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China's Reform of State-Owned Enterprises and Their Speed of Employment Adjustment

Yoshihiro HASHIGUCHI

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Graduate School of International
Cooperation Studies
Kobe University

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Yoshihiro HASHIGUCHI*

Abstract

China's State-Owned Enterprises (SOEs), known to suffer from an over-manning problem, have decreased their number of employees recently. Did China's reform begin to take effect and SOEs speed up their employment adjustment? According to a generalized method of moments estimate using panel data of China's provinces from 1992 to 2002, their speed of employment adjustment did not change significantly. It seems that the employment decrease was due mainly to a decrease in the number of SOEs and that SOEs themselves were not successful in reducing their redundant labor force.

I. Introduction

Before China's government seriously introduced Ownership System Reform (corporatization or privatization of China's State-Owned Enterprises [SOEs]) in 1997, reform had focused mainly on how the autonomous management of SOEs under the government ownership was realized [Marukawa 2002a]. Throughout the reform, SOEs' managers have obtained the decision rights for the management, [1)] and many researchers have observed that the Total Factor Productivity (TFP) of SOEs increased from 1978 to middle of the 1990s [Liu 1999; Nakagane 1999].

Nevertheless, since the 1990s, SOEs have suffered from an over manning problem [Chen and Hashiguchi 2004; Dong and Putterman 2003; Marukawa 2002b, p. 94; Hao 1999, p. 34]. According to considerable questionnaire research for SOEs' management, a major cause of the problem is quite likely the fact that SOEs' managers have rarely exercised the right of autonomous management, in particular the personnel and employment decisions and the veto over the government allocations, although these rights were formally given the manager since Some of Provision about the State-Owned Industry Enterprises' Management Autonomy in 1979 [Nakagane 1999, p. 244; Hao 1999, p. 34]. While the productivity of SOEs has somewhat increased as a result of the reform, the intervention of the government in the managers' decision still exits; we believe that this intervention has prevented the SOEs from adequately adjusting the number of their employees.

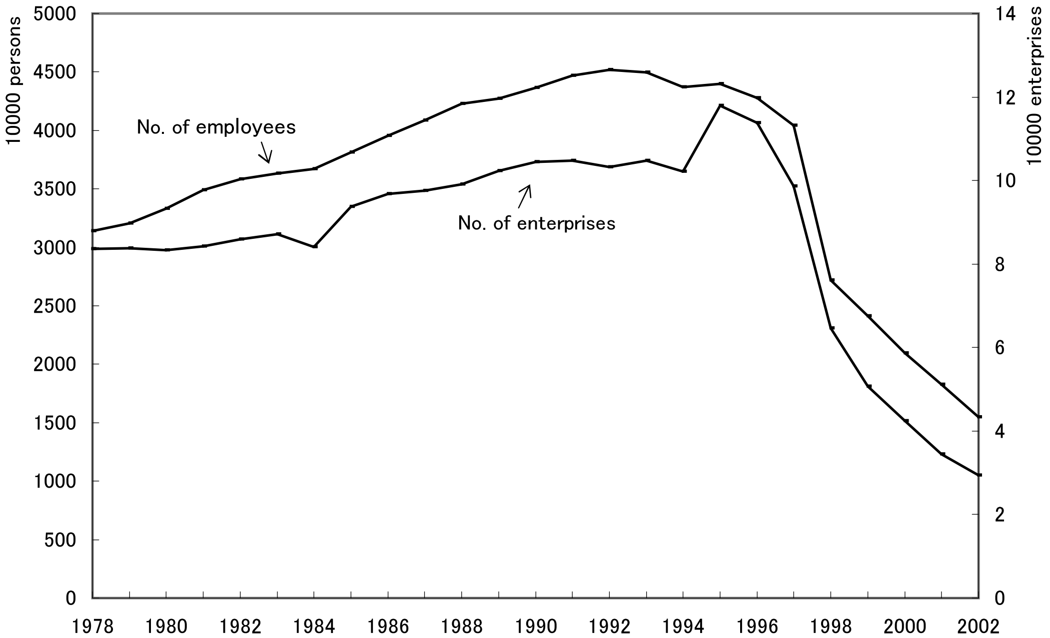
In recent years, however, the number of SOEs' employees has been decreasing. As Figure 1 indicates, macroeconomic data of SOEs' employed have shown a sharp decrease since 1995. It seems that SOEs no longer have the power to absorb employees, which may be connected to the problem of urban unemployment.

