient GMM with a firm-clustered weight matrix (Hansen, 1982). The first stage uses the share equation alone and identifies $(\theta, \rho_L, \tau_0, \tau_{\text{share}}, \tau_\ell, d_g, a^L_g)$. The second stage imposes $\hat{\theta}$ and the fitted wedge $\hat{\tau}_{it}$ on the output equation[9] and identifies $(\alpha_K, \nu, \rho_H, a^H_g)$. Standard errors are clustered at the firm level, and those of the second stage account for the estimation of the first (Newey, 1984; Newey and McFadden, 1994).

[9] Doraszelski and Jaumandreu (2018) also impose the estimates of the first equation on the second and correct the standard errors of the second for the estimation of the first. Wang and Jung (2026) do the same.

4 Results

Table 3 reports the GMM estimates on 606,735 firm-years in 200,669 firms, Table 4 the wedge at each reform transition against the group it left, Table 5 the political cost of unemployment by ownership state, Table 6 the productivity shifters, and Figure 1 the fitted wedge.

Table 3: Translog technology and the labor wedge by ownership state

	Estimate
Panel A: Technology	
θ	$+4.775^{***}$
	(0.482)
α_K	$+0.016^{***}$
	(0.001)
ν	$+1.011^{***}$
	(0.011)
ρ_L	$+0.911^{***}$
	(0.001)
ρ_H	$+0.845^{***}$
	(0.003)
$\alpha = \nu/\theta$	0.212
σ_{it} at the median of B_{it}	0.381
$\varepsilon_L = \nu B_{it}$ at the median	0.154
Panel B: Share and size terms	
τ_{share}, log county employment share	$+0.301^{***}$
	(0.068)
τ_ℓ, log employment	$+0.916^{***}$
	(0.251)
Panel C: State-group level and ownership deviations, τ_0 and d_g	
τ_0, state group	+0.142
	(0.404)
Collective	$+1.021^{***}$
	(0.368)
Private	$+1.231^{***}$
	(0.308)
Post S→P	$+0.269^{***}$
	(0.070)
Post C→P	$+1.186^{***}$
	(0.388)
Post S→C	+0.207
	(0.168)

Notes: Two-step efficient GMM (Section 3.8) on 606,735 firm-years in 200,669 firms, with industry-year effects partialled out. The state group is the omitted ownership state. Standard errors clustered by firm are in parentheses, and those of the second stage account for the first stage. α, σ_{it} and ε_L are computed from the estimates and shown without standard errors. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

4.1 Technology

Labor and materials are strong complements (Table 3, Panel A). Their elasticity of substitution is 0.381 at the median of the wedge-modified labor share B and 0.266 at the median labor share of variable cost, which B equals when $\tau = 0$. Estimates of the elasticity of substitution that allow for factor-augmenting productivity in Chinese manufacturing firms also lie well below one (Zhang, 2019; Wang, 2026). Both productivity processes are persistent. Total returns to scale, $\alpha_K + \nu$, are 1.027.

4.2 The Wedge across Ownership States

A firm with a larger county employment share has a higher wedge, as monopsony predicts. The share term, $\tau_{\text{share}} = 0.301$, and the size term, $\tau_\ell = 0.916$, are both positive and significant (Table 3, Panel B). The level $\tau_0 = \eta_0 - \kappa_{\text{SOE}}$ is the wedge of the state group at the sample means of $\ln \text{share}$ and ℓ. It is 0.142 and not significantly different from zero.

At the same share and size, the wedges of the collective group and of private firms lie significantly above that of the state group, by 1.021 and 1.231 (Table 3, Panel C), and cannot be distinguished from each other (Table 5, column (1)). Under the two assumptions of Section 3.4, these gaps are differences in the political cost of unemployment (Section 4.4).

Evaluated at each firm's own county share and size, the fitted wedge is positive for most firm-years (Figure 1).[10] Over all firm-years, the mean fitted wedge is 1.21 for private firms and 1.07 for the state group. These levels rest on the scale of the wedge, which the share equation pins less tightly than the ratios of $1 + \tau$ (Section 3.8).

The gap between the two means is smaller than the gap between the two groups' wedges at the same share and size. The state group holds larger county shares and employs more workers than private firms (Table 2), so the share term and the size term both raise its fitted

[10] Of all firm-years, 3.2 percent have a wedge at or below -1, $1 + \hat{\tau}_{it} \leq 0$, against 11.7 percent of those in the state group. There the linear form (11), which is not bounded below (Section 3.5), can take $1 + \hat{\tau}_{it}$ below zero, and in the state group so can a political cost of unemployment above $1 + \eta_{it}$.

wedge relative to theirs. Under the two assumptions, the same terms give the state group more monopsony power, $\eta_{it} = \tau_{it} + \kappa_g$. The mean of η_{it} is 2.30 in the state group, against 1.21 for private firms. The gap of 1.231 in the political cost of unemployment roughly offsets this difference of 1.09, so the two mean wedges are close, and they do not differ significantly.[11]

Within an ownership state the fitted wedge changes over time only through the county share and size, so the yearly means in panel (a) of Figure 1 follow the county shares and employment of the firms in each state.

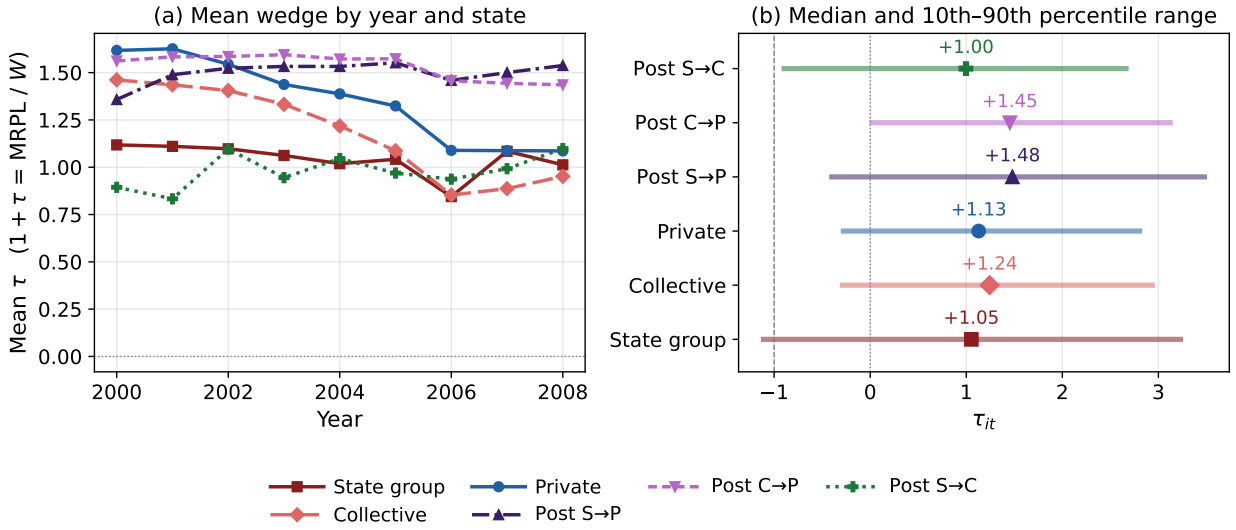


Figure 1: Fitted labor wedge by year and ownership state. Panel (b) pools the years. Dotted lines mark $\tau = 0$ and the dashed line in panel (b) marks $\tau = -1$.

4.3 The Wedge at the Reform Transitions

At the same share and size, both privatized groups carry significantly higher wedges than the groups they left, by 0.269 at the state-to-private transition and by 0.165 at the collective-to-private transition (Table 4, Panel A). At the share and size that the privatized firms had before privatization, the marginal revenue product of labor relative to the wage, $1 + \hat{\tau}$, rises at the state-to-private transition to 1.103 times its level before privatization, and at the

[11] The test uses the covariance of the estimates, by the delta method as in Table 5, and holds each firm-year's county share and size fixed.

Table 4: The labor wedge relative to the group left

	S→P (1)	S→C (2)	C→P (3)
Group left	State	State	Collective
Panel A: Labor wedge			
Difference at the same share and size, $d_{\text{post}} - d_{\text{left}}$	$+0.269^{***}$	$+0.207$	$+0.165^{***}$
	(0.070)	(0.168)	(0.050)
Ratio of $1+\tau$ at the same share and size	1.103^{***}	1.104	1.068^{***}
	(0.019)	(0.077)	(0.018)
Difference at the firm's own share and size	$+0.220^{***}$	$+0.147$	$+0.166^{***}$
	(0.064)	(0.168)	(0.051)
Ratio of $1+\tau$ at the firm's own share and size	1.084^{***}	1.074	1.068^{***}
	(0.020)	(0.080)	(0.018)
Panel B: The post-transition group			
Firms	5,438	423	14,742
Firm-years	19,380	936	54,533
Firms with years in the group they left	2,534	119	5,442

Notes: Each ratio divides $1+\tau$ after the transition by its mean over the years in the group left of the firms in the last row of Panel B. At the firm's own share and size, the difference adds the share and size terms at the changes in log county share and log employment, estimated with firm effects and with year effects on the firm-years of the group left and the post-transition group. The stars on the ratios test them against one, and their standard errors use the delta method. Estimation as in Table 3. Standard errors clustered by firm are in parentheses, and those in column (3) use the covariance of the two estimates. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

collective-to-private transition to 1.068 times. Relative to firms that remain in the group they left, the county employment share and employment of privatized firms change only slightly.[12] At their own share and size, the wedge of the state-to-private group therefore still rises by 0.220, and its $1+\hat{\tau}$ rises to 1.084 times its level before privatization. At the collective-to-private transition, the ratio stays at 1.068. All four ratios differ significantly from one. The difference for the state-to-collective group, which contributes 936 firm-years, is not significant.

4.4 The Political Cost of Unemployment

Under the two assumptions of Section 3.4, the gap between the wedge of private firms and that of an ownership state at the same share and size is the political cost of unemployment to its owners, $\kappa_g = t_{\text{Pri}} - t_g$ in (13), in units of the wage (Table 5, column (1)). An unemployed

[12] At the state-to-private transition, the log county employment share falls by 0.030 and log employment by 0.042.

worker costs a state owner 1.231 times the wage. At the share and size of the state group, its $1+\tau$ is 0.627 times that of a private firm (column (2)), so at that share and size one more worker lowers the political cost by less than it raises the wage bill, $\kappa_{\text{SOE}} < 1+\eta$. The collective-to-private transition lowers the political cost of unemployment by a significant 0.165 of the wage (Table 4), but the political cost to a collective owner, 0.210 of the wage, cannot be distinguished from zero. Every political cost in Table 5 is positive, as the restriction $\kappa_g \geq 0$ requires, and so is $\eta_0 = \tau_0 + d_{\text{Pri}}$.

Table 5: The political cost of unemployment by ownership state

	Political cost κ_g (1)	Ratio of $1+\tau$ to private firms (2)
State group	$+1.231^{***}$	0.627^{***}
	(0.308)	(0.080)
Collective	+0.210	0.916
	(0.242)	(0.097)
Post S→P	$+0.962^{***}$	0.722^{***}
	(0.293)	(0.083)
Post C→P	+0.045	0.983
	(0.251)	(0.098)
Post S→C	$+1.024^{***}$	0.656^{***}
	(0.335)	(0.110)

Notes: By the second assumption of Section 3.4, the owners of private firms bear no political cost of unemployment, $\kappa_{\text{Pri}} = 0$. Each row compares an ownership state with private firms at the same county share and size. Column (1) is $t_{\text{Pri}} - t_g$, in units of the wage, which equals κ_g under the two assumptions. Column (2) divides $1+\tau$ of the state by that of private firms at the mean log county share and log employment of the state, and its stars test it against one. Estimation as in Table 3. Standard errors clustered by firm are in parentheses, use the covariance of the estimated deviations, and in column (2) the delta method. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Privatization removes part of the political cost of unemployment. In the state-to-private group the political cost of unemployment falls by 0.269 of the wage, the rise in its wedge in Table 4, and remains 0.962 times the wage, about four fifths of that to a state owner. Privatized state firms kept most of their workers (Chen et al., 2021; Bai et al., 2009), and here, too, their employment changes only slightly relative to firms that remain in the group they left (Section 4.3). In the collective-to-private group the political cost of unemployment is 0.045 of the wage, which cannot be distinguished from zero. In the state-to-collective group, which stays in public ownership, it is 1.024 times the wage.