There are two probable main factors in the decrease of employees. The first is the decrease in the number of SOEs. As Figure 1 indicates, the number of SOEs has certainly decreased since the middle of the 1990s. Although intensifying the competition between SOEs and other ownership firms may account as the reason for decreasing the

*Graduate School of International Cooperation Studies, Kobe University.

1)For the details of the structure of SOEs' autonomy and changes in the system, refer to Nakagane (1999, p. 266).

Figure 1: SOEs' Number of Employees and Enterprises



Source: The left axis is employment obtained from *the China Statistical Year Book*. The right axis is the number of SOEs obtained from *the China Labor Statistical Year Book*.

number of SOEs, there may be another important reason as follows: since the reform of SOEs has taken place in earnest after 1997, many medium and small SOEs have corporatized or privatized, and then, these SOEs' data have been included in the non-SOEs category.

The second factor leading to a decrease in employees is a speeding up in their employment adjustment due to the reform since 1995. Assuming that, since 1997, government intervention in the employment adjustment has tended to weaken due to proceeding the reform, the adjustment speed of redundant labor has occurred quickly. The speeding up in their employment adjustment should have contributed to a decrease in SOEs' employees.

To verify whether the second factor is plausible by using descriptive statistics is so difficult that the employment adjustment speed is usually estimated. Zheng (2001) estimated employment adjustment speed using panel data of SOEs and the other ownership enterprises from 1986 to 1990; the empirical results showed that SOEs' employment adjustment speed was slower than that of the other ownership enterprises. [2)]

This paper attempts to estimate the employment adjustment speed using panel data of China's 30 provinces from 1992 to 2002 and to verify whether SOEs sped up their employment adjustment. The remainder of this paper is organized as follows. Section II contains the explanation of the model for estimating the adjustment speed. In Section III, we show the estimation method and describe the data set, and the empirical results are presented and discussed. According to our empirical results, the estimate of the adjustment speed parameter indicates an increase,

[2)] Yano (1999) tried to estimate the employment adjustment cost using panel data of SOEs in Shanghai and Beijing from 1990 to 1994, and they showed that the cost of SOEs was small enough compared with the one of Japanese enterprises. But since his model is different from our model, we cannot directly compare these empirical results.

however, the increase is not statistically significant, and hence we cannot say that changes in the adjustment speed contribute to the reduction of the SOEs' employment.

II. The Model

We assume that a representative SOE is involved in productive activity using labor and capital stock, and their production function is given by the CES function as follows:

$$Y_{it} = Ae^{\mu_i+\varepsilon_{it}} \left[\delta K_{i,t-1}^{-\rho} + (1-\delta)L_{it}^{-\rho}\right]^{-\frac{m}{\rho}} \tag{1}$$

where i and t denote region and time; A, δ, ρ and m are parameters; and μ_i and ε_{it} are random variables. μ_i represents regional variety, e.g., the difference in productive efficiency, and ε_{it} represents the technology shock.

We define the profit of SOE at the period t as follows:

$$\pi_{it} = p_{it}Y_{it} - w_{it}L_{it} \tag{2}$$

where π_{it}, Y_{it}, p_{it} and w_{it} are profit, output, the price of productive goods and wage rates. Assuming that the SOE is not a price taker, its necessary employment L^* to maximize their profit is derived from the first order condition, that is

$$L_{it}^* = \left[m(1-\delta)A^{\frac{\rho}{m}}\right]^{\sigma} \left(\frac{w_{it}}{p_{it}}\right)^{-\sigma} Y_{it}^{*\ \frac{m+\rho}{m}\sigma} e^{-\sigma\frac{\rho}{m}(\mu_i+\varepsilon_{it})} \tag{3}$$

where $\sigma = 1/(1+\rho)$. Y_{it}^* is the output to maximize the profit, and it is obtained if L_{it}^* is used for production. [3)]