The estimates in Table 5 are too high if an ownership state has, relative to private firms, a larger component of compensation that does not rise with the marginal hire or more workers who add nothing to output (Section 3.5). They are also too high if its employers face a more elastic residual supply of labor at the same share and size, as when applicants queue for its jobs, and too low if its jobs carry a non-wage attribute that every worker values at the same amount.[13] The fall in the political cost at privatization compares each privatized group with the group it left, and benefits and statutory contributions raise the wage bill above wages by about the same proportion on both sides of each comparison,[14] so a difference in this part of compensation does not drive the fall.

4.5 Labor-Augmenting and Hicks-Neutral Productivity

The collective group and private firms have higher labor-augmenting and lower Hicks-neutral productivity than the state group (Table 6, Panel A). In the labor-augmenting shifter a^L, private firms are 0.065 log points above the state group, and the collective group is 0.047 above it. Wang (2026) also finds private firms above SOEs in labor-augmenting productivity. In the Hicks-neutral shifter a^H, the state group is significantly above every other ownership state, by 0.075 relative to private firms.

Like the wedge, labor-augmenting productivity is significantly higher in each privatized group than in the group it left (Table 6, Panel B). The state-to-private group is 0.066 above the state group, and the collective-to-private group is 0.026 above the collective group. Neither privatized group can be distinguished from private firms in labor-augmenting productivity (Table 6, Panel A). In a^H the state-to-private group is significantly below the state group, by 0.057, while the collective-to-private group differs from the collective group by

[13] Such an attribute lowers the wage the firm needs at every level of employment by the same amount and leaves unchanged the rise in the wage that one more worker requires, which is then a larger proportion of a lower wage.

[14] At the median, the log ratio of the wage bill to wages is 0.267 in the state-to-private group against 0.270 in the state group, and 0.145 in the collective-to-private group against 0.140 in the collective group. Within firms, with firm and year effects, it changes by -0.006 at the state-to-private transition and does not change at the collective-to-private transition. Neither estimate is significant.

Table 6: Productivity shifters by ownership state and relative to the group left

	Labor-augmenting, a_g^L (1)	Hicks-neutral, a_g^H (2)
Panel A: Relative to the state group		
Collective	$+0.047^{***}$	-0.076^{***}
	(0.015)	(0.007)
Private	$+0.065^{***}$	-0.075^{***}
	(0.012)	(0.007)
Post S→P	$+0.066^{***}$	-0.057^{***}
	(0.009)	(0.005)
Post C→P	$+0.073^{***}$	-0.079^{***}
	(0.014)	(0.008)
Post S→C	-0.062^{**}	-0.037^{***}
	(0.029)	(0.012)
Panel B: Relative to the group left		
S→P	$+0.066^{***}$	-0.057^{***}
	(0.009)	(0.005)
S→C	-0.062^{**}	-0.037^{***}
	(0.029)	(0.012)
C→P	$+0.026^{***}$	-0.003^{*}
	(0.006)	(0.002)

Notes: In Panel A the state group is the omitted ownership state. Estimation as in Table 3. Standard errors clustered by firm are in parentheses, and those of the C→P row use the covariance of the two estimates. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

only 0.003. The state-to-collective group is significantly below the state group in both a^L and a^H.

5 Product Market Power

The firm takes the materials price as given, so the materials condition identifies the product-market markup μ_{it}, which is not the wage markup of Section 3.2. The wedge still enters the markup through the output elasticity of materials. The ratio of the first-order conditions identifies that elasticity, together with labor-augmenting productivity, from the labor share $S_{it}^L = W_{it}L_{it}/VC_{it}$ of variable cost $VC_{it} = W_{it}L_{it} + P_{it}^M M_{it}$. The wedge separates the labor share from the output elasticity of labor. Substituting B_{it} from (15) into $\varepsilon_{M,it} = \nu(1 - B_{it})$ and dividing by the share of materials in revenue, $P_{it}^M M_{it}/R_{it}$, gives

$$\mu_{it} = \frac{\nu\, R_{it}/VC_{it}}{1 + S_{it}^L \tau_{it}} = \frac{\nu\, R_{it}}{(1+\tau_{it})W_{it}L_{it} + P_{it}^M M_{it}}. \tag{22}$$

A study that recovers the output elasticities from the cost shares without a wedge measures $\mu_{it}^{\tau\equiv 0} = \nu^{\tau\equiv 0} R_{it}/VC_{it}$ instead, where $\nu^{\tau\equiv 0} = 0.975$ is estimated with the wedge restricted to zero. The two differ by $\ln \mu_{it}^{\tau\equiv 0} - \ln \mu_{it} = \ln(1 + S_{it}^{L}\tau_{it}) + \ln(\nu^{\tau\equiv 0}/\nu)$, so allowing a labor wedge takes out of the markup what the wedge contributes to gross profitability $\ln(R_{it}/VC_{it})$, less the 0.037 log points by which the scale parameter is lower with the wedge restricted to zero.[15]

Table 7: The markup implied by the materials condition

Panel A: Levels by ownership state	N	Median μ	Median $\mu^{\tau\equiv 0}$	Mean $\ln \mu^{\tau\equiv 0} - \ln \mu$
State group	36,647	1.039	1.139	+0.132
Collective	43,142	1.056	1.113	+0.107
Private	452,097	1.063	1.104	+0.084
Post S→P	19,380	1.040	1.149	+0.154
Post C→P	54,533	1.051	1.113	+0.104
Post S→C	936	1.041	1.122	+0.123
All firm-years	606,735	1.060	1.108	+0.092

Panel B: Transitions, difference from the state the group left	Firms	$\Delta \ln \mu$		$\Delta \ln \mu^{\tau\equiv 0}$	
	with both	Between	Within	Between	Within
S→P (from state)	2,525	−0.012**	+0.020***	+0.024***	+0.006*
		(0.005)	(0.005)	(0.003)	(0.004)
S→C (from state)	118	−0.015	−0.016	−0.023***	−0.005
		(0.016)	(0.022)	(0.009)	(0.018)
C→P (from collective)	5,441	−0.001	−0.010***	+0.008***	+0.002
		(0.003)	(0.003)	(0.002)	(0.002)

Notes: N includes the 699 firm-years held at a numerical guard, which the statistics leave out. Panel B reports differences between ownership-state effects from regressions of $\ln \mu_{it}$ and $\ln \mu_{it}^{\tau\equiv 0}$ on ownership-state and year indicators, without (Between) and with (Within) firm effects. Firms with both counts the firms observed in both states. Standard errors clustered by firm are in parentheses and condition on ν and the fitted wedge. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Leaving the wedge out overstates the markup. The mean of $\ln \mu_{it}^{\tau\equiv 0} - \ln \mu_{it}$ is 0.092 over all firm-years. It is positive in every ownership state (Table 7, Panel A). The markup has a median of 1.060 and a mean of 1.080, against a mean of 1.171 for $\mu^{\tau\equiv 0}$. The mean of $\ln \mu_{it}$ is positive in every ownership state, so the estimated wedge meets the requirement of Azzam et al. (2026) that the markup be at least one on average.[16]

[15] The statistics below leave out the 699 firm-years at which B_{it} or its denominator is held at a numerical guard.