Taking a logarithm to both side of Equation (3) and arranging these parameters, we obtain the following equation:

$$\begin{aligned} \ln L_{it}^* &= \sigma \ln m(1-\delta)A^{\frac{\rho}{m}} - \sigma \ln\left(\frac{w_{it}}{p_{it}}\right) + \sigma\frac{m+\rho}{m}\ln Y_{it}^* - \sigma\frac{\rho}{m}(\mu_i+\varepsilon_{it}) \\ &= c - \sigma\ln\left(\frac{w_{it}}{p_{it}}\right) + \alpha \ln Y_{it}^* + \beta\mu_i + \beta\varepsilon_{it} \end{aligned} \tag{4}$$

where ln represents the natural logarithm and

$$\sigma = \frac{1}{1+\rho} > 0, \quad \alpha = \sigma\frac{m+\rho}{m} > 0, \quad c = \sigma \ln m(1-\delta)A^{\frac{\rho}{m}}, \quad \beta = -\sigma\frac{\rho}{m}.$$

However, SOEs do not necessarily employ L_{it}^* for production because, as mentioned at Section I, it is quite likely that the government intervention in SOE management prevents the optimal employment L_{it}^*, thereby making a difference between actual employment L_{it} and L_{it}^*. We then propose the partial adjustments between L_{it} and L_{it}^*:

$$(\ln L_{it} - \ln L_{i,t-1}) = \gamma(\ln L_{it}^* - \ln L_{i,t-1}) \tag{5}$$

$$0 < \gamma \leq 1 .$$

3) We can represent L_{it}^* and Y_{it}^* as follows:

$$L_{it}^* = f(p_{it},\ w_{it},\ K_{i,t-1})$$
$$\begin{aligned} Y_{it}^* &= g(L_{it}^*) \\ &= g(p_{it},\ w_{it},\ K_{i,t-1}). \end{aligned}$$

In this paper, to delete $K_{i,t-1}$, we change this representation to the following:

$$L_{it}^* = f(p_{it},\ w_{it},\ Y_{it}^*).$$

Thus, Y_{it}^* is not an exogenous variable but an endogenous one.

where γ is the parameter of the adjustment speed. The γ denotes that as $\gamma \to 1$, the faster the speed, and as $\gamma \to 0$, the slower the speed. Equation (5) indicates that the SOE makes a partial adjustment to the actual employment toward the optimal one, and the adjustment goes on by the rate of $100\gamma\%$.

Substituting Equation (5) for (4) and arranging the parameter and variables, we obtain the following:

$$\begin{aligned} \ln L_{it} &= \gamma c - \gamma\sigma \ln\left(\frac{w_{it}}{p_{it}}\right) + \gamma\alpha \ln Y_{it} + (1-\gamma)\ln L_{i,t-1} + \gamma\beta\mu_i + \gamma\beta\varepsilon_{it} \\ &= \theta_0 + \theta_1 \ln\left(\frac{w_{it}}{p_{it}}\right) + \theta_2 \ln Y_{it} + \theta_3 \ln L_{i,t-1} + \nu_i + \eta_{it} \quad . \end{aligned} \tag{6}$$

Taking first order difference, we obtain Equation (7):

$$\Delta \ln L_{it} = \theta_1 \Delta \ln\left(\frac{w_{it}}{p_{it}}\right) + \theta_2 \Delta \ln Y^*_{it} + \theta_3 \Delta \ln L_{i,t-1} + \Delta\eta_{it} \tag{7}$$

where $\gamma = 1 - \theta$.

In the following part of this paper, we attempt to estimate γ using Equation (7) and to test statistically whether the γ changes or not. When we proceed to the estimation problem, we need to note that, in our model, $\Delta \ln Y^*_{it}$ is unobservable and $\Delta \ln Y^*_{it}$ and $\Delta \ln L_{i,t-1}$ contain an endogenous problem, being likely to have correlations with the error term $\Delta\eta_{it}$. We then have adopted the Generalized Method of Moments (GMM) as the estimation method to obtain consistent estimates. [4)]

III. Estimation

A. GMM

For the sake of simplicity of presentation, we now provide a general formulation of Equation (7) as follows:

$$\mathbf{y}_i = \mathbf{X}_i \boldsymbol{\theta} + \mathbf{u}_i \qquad (i = 1, 2, \ldots, N) \tag{8}$$

where $\mathbf{y}_i$ is the $(T-2) \times 1$ vector of the dependent variable, $\boldsymbol{\theta}$ is the $K \times 1$ coefficient vector, $\mathbf{u}_i$ is the $(T-2) \times 1$ vector of the error term, $\mathbf{X}_i$ is the $(T-2) \times K$ matrix of the regressors. T is the length of time series data available, and N is the sample size of cross section data. [5)]