[16] Appendix B divides gross profitability into a scale term, a markup term and a wedge term.

Across firms, $\mu^{\tau \equiv 0}$ is significantly higher at both privatizations, by 0.024 log points at the state-to-private transition and 0.008 at the collective-to-private one (Panel B). Since $\ln \mu_{it}^{\tau \equiv 0}$ is gross profitability plus a constant, these are the differences in gross profitability. Across firms, the markup of the collective-to-private group does not differ significantly from that of the collective group, so all of the rise in its gross profitability goes into the wedge term $\ln(1 + S_{it}^{L} \tau_{it})$.

6 Discussion

The estimated wedge gives the change in the gap between the wage and the marginal revenue product of labor at privatization (Section 6.1). The estimates divide employment at a given output and the labor share of variable cost into parts from the wedge and from productivity (Sections 6.1 and 6.2). Both divisions first compare the state group with private firms in the same industry and year, and then compare each privatized group with the group it left.

6.1 The Wage Gap and Employment

In 87 percent of the state-to-private and 90 percent of the collective-to-private firm-years, the rise in the wedge widens the gap between the wage and the marginal revenue product of labor.[17] By (8), the marginal revenue product of labor differs from the wage by $\tau_{it} W_{it}$. The rise therefore widens the gap where the wedge of the group the firm left is a wage markdown and can narrow it where that wedge is a wage markup. Under the two assumptions of Section 3.4, the rise in the wedge is the part of the political cost of unemployment that privatization removes. Where monopsony power exceeds the political cost, the political cost offsets part of monopsony power, and the loss of part of that offset widens the gap.

A higher wedge also lowers employment at a given output, and so does higher productivity of either kind. Neither first-order condition restricts how the firm sets its output price

[17] The calculation and the percentages use the firm-years in which $1 + \tau_{it}$ is positive both at the fitted wedge and at the wedge of the group the firm left, 93 and 98 percent of the two groups.

(Section 3.2), so the model does not determine output, and I hold it fixed. With capital, both productivities, the wage and the price of materials fixed as well, employment responds to the wedge as

$$\frac{\partial \ell_{it}}{\partial \ln(1+\tau_{it})} = -(1 - B_{it})\,\sigma_{it}, \tag{23}$$

which follows from (1)–(3), (14) and (15). The elasticity has the form of a wage elasticity of labor demand at a given output, with B_{it} in place of S^L_{it}. The wedge-modified labor share B_{it} is the labor share of variable cost at the shadow price of labor. The same labor demand gives $\partial \ell_{it}/\partial \omega^L_{it} = -[1-(1-B_{it})\sigma_{it}]$ and $\partial \ell_{it}/\partial \omega^H_{it} = -1/\nu$. Because labor and materials are strong complements, $(1-B_{it})\sigma_{it}$ is small, so the wedge moves employment at a given output by much less than it moves the shadow price of labor.

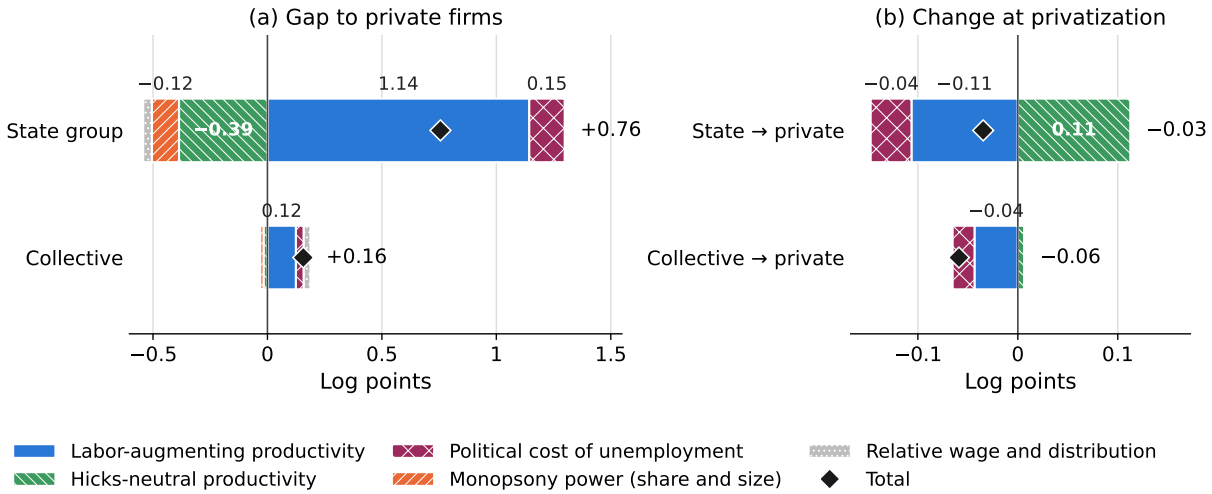


Figure 2: Employment at a given output by ownership state and at privatization. Panel (a) compares each group with private firms in the same industry and year. Panel (b) compares each post-transition firm-year with the same firm-year at the wedge of the group it left and without the differences in a^L and a^H accumulated since the transition. Under the two assumptions of Section 3.4, the wedge part divides into the political cost of unemployment and, in panel (a), monopsony power (the share and size terms). Firm-years with $1+\tau_{it} > 0$, in panel (b) under both wedges.