We assume that $L_t\,(\geq K_t) \times 1$ vectors of instrumental variables $\mathbf{z}_{it}$ $(t = 3, 4, \ldots T)$ are available, whose variables do not correlate with the error term but with regressors, and can be represented as a following diagonal matrix:

$$\mathbf{Z}'_i = \begin{pmatrix} \mathbf{z}_{i3} & 0 & 0 & \ldots & 0 \\ 0 & \mathbf{z}_{i4} & 0 & \ldots & 0 \\ 0 & 0 & \mathbf{z}_{i5} & \ldots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \ldots & \mathbf{z}_{iT} \end{pmatrix}.$$

[4)] A kind of Equation (7), in which the lag of dependent variables is included in the independent variables, is called the dynamic model. When the model is estimated using panel data, the least squares methods (OLS and LSDV), in general, do not lead to consistent estimators. Arellano and Bond (1991) proposed one method, which exploits the GMM procedure, to obtain consistent estimator. We adopt their method. For the endogenous problem of the models, refer to Baltagi (2001, chap. 8), Nickell (1981) and Hsiao (2003).

[5)] Since the regressors of Equation (7) contain the first difference of the dependent variable at the period $t-1$, the sample size of time series is $T-2$ if the length of time series available is T.

Multiplying both sides of Equation (8) by $\mathbf{Z}_i'$ from the left side and operating its mathematical expectation, orthogonality conditions are given by

$$\mathrm{E}(\mathbf{Z}_i'\mathbf{u}_i) = \mathrm{E}[\mathbf{Z}_i'(\mathbf{y}_i - \mathbf{X}_i\,\boldsymbol{\theta})] = \mathbf{0}. \tag{9}$$

To estimate consistent estimators, applying the Method of Moments (MM) to the above model amounts to using the sample analogue of Equation (9), that is its sample mean:

$$\frac{1}{N}\sum_i^N \mathbf{Z}_i'(\mathbf{y}_i - \mathbf{X}_i\,\hat{\boldsymbol{\theta}}) = \mathbf{0}. \tag{10}$$

In our model, however, we cannot in general choose a $\hat{\boldsymbol{\theta}}$ to satisfy Equation (10) because the number of equations $\Sigma_t L_t$ is more than of unknown parameter K. The extended MM to cover the problem is the Generalized Method of Moments (GMM).

To obtain the $\hat{\boldsymbol{\theta}}$, we define a $\Sigma_t L_t \times \Sigma_t L_t$ positive definite matrix $\hat{\mathbf{W}}$, which is often called the weighting matrix, and the quadratic form as follows:

$$g(\hat{\theta}, \hat{\mathbf{W}}) = \left[\frac{1}{N}\sum_i^N \mathbf{Z}_i'(\mathbf{y}_i - \mathbf{X}_i\,\hat{\boldsymbol{\theta}})\right]' \hat{\mathbf{W}} \left[\frac{1}{N}\sum_i^N \mathbf{Z}_i'(\mathbf{y}_i - \mathbf{X}_i\,\hat{\boldsymbol{\theta}})\right]$$

and then, the $\hat{\boldsymbol{\theta}}$ minimizing the quadratic form is the GMM estimator.

Whereas consistency of the GMM estimator is ensured under usual assumptions if $\hat{\mathbf{W}}$ is positive definite at least, the extent of the asymptotic variance of the estimator depends on which $\hat{\mathbf{W}}$ is chosen. Hansen (1982) showed that the minimized asymptotic variance of the GMM estimator is obtained by using the inverse of the consistent estimator of $\mathbf{S} = \mathrm{E}(\mathbf{Z}_i'\mathbf{u}_i\mathbf{u}_i'\mathbf{Z}_i)$ as the weighting matrix; that is, if replacing $\hat{\mathbf{W}}$ by

$$\hat{\mathbf{S}}^{-1} = \left[\frac{1}{N}\left(\sum_i^N \mathbf{Z}_i'\hat{\mathbf{u}}_i\hat{\mathbf{u}}_i'\mathbf{Z}_i\right)\right]^{-1}, \tag{11}$$

then the GMM estimator $\hat{\boldsymbol{\theta}}$ minimizing its asymptotic variance is obtained. The estimator, usually called the efficient GMM estimator, is obtained by the following procedure:

1. As Equation (11) obviously indicates, to obtain $\hat{\mathbf{S}}^{-1}$, we need to estimate $\mathbf{u}_i = \mathbf{y}_i - \mathbf{X}_i\boldsymbol{\theta}$, in other words, to estimate $\boldsymbol{\theta}$ with consistency. For this purpose, we first estimate a GMM estimate of $\boldsymbol{\theta}$ using a $\hat{\mathbf{W}}$ which is available in an arbitrary symmetric and positive definite matrix. But if it is possible to assume that η_{it} satisfies some conditions such as

$$\begin{aligned} &\mathrm{E}(\eta_{it} \mid \mathbf{Z}_i) = 0 \\ &\mathrm{E}(\eta_{it}\,\eta_{is} \mid \mathbf{Z}_i) = \begin{cases} \sigma_\eta^2 & (t = s) \\ 0 & (t \neq s) \end{cases}, \end{aligned} \tag{12}$$

we obtain

$$\begin{aligned} \mathrm{E}(\mathbf{Z}_i'\mathbf{u}_i\mathbf{u}_i'\mathbf{Z}_i) &= \mathrm{E}(\mathbf{Z}_i'\,\Delta\boldsymbol{\eta}_i\,\Delta\boldsymbol{\eta}_i'\,\mathbf{Z}_i) \\ &= \sigma_\eta^2\,\mathrm{E}(\mathbf{Z}_i'\,\mathbf{H}\,\mathbf{Z}_i) \end{aligned}$$

where $\mathbf{H}$ is $(T-2)\times(T-2)$ matrix

$$\mathbf{H} = \begin{pmatrix} 2 & -1 & 0 & \dots & 0 & 0 \\ -1 & 2 & -1 & \dots & 0 & 0 \\ 0 & -1 & 2 & \dots & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & 0 & \dots & 2 & -1 \\ 0 & 0 & 0 & \dots & -1 & 2 \end{pmatrix}$$

and the GMM estimator satisfied the above assumptions does not depend on $\hat{\sigma}_\eta^2$ [Hayashi 2000, p. 226]. These facts enable us to obtain

$$\hat{\mathbf{S}}^{-1} = \left(\frac{1}{N}\sum_i \mathbf{Z}_i' \mathbf{H} \mathbf{Z}_i\right)^{-1} \tag{13}$$

without estimating $\mathbf{u}_i$ or $\boldsymbol{\theta}$ in advance and to estimate the efficient GMM estimator. The resulting estimator is called Arellano and Bond's 1-step GMM estimator [Arellano and Bond 1991].

2. Although Arellano and Bond's method provides just a 1-step procedure to estimate $\boldsymbol{\theta}$, their method requires somewhat strong assumptions. An alternative to avoid these assumptions is to exploit their 1-step consistent estimator or the residual as preliminary estimators for constructing $\hat{\mathbf{S}}^{-1}$:

$$\hat{\mathbf{S}}^{-1} = \left(\frac{1}{N}\sum_i^N \mathbf{Z}_i'\hat{\mathbf{u}}_i\hat{\mathbf{u}}_i'\mathbf{Z}_i\right)^{-1}, \tag{14}$$

and to estimate the efficient $\hat{\boldsymbol{\theta}}$ using Equation (14) as the weighting matrix. This estimator is usually called the 2-step GMM estimator. We adopt this estimator in this paper. [6)]

B. Data

The required data for estimating Equation (7) is employment L_{it}, the nominal wage rate w_{it}, the price of value-added p_{it}, the optimal output Y_{it}^*, and the instrumental variable data $\mathbf{z}_{it}$. These above data are described as follows. [7)].