At the same output and capital, the state group employs 0.76 log points more workers

than private firms in the same industry and year (Figure 2, panel (a)).[18] Its lower labor-augmenting productivity accounts for more than the whole gap, and its higher Hicks-neutral productivity works the other way. The difference in fitted wedges (Section 4.2) adds 0.04. Under the two assumptions, the political cost of unemployment adds 0.15 log points, and the larger county shares and size of the state group, which raise its monopsony power, offset most of this.[19] The labor-augmenting part also contains any workers the state group keeps who add nothing to output, since they lower measured labor-augmenting productivity. For the collective group the gap is smaller, and most of it comes from labor-augmenting productivity.

Privatization of Chinese state firms raised sales per worker with little change in employment (Bai et al., 2009). I compare each post-transition firm-year with the same firm-year at the wedge of the group it left and without the differences in a^L and a^H accumulated since the transition (Figure 2, panel (b)). Employment at a given output is on average 0.03 log points lower in the state-to-private group and 0.06 lower in the collective-to-private group. The higher wedge lowers it by 0.04 and 0.02 log points.[20] In the state-to-private group, the higher a^L lowers employment and the lower a^H raises it, each by more than the wedge does. They nearly offset and together raise it slightly, so on average the wedge accounts for more than the whole difference. The two productivity parts accumulate through the laws of motion and grow with the years since the transition, while the wedge part does not. In the collective-to-private group, whose a^H barely differs from that of the collective group, the higher a^L accounts for most of the difference.

[18] Employment at a given output and capital is $\ell_{it} - (y_{it} - \alpha_K k_{it})/\nu$. Each firm-year of the state group with $1 + \tau_{it} > 0$ is shifted, within its industry and year, by the difference between private firms and the state group in the means of $\ln(1+\tau)$, ω^L, ω^H and $\ln(W/P^M)$, the wage relative to the price of materials (the relative wage). By (15) and (16), B_{it} depends on the wedge, the relative wage and ω^L only through $\ln(1+\tau_{it}) + \ln(W_{it}/P^M_{it}) - \omega^L_{it}$, so the part of the change that runs through B_{it} divides among the three in proportion to their shifts, and the parts add up for each firm-year. The relative wage and the shape of the distributions within industry-years lower the gap by the remaining 0.04.

[19] The shift in $\ln(1+\tau_{it})$ of footnote 18 is divided into the mean change from adding κ_{SOE} to τ_{it} and the rest, which comes from the share and size terms. The wedge part divides in the same proportions.

[20] The calculation uses the firm-years of footnote 17 at their observed prices, county share and size, and reports the mean log change, computed exactly. The change is divided as in footnote 18.

6.2 The Labor Share

Both the wedge and labor-augmenting productivity move the labor share of variable cost. With the price of materials relative to the wage held fixed, the ratio of the first-order conditions (14), the output elasticities (2) and the elasticity of substitution (3) give

$$\frac{\partial \ln\left[S_{it}^{L}/(1-S_{it}^{L})\right]}{\partial \ln(1+\tau_{it})} = -\sigma_{it}, \qquad \frac{\partial \ln\left[S_{it}^{L}/(1-S_{it}^{L})\right]}{\partial \omega_{it}^{L}} = -(1-\sigma_{it}). \tag{24}$$

A higher wedge raises the shadow price of labor, so the firm substitutes materials for labor. Higher labor-augmenting productivity lowers the labor share because labor and materials are complements. At both medians reported in Section 4.1, the elasticity of substitution is below one half. A unit of labor-augmenting productivity then moves the labor share by more than a unit of $\ln(1+\tau)$.

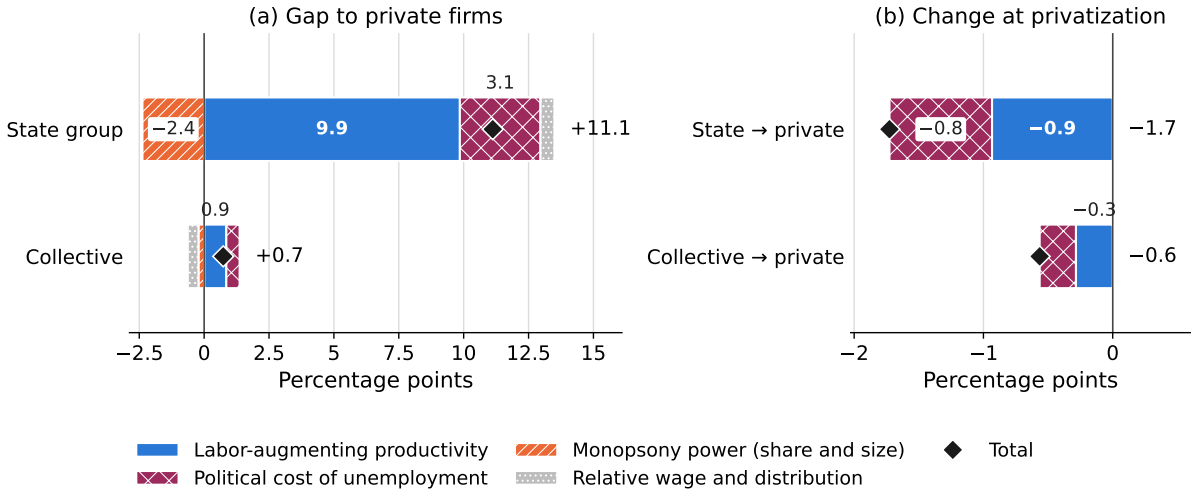


Figure 3: Labor share of variable cost by ownership state and at privatization. Panel (a) compares each group with private firms in the same industry and year. Panel (b) compares each post-transition firm-year with the same firm-year at the wedge of the group it left and without the difference in a^L accumulated since the transition. Under the two assumptions of Section 3.4, the wedge part divides into the political cost of unemployment and, in panel (a), monopsony power (the share and size terms). Firm-years with $1+\tau_{it} > 0$, in panel (b) under both wedges.

In the same industry and year, the labor share of variable cost of the state group is

twice that of private firms. The lower labor-augmenting productivity of the state group accounts for 9.9 of the 11.1 percentage points between them, and the difference in fitted wedges accounts for 0.7 (Figure 3, panel (a)).[21] Under the two assumptions of Section 3.4, the political cost of unemployment adds 3.1 percentage points, and, as with employment, the larger county shares and size of the state group offset most of this (footnote 19). The labor share of variable cost of the collective group is within one percentage point of that of private firms.