Employment L_{it} was obtained as the number of Staff and Workers at the year-end taken from the SOEs' industry sector of *China Labor Statistical Year Book* [8)]. The nominal wage rate w_{it} was obtained by dividing total wages by L_{it}, both of which were taken from the *China Labor Statistical Year Book* Since Y_{it}^* is unobservable, we exploited real value-added Y_{it} instead, which was computed by dividing the nominal value-added to its deflator. Y_{it} was taken from SOEs' industry sector contained in *China Statistical Year Book* and each province's year book. Since nominal value added in Hubei from 1999 to 2002 and in Ningxia from 1998 to 1999 was not available for SOEs' but only for State-owned and State-controlled Enterprises (SSEs)', we derived SOEs' nominal value added for both regions from the following calculations:

$$PY_{it}^{soe} = PY_{it}^{sse} \times (PO_{it}^{soe}/PO_{it}^{sse}) \quad i = \text{Hubei , Ningxia}$$

6)Note that the 1-step and 2-step GMM estimator are asymptotically equivalent if the assumptions of Equation (12) are true.

7)Since 1998, data of SOEs contained *industry* section of *China Statistical Year Book* has changed into State-owned and State-controlled Enterprises (SSEs), whose new classification contains both SOEs (100% state ownership) and state-holding enterprises. To keep continuity of data from 1992 to 2002, we exploit only SOEs' data using not only *Statistical Year Book* but also each province's *Statistical Year Book*. The industry section includes Mining and Quarry, Manufacturing, and Production and Distribution of Electricity, Gas, and Power.

8)Staff and Workers is defined as follows: persons working in, and receiving payment from units of state ownership, collective ownership, joint ownership, share holding ownership, foreign ownership, ownership by entrepreneurs from Hong Kong, Macao, and Taiwan, and other types of ownership and their affiliated units [China Labor Statistical Year Book 2004, p. 651].

Table 1: Unit Root Test

	$Z_{\tilde{t}bar}$	W_{tbar}	L^0	L^1	L^2
$\Delta\ln(w_{it}/p_{it})$	-19.72^{***}	-5.18^{***}	22	1	7
$\Delta\ln Y_{it}$	-13.01^{***}	-8.86^{***}	20	6	4
$\Delta\ln L_{i,t-1}$	-6.39^{***}	-3.38^{***}	29	0	1

Note: W_{tbar} is based on the average of augmented Dickey-Fuller statistics computed for each i. $Z_{\tilde{t}bar}$ is based on Dickey-Fuller statistics (not allowing for serial correlation of ε_{it}, i.e., $\theta_j = 0$, for all j) computed for each i. Both W_{tbar} and $Z_{\tilde{t}bar}$ are normalized by a mean and variance shown by Im, Pesaran and Shin (2003, Table 1 and 3) and using the following model:

$$\Delta y_{it} = \delta_i y_{i,t-1} + \mu_i + \sum\nolimits_{j=0}^{p_i} \theta_j \, \Delta y_{i,t-j} + \varepsilon_{it}.$$

These statistics converge to $N(0.1)$ under the null hypothesis: $\delta_i = 0$. The lag length p_i is decided by the *t rule*, that is, starting from $p_i = 2$, if the last lag is significant at the 10% significance level, we choose the lag length. L^0, L^1 and L^2 are the number of regions and the subscript means the decided p_i based on the *t rule*. *** denotes 1% significance. For unit root tests in panel data, refer to Im, Pesaran and Shin (2003).

where PY_{it}^{soe} and PY_{it}^{sse} are the nominal value added of SOEs and SSEs, PO_{it}^{soe} and PO_{it}^{sse} is the nominal industrial output, respectively. In addition, since nominal value added of Guangxi in 2000 and of Yunnan in 2002 was also not available, we supplemented it with linear approximation.

Although p_{it} is usually constructed as value added deflator, the deflator classified in the SOE's industry sector and by region is not available. As an alternative, we have adopted a deflator such as

$$p_{it} = \frac{(PY_{it}^{2nd}/Y_{it}^{2nd})}{(PY_{i,98}^{2nd}/Y_{i,98}^{2nd})}$$

where PY_{it}^{2nd} and Y_{it}^{2nd} are nominal and real value-added of the secondary industry (Industry + Construction) for region i, and $p_{i,98} = 1$.