The wedge and a^L of each privatized group are both higher than those of the group it left (Tables 4 and 6), so both lower its labor share of variable cost (Figure 3, panel (b)). The labor share of variable cost of the state-to-private group is on average 1.7 percentage points lower than it would be at the wedge of the group it left and without the difference in a^L accumulated since the transition. Labor-augmenting productivity accounts for 0.9 of these percentage points, and the wedge accounts for 0.8. In the collective-to-private group, each part is 0.3 percentage points.[22] As with employment, the labor-augmenting part accumulates through the law of motion and grows with the years since the transition, while the wedge part changes little.

7 Conclusion

This paper estimates the labor wedge jointly with labor-augmenting and Hicks-neutral productivity in a translog production function. The labor wedge is the firm's monopsony power net of its owner's political cost of unemployment. Cost minimization and dynamic panel GMM recover the wedge and both productivities, each shifted by ownership. The wedge and labor-augmenting productivity require no assumption on how the firm sets its output price.

[21] Each firm-year of the state group is shifted as in footnote 18, except in ω^H, which does not move the labor share. Since the wedge also enters the labor share directly, the change is divided among the wedge, labor-augmenting productivity and the relative wage with the elasticity of substitution averaged over the move, so the parts add up for each firm-year. The relative wage and the shape of the distributions within industry-years account for the remaining 0.5 percentage points.

[22] The calculation uses the firm-years of footnote 17 at their observed prices, county share and size, and divides the change between the two parts as in footnote 21.

I apply the framework to domestic firms in Chinese manufacturing from 1998 to 2008.

As monopsony predicts, the wedge rises with the firm's county employment share. At the same share and size, it is higher for private firms than for SOEs, and privatization raises it at both the state-to-private and the collective-to-private transitions. Under two assumptions, the gap between private firms and SOEs is the political cost of unemployment to a state owner, and each rise at privatization is the part of the former owners' political cost that privatization removes. The first is that ownership does not change the elasticity of the residual supply of labor that a firm faces at a given share and size. The second is that the owners of firms that are private throughout bear no political cost of unemployment. An unemployed worker then costs a state owner far more than it costs a collective owner, and in the state-to-private group it still costs most of what it costs a state owner. On average the wedges of SOEs and private firms are close, because the larger county shares and employment of SOEs raise their monopsony power. Private firms sit above SOEs in labor-augmenting productivity and below them in Hicks-neutral productivity, and the lower labor-augmenting productivity of SOEs accounts for most of their higher labor share of variable cost. Under the two assumptions, the political cost of unemployment also raises their labor share. Both privatizations raise labor-augmenting productivity, and the state-to-private transition also lowers Hicks-neutral productivity.

On average over the years after privatization, the higher wedge and the higher labor-augmenting productivity of the privatized groups lower their labor share of variable cost by comparable amounts. Across firms, a model without the wedge records the higher gross profitability of the privatized groups as higher markups. With both the wedge and labor-augmenting productivity in the model, privatization raises labor-augmenting productivity and, for most privatized firms, widens the gap between the wage and the marginal revenue product of labor.

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A Data and Sample Construction

A.1 Variables and the County Identifier

Variables follow Jaumandreu and Yin (2018). The panel links the records of a firm whose identifier changes, as it can at restructuring. Revenue is deflated with the output price index of the firm's two-digit industry, and materials with an index that weights the output prices of the supplying industries by the 2002 input-output table (Brandt et al., 2012). Capital is the real stock that Jaumandreu and Yin (2018) build by perpetual inventory at a depreciation rate of 9 percent. Employment is the number of full-time employees. The wage bill is total compensation, the sum of wages, welfare payments, labor insurance, pension and medical contributions, and the housing fund. The items other than wages make up on average about 15 percent of a firm's wage bill in every year. Compensation per worker W_{it} is the wage bill over employment, and S^L_{it} is the wage bill over the wage bill plus the cost of materials.

The survey files carry no county code. I take each firm's six-digit administrative code from a 1998–2013 release of the same survey. The match on year, province, employment and revenue succeeds for 98.3 percent of firm-years. I harmonize the codes to the national county list (GB/T 2260) with boundary changes up to 2008. I set to missing the codes that contradict the firm's province or identify only a prefecture or province, keep the codes that stand for all urban districts of a prefecture, and give each firm its modal code. The cleaned panel then has 2,925 counties. The code is missing for 2.2 percent of the firm-years of the cleaned panel. Firms without a code leave both samples. The denominator of the county employment share includes the firm itself and every firm of the cleaned panel with a code, foreign firms among them.

A.2 Descriptive Statistics

Table 8 reports firm-year means of the core production variables by ownership type.

Table 9 compares ownership states in compensation per worker and in the labor share of variable cost, holding size fixed. The county employment share is the firm's own employment over the employment of its county, so within a county and year the share and the size of the firm are the same regressor. The county-year and county-industry-year columns hold both fixed. The state group pays 0.091 log points more per worker than private firms of the same size in the same county, industry and year, with a labor share 0.081 higher (columns (3) and (6)). Pooled over years and without those controls, it pays less, 12.2 thousand RMB per worker against 17.3 for private firm-years, including those after a transition (Table 8). Industry-year effects alone shrink that deficit to 0.03 log points, and with log employment

Table 8: Descriptive statistics by ownership type

Variable	SOE	Collective	Private
Employment (workers)	529	215	184
Revenue	110,241	36,086	58,436
Capital	73,721	10,721	15,165
Materials	79,567	28,811	46,266
Compensation per worker	12.2	11.0	17.3
Capital per worker	78.7	50.8	71.2
Labor share of revenue	0.172	0.094	0.087
Material share of revenue	0.656	0.755	0.771
Variable profit per worker	23.5	29.7	48.2
Firm-years	79,648	105,538	992,202

Notes: Firm-year means, 1998–2008. Revenue and materials are in thousands of RMB at current prices, and capital is the real capital stock in thousands of RMB. Per-worker values are in thousands of RMB, and variable profit is revenue minus the wage bill and materials.

and log county employment the state group pays 0.065 log points more (column (1)). These differences are not wedges. The labor share moves with labor-augmenting productivity as well as with the price of labor.