As for the choice of instrumental variables $\mathbf{z}_{it}$, following Arellano and Bond (1991), we used all the available lag variables of each regressor to which the error term dose not seem to correlate, [9] that is

$$\begin{aligned}
\mathbf{z}_{i3}' &= \left[\ln\left(\frac{w_{i1}}{p_{i1}}\right), \ln\left(\frac{w_{i2}}{p_{i2}}\right), \ln Y_{i1}, \ln L_{i1}\right] \\
\mathbf{z}_{i4}' &= \left[\ln\left(\frac{w_{i1}}{p_{i1}}\right), \ln\left(\frac{w_{i2}}{p_{i2}}\right), \ln\left(\frac{w_{i3}}{p_{i3}}\right), \ln Y_{i1}, \ln Y_{i2}, \ln L_{i1}, \ln L_{i2}\right] \\
&\vdots \\
\mathbf{z}_{iT}' &= \left[\ln\left(\frac{w_{i1}}{p_{i1}}\right), \ln\left(\frac{w_{i2}}{p_{i2}}\right), \ldots, \ln\left(\frac{w_{i,T-1}}{p_{i,T-1}}\right), \ln Y_{i1}, \ln Y_{i2}, \ldots, \ln Y_{i,T-2}, \ln L_{i1}, \ln L_{i2}, \ldots, \ln L_{i,T-2}\right].
\end{aligned}$$

Our sample size of cross section is 30 provinces (except Chongqing) and time series is available from 1992 to 2002. Therefore, the total sample size is $N = 30$ and $T - 2 = 9$.

[9] For the way of choosing the instrumental variables, refer to Baltagi (2001, pp. 131–135).

Table 2: Estimation Results

	1994–1997		1998–2002	
	Estimates	S.E.	Estimates	S.E.
$\Delta\ln(w_{it}/p_{it})$	-0.255	$0.04^{***}(0.15^{*})$	-2.872	$0.32^{***}(0.50^{***})$
$\Delta\ln Y_{it}$	0.052	0.02^{**} (0.11)	0.153	$0.02^{***}(0.04^{***})$
$\Delta\ln L_{i,t-1}$	0.818	$0.06^{***}(0.26^{***})$	0.589	$0.04^{***}(0.07^{***})$
γ	0.182	-	0.411	-
J statistics			160.67 (138, 0.09)	
m_2 statistics			-1.67 (0.10)	
N, $T-2$			N: 30, $T-2$: 9	

Note: S.E. is the standard error and the value of parentheses is the standard error of 1-step GMM estimator. ***, **, * mean 1% , 5% and, 10% significance, respectively. The parenthesized value of J statistics, which is asymptotically distributed as $\chi^2(\Sigma_t L_t - K)$, is the degree of freedom and p value. The parenthesized value of m_2 statistics is p value. m_2 statistics is for the test of second-order serial correlation, following $N(0,1)$ asymptotically under the null hypothesis; there is no second-order serial correlation [Arellano 2003, p. 121].

C. Unit Root Test

To apply the GMM procedure to our model, the data must follow the stationary process. Before proceeding with the estimation, we carried out unit root tests. Because our sample size for time series direction is small, we have adopted a unit root test using panel data proposed by Im, Pesaran and Shin (2003). The test result is shown in Table 1. $Z_{\tilde{t}bar}$ statistics converge to $N(0,1)$ under the null as $N \to \infty$ for a fixed T although it does not allow for serial correlation, whereas W_{tbar} statistics allow for serial correlation and converge to $N(0,1)$ under the null as $N \to \infty$ and $T \to \infty$ [Im, Pesaran and Shin 2003, p. 69]. As a result of the test, the null hypothesis, which states unit roots exist for all i, is rejected for all variables. [10)]

D. The Speed of Employment Adjustment

Table 2 shows the estimation results. To allow the parameter $\boldsymbol{\theta} = (\theta_1, \theta_2, \theta_3)'$ to change between 1994–1997 and 1998–2002, we divide it into two parts: $\boldsymbol{\theta} = (\theta_1^f, \theta_2^f, \theta_3^f, \theta_1^s, \theta_2^s, \theta_3^s)'$ where subscript f and s denote the former (1994–97) and latter (1998–02) parameter. We used the 2-step GMM procedure to obtain an efficient and consistent estimator with few assumptions, although it is pointed out in the econometric literature that the asymptotic standard errors associated with the procedure have a downward finite-sample bias [Arellano and Bond 1991, pp. 285–291]. Allowing for the bias, we carried out hypothesis tests for parameter using the standard errors obtained in 1-step GMM procedure.