A.3 Transition Indicators

Each transition c has an origin type $o(c)$ and a destination set $D(c)$, where $D(S \to P) = D(C \to P) = \{P, F\}$ and $D(S \to C) = \{C\}$. The post-transition indicator Post_{it}^{c} of Section 2.3 places no condition on the years before T_i^c. Instead, the trajectory screen of Appendix A.4 keeps only switchers whose first type is $o(c)$ and whose last type is in $D(c)$. The exclusion of Section 2.2 then drops the switchers that are majority foreign in a post-transition year. In the estimation sample of Appendix A.5, observations with $\text{Post}_{it}^{c} = 1$ total 19,380 firm-years on 5,438 firms for S→P, 54,533 firm-years on 14,742 firms for C→P, and 936 firm-years on 423 firms for S→C.

A.4 Ownership-History Screens

Threshold noise. Table 10 collapses each firm's ownership path over the full panel into its non-repeated sequence, so that SSSPP becomes SP. The five most common multi-step sequences are all round trips in which the firm returns to an earlier classification: P→C→P (7,052), P→F→P (3,365), C→P→C (2,673), C→P→C→P (2,506) and F→P→F (1,729). On the private–foreign margin these round trips most likely reflect errors in the reported capital shares, and the errors are large. In 61 percent of the flips the foreign share jumps

Table 9: Compensation per worker and the labor share of variable cost by ownership state

	$\ln W_{it}$			S^L_{it}		
	(1)	(2)	(3)	(4)	(5)	(6)
Collective	-0.132^{***}	-0.121^{***}	-0.138^{***}	-0.100^{***}	-0.077^{***}	-0.075^{***}
	(0.006)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)
Private	-0.065^{***}	-0.083^{***}	-0.091^{***}	-0.102^{***}	-0.084^{***}	-0.081^{***}
	(0.005)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)
Post S→P	$+0.200^{***}$	$+0.147^{***}$	$+0.129^{***}$	-0.064^{***}	-0.055^{***}	-0.051^{***}
	(0.008)	(0.007)	(0.007)	(0.002)	(0.002)	(0.002)
Post C→P	-0.079^{***}	-0.068^{***}	-0.083^{***}	-0.114^{***}	-0.089^{***}	-0.086^{***}
	(0.006)	(0.005)	(0.006)	(0.001)	(0.001)	(0.001)
Post S→C	-0.052^{*}	-0.065^{***}	-0.075^{***}	-0.048^{***}	-0.044^{***}	-0.045^{***}
	(0.028)	(0.025)	(0.025)	(0.006)	(0.006)	(0.006)
Post C→P − collective	$+0.053^{***}$	$+0.053^{***}$	$+0.055^{***}$	-0.014^{***}	-0.013^{***}	-0.010^{***}
	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)
Industry-year effects	Yes			Yes		
County-year effects		Yes			Yes	
County-industry-year effects			Yes			Yes

Notes: Sample of Table 2. Deviations from the state group, one regression per column on the five ownership indicators and log employment. Columns (1) and (4) also include log county surveyed employment. Standard errors clustered by firm are in parentheses. $^{*}\,p < 0.10$, $^{**}\,p < 0.05$, $^{***}\,p < 0.01$.

between zero and one. Of the flips with detailed capital data, 42 percent exchange the foreign amount exactly with another capital item, often capital from Hong Kong, Macao and Taiwan. The gross year-over-year flows across the private–foreign margin are also nearly symmetric, with 14,055 moves from private to foreign against 14,228 in the other direction. On the state and collective margins a round trip may be a reporting error or a real reversal. In either case it is not a one-way reform transition. The three screens below remove these firms.

Ownership-history screen. The screen drops four groups of firms, and no firm belongs to more than one. The first are 3,613 "flicker" firms, which leave majority state ownership and later return to it. Their crossings are not one-way reform transitions. The second are 3,303 "re-nationalizers," which are not state-owned at their first observation, become majority state-owned and later leave state ownership for good. Their exit is not the privatization of a state firm. Together the two groups are the 6,916 firms that cross the 50 percent state-ownership threshold more than once. Almost all S→P→S and S→P→S→P firms in Table 10 are flickers, and almost all P→S→P firms are re-nationalizers. The third are 3,209 nationalized firms, which are not state-owned at their first observation and become majority state-owned without leaving again. The fourth are 760 never-state firms with a year in which no owner holds a majority. The screen keeps every other firm, including the 8,695 clean privatizers, which are state-owned at their first observation and leave state ownership exactly once. The four group counts are for the full panel. In the lag-restricted sample of

Table 10: Most common multi-step ownership sequences

Simplified sequence	Firms
P→C→P	7,052
P→F→P	3,365
C→P→C	2,673
C→P→C→P	2,506
F→P→F	1,729
P→S→P	1,667
S→P→S	1,178
S→P→S→P	785
P→C→P→C→P	738
P→C→P→C	690
F→P→F→P	606
P→F→P→F	565
S→C→P	377
P→F→P→F→P	308
C→P→C→P→C	304

Notes: Ownership sequences in the full 1998–2008 panel after collapsing consecutive repeats, for the 30,485 firms with two or more year-over-year ownership changes.

Appendix A.5 the screen removes 3,559, 3,215, 2,252 and 648 firms of the four groups, 9,674 firms and 45,733 firm-years in all.

I drop the re-nationalizers, the nationalized firms and the never-state firms because the wedge parameters t_g of Section 3.5 are estimated jointly with θ and ρ_L and then imposed on the output equation. A contaminated ownership state moves the technology parameters and the wedge of every other ownership state, not only its own. If these groups were kept, firms whose ownership history is not clean would contribute about a quarter of the firm-years of the state-to-private group and about a seventh of the firm-years of the state group.[23]

One-to-one screen. The first three groups above are defined by crossings of the 50 percent state-ownership threshold, so the ownership-history screen keeps firms that move back and forth between collective and private ownership without ever being majority state-owned. A firm that occupies two of the ownership states of Section 3.5 contributes to two t_g at once, and its moves between the two states help identify the contrast between those two t_g. So that these moves form a single one-way reform transition, I keep a firm only if the states it occupies at t, $t-1$ and $t-2$ over its estimation rows are a single state, or the origin and post-transition states of one transition: SOE and Post^{SP}, collective and Post^{CP}, or SOE and Post^{SC}. The specification uses the ownership state only at t and $t-1$ (Section 3.8). The check at $t-2$ is stricter than the specification requires. It removes 71 firm-years of 17 firms

[23] Wang (2026) drops the flicker firms and keeps the other three groups in a nuisance category that is estimated but not interpreted.

that the other screens would keep. Private and foreign ownership count as one state in this screen.

The one-to-one screen removes a further 18,205 firms and 84,932 firm-years. Of these firms, 17,733 have firm-years both in the collective group and in private or foreign ownership, with or without Post^{CP}. Those with Post^{CP} have both because the durability rule of Section 2.3 checks for a return to the origin type only at or after T_i^c. A firm that is private, becomes collective and then becomes private again is recorded as a collective-to-private transition. Another 365 firms move from SOE to collective and then to private ownership and occupy two post-transition states.

Trajectory screen. The trajectory screen classifies each firm's ownership path over the full 1998–2008 panel. Years with no majority owner are coded as private, and private and foreign form one destination. The screen keeps firms whose ownership never changes and firms that leave state or collective ownership exactly once for private or foreign ownership. It also keeps state firms that leave state ownership exactly once for collective ownership. It drops firms that are never state or collective and move between private and foreign ownership, firms that pass through two transitions, and firms with any other path.

A.5 Estimation Sample

The structural system of Section 3 quasi-differences both equations, and its share-equation instruments use the labor share at $t-2$, so the estimation sample keeps only the firm-years of the cleaned panel for which those lags exist. The cleaned panel has 1,659,599 firm-years on 372,811 firms. Requiring the $t-1$ inputs and prices leaves 1,286,788 firm-years, and requiring revenue, the wage bill and materials at $t-2$ leaves 913,977 firm-years on 276,429 firms. Together the two requirements remove every firm observed for fewer than three consecutive years, and the 1998 and 1999 data enter as lags. Restricting the labor share of variable cost to $(0.01, 0.99)$ at t and $t-1$ leaves 871,866 firm-years, and keeping the ten manufacturing sectors of Appendix A.6 leaves 847,665. The ownership-history screen brings the sample to 801,932 firm-years on 249,963 firms, and the one-to-one screen to 717,000 firm-years on 231,758 firms. The trajectory screen removes a further 14,407 firms and brings the sample to 661,524 firm-years on 217,351 firms. Requiring the county employment share and its lag leaves 646,866 firm-years on 212,636 firms. Dropping, as in Section 2.2, the 11,352 firms of this sample that are foreign throughout and its 615 switching firms that are majority foreign in a post-transition year leaves the 606,735 firm-years on 200,669 firms used in Section 4.

The sample of Section 2 and Appendix A.2 applies the same screens without the lag requirements. It trims the labor share and requires the county employment share in the

current year only, keeps the 1998 and 1999 data and the first two years of every firm, and contains 1,177,388 firm-years on 286,894 firms.

A.6 Industry Classification

Throughout the paper I use the classification of Jaumandreu and Yin (2018), which aggregates the two-digit manufacturing codes of the Chinese Industrial Classification (CIC) into ten sectors. I add petroleum processing and coking (CIC 25) to chemical products (Table 11). Codes 24, 42 and 43 belong to none of the ten sectors, and their 24,201 firm-years that meet the other requirements leave the sample (Appendix A.5). The ten sectors are the industries j of the industry-year effects $\delta^H_{j(i)t}$ and $\delta^L_{j(i)t}$ in the two laws of motion.

Table 11: Industry classification and two-digit CIC codes

Sector	Two-digit CIC industries
1. Food, drink and tobacco	13. Agricultural and by-product proc. 14. Food manufacturing 15. Beverage manufacturing 16. Tobacco products
2. Textile, leather and shoes	17. Textile 18. Apparel, shoes, and hat manuf. 19. Leather, fur, and coat prod. manuf.
3. Timber and furniture	20. Wood proc., and other wood prod. 21. Furniture manufacturing
4. Paper and printing products	22. Paper making and paper products 23. Printing and recording media reprod.
5. Chemical products	25. Petroleum proc. and coking 26. Chemical materials and products 27. Pharmaceutical 28. Chemical fiber 29. Rubber products 30. Plastic products
6. Non-metallic minerals	31. Non-metallic mineral products
7. Metals and metal products	32. Ferr. metal smelting and rolling proc. 33. Non-ferr. metal smelting and rolling proc. 34. Metal products
8. Machinery	35. General machinery manufacturing 36. Special machinery manufacturing
9. Transport equipment	37. Transportation equipment manuf.
10. Electronics	39. Electrical machinery and equipment 40. Elec. commun. equip. and computer 41. Instr., meter, stat. and office machine

B Gross Profitability

Writing (22) in logs with the markup on the right divides gross profitability into a scale term, a markup term and a wedge term,

$$\ln \frac{R_{it}}{VC_{it}} = -\ln \nu + \ln \mu_{it} + \ln \left(1 + S_{it}^{L} \tau_{it}\right). \tag{25}$$

The decomposition holds exactly in each firm-year that enters the means of Table 12, because the markup is recovered residually from the materials condition at the same ν and the same B_{it}. The table reports the mean of each term.

Moving the scale term across gives $\ln \mu_{it} + \ln(1 + S_{it}^{L} \tau_{it}) = \ln(R_{it}/VC_{it}) + \ln \nu$. At a given ν, the right side carries no wedge, so the accounting pins the sum of the markup term and the wedge term. To divide the sum, Azzam et al. (2026) set the constant of their wage markdown schedule at the smallest value at which no plant pays a wage above the marginal revenue product of labor. In this model such a normalization would rule out the wage markups that a political cost of unemployment can produce. I divide the sum with the estimated wedge. The share equation leaves the wedge unrestricted in sign and pins its level less tightly than ratios of $1 + \tau$ (Section 3.8). The mean wedge term is 0.129 and the mean markup term is 0.050.

Beyond the accounting, the mean of $\ln \mu_{it}$ should be at least zero, which keeps the markup at least one on average. This requirement caps the mean wedge term at mean gross profitability plus $\ln \nu$, and so it bounds the level of the wedge from above. Azzam et al. (2026) set their livestock markdown to zero because its estimate is insignificant and because of the same requirement. The estimated wedge meets the requirement in every ownership state (Section 5).

Table 12: The terms of gross profitability

	N	Gross profitability $\ln(R/VC)$	Scale $-\ln \nu$	Markup $\ln \mu$	Wedge $\ln(1 + S^{L}\tau)$	Markup and wedge
All firm-years	606,735	0.168	-0.011 (0.011)	0.050	0.129	0.179

Notes: N includes the 699 firm-years held at a numerical guard, which the means leave out. Means of the terms of (25) at the estimates of Table 3. The standard error of $-\ln \nu$ is in parentheses.