As Table 2 indicates, all the parameter estimates are significant at the 1% or 5% level except the parameter of $\Delta\ln Y_{it}$ (1994–1997), and the signs are valid in economic theory. The p value of J statistics, which is for Hansen's test of overidentifying restrictions [Hansen 1982], is 9%. Thus, specification errors of our model are not detected at the 5% critical value. The p value of m statistics, which is for the test of second-order serial correlation, is 10%; therefore, the null hypothesis that there is no second-order serial correlation is not rejected at 5% critical value.

[10)] Note that because the alternative hypothesis of the test states that at least one of the cross section series is stationary, i.e., $H_1 : \delta_i \leq 1$, rejecting the null does not necessarily deduce that unit roots does not exit for all i.

Table 3: Wald Test

Null hypothesis	Wald statistics
$\theta_1^f = \theta_1^s, \theta_2^f = \theta_2^s, \theta_3^f = \theta_3^s$	26.98(3)***
$\theta_1^f = \theta_1^s$	24.07(1)***
$\theta_2^f = \theta_2^s$	0.69(1)
$\theta_3^f = \theta_3^s$	0.67(1)
$\sigma^f = \sigma^s$	11.09(1)***

Note: Wald statistics are asymptotically distributed as χ^2 with the degrees of freedom (=the number of restrictions). The value in parentheses is the degree of freedom. *** means 1% significant. The standard errors computed by the 1-step GMM procedure is used for calculating the test statistics.

Parameter estimates of γ, θ_1 and θ_2 are 0.182 in 1994–1997 and 0.411 in 1997–2002, -0.255 and -2.872, and 0.052 and 0.153, respectively. It seems that all the parameter estimates increase in the latter half of the sample period. To test whether the change of the parameter is statistically significant, we carry out the Wald test. The result are shown in Table 3. The null hypothesis of the 1st and 2nd row in Table 3 is rejected at the 1% significance level, and that of the 3rd and 4th row is not rejected; hence, we cannot say that the estimates of the elasticity of production θ_2 and the adjustment parameter $\theta_3 = 1 - \gamma$ change significantly.

As for the increase in the price elasticity θ_1, it is likely to be a sign of changing production technology of SOEs. As Equation (6) shows, θ_1 consists of two parts: the adjustment parameter γ and the elasticity of substitution for production function σ, and, as the Wald test shows, the null hypothesis of σ is rejected at the 1% level, showing the significant change of σ. Hence, the increase in price elasticity results mainly from the change of σ. [11)]

These empirical results lead us to the conclusion that the cause of the decrease in SOEs' employees is not due to the speeding up of their employment adjustment, but mainly to the reduction in the number of SOEs. Since the 1990's, having adopted Ownership System Reform, the reform of SOEs has proceeded to such an extent that the the government has finally allowed corporatization or privatization of SOEs. However, the SOEs, the enterprises owned solely by the state, did not receive the ripple effect of the reform, and we thereby believe that their employment adjustment did not speed up. Although the SOEs may improve their productivity to some degree due to the reform, it seems that the government intervention in the SOEs' decisions, especially related to employment and displacement (layoff) associated with social stability, has remained considerable and that it is difficult to weaken the intervention as long as there is government ownership.

IV. Conclusion

We attempt to estimate the employment adjustment speed of China's SOEs using panel data and to verify whether SOEs sped up their employment adjustment. According to our empirical results, there is no statistical evidence that the speed changed significantly from 1994 to 2002; hence, we can say that the decrease in SOEs' employment was

11) The increase in price elasticity may also imply hardening of the budget constraint pointed out by Kornai (1984, pp. 50–58).

caused mainly by reducing the number of SOEs.

Having seriously proceeded with the Ownership System Reform since 1997, state-controlled enterprises, which are owned not only by government but also others, have been increasing. Our empirical results show that, even with SOEs' reform, it is difficult to speed up their employment adjustment as long as the ownership remains with the Chinese government only; in other words, if the Ownership System Reform should proceed and be involved in changing the ownership system, it would be expected that the reform would contribute to weakening the government intervention, thereby making an smooth employment adjustment. However, whether reforming the ownership system after 1997 has actually contributed toward a smooth adjustment or not is open to discussion. Although we could not analyze the topic in this paper, it is one of the issues that we should further investigate in the future.

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