



Privatization and firm performance: A comparison between rural and urban enterprises in China

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Received 29 October 2004; revised 16 June 2006

Available online 24 July 2006

Dong, Xiao-yuan, Putterman, Louis, and Unel, Bulent—Privatization and firm performance: A comparison between rural and urban enterprises in China

Using panel data on 165 rural and urban firms from Nanjing municipality and its environs, we investigate the pattern and consequences of property rights reform and privatization in the late 1990s. We find that privatization policies appear to have targeted the weakest firms in the urban sector, whereas no correlation is found between performance and selection for privatization in the rural sector. For urban firms, the adoption of some degree of private ownership is associated with significant improvements in productivity and profitability; in contrast, the positive effects of privatization on rural firms are found only for some measures. *Journal of Comparative Economics* 34 (3) (2006) 608–633. University of Winnipeg, Winnipeg, MB, Canada R3B 2E9; Brown University, Providence, RI 02912, USA; Louisiana State University, Baton Rouge, LA 70803, USA.

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JEL classification: O53; P31; P26; P25

Keywords: Privatization; China; Economic reform; Transition; SOE; TVE

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1. Introduction

In late 1992, China's leaders formally endorsed private property rights and initiated ownership reforms in public enterprises. These reform policies, described as "grasp the large and let go of the small" (*zhuadafangxiao*), were reaffirmed during the 15th Congress of the Chinese Communist Party in September 1997. With a combination of spontaneous movement from below and encouragement from above, China's industry has seen an enormous wave of ownership restructuring since the late 1990s. Because ownership restructuring in China's industry is a relatively recent event, empirical studies of its effects have just begun to emerge. Jefferson et al. (2005) examine the impact of conversion on former state-owned enterprises (SOEs) using the full population of 22,000 large and medium-size enterprises for the period from 1994 to 1999. They find that ownership conversion increased both current productivity and investments in research and development. Using a survey of 683 SOEs in 11 cities for the years 1995 to 2001, Yao and Song (in press) examine the impacts of ownership changes on enterprise performance. Their results indicate that the shift of ownership rights from the state to private investors improved the profitability of firms but had no effect on unit cost and labor productivity. Sun et al. (2002) estimate the effects of privatization on SOEs listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange. They find an inverted-U shaped relationship between firm performance and the degree of privatization.

With respect to rural industry, Kung and Lin (2000), Park and Shen (2003), and Li (2003) investigate the sweeping change in property rights in township and village enterprises (TVEs). Changes in ideological commitment, shifts in the preference of financial institutions, and increased market competition are identified as some of the chief factors that contributed to massive privatization of TVEs in the late 1990s. Li and Rozelle (2004) estimate the impact of privatization on TVE performance using a sample of 88 privatized TVEs from Jiangsu and Zhejiang for the period from 1994 to 1997 and find a significant positive effect of the reform on labor productivity. With a survey of 45 TVEs in Shandong and Jiangsu in 2000, Ho et al. (2003) provide evidence that privatization had increased efficiency by making managers more responsible for the use of enterprise assets and by making firms more profit oriented.

In this paper, we examine differences in the experiences of ownership reforms between urban SOEs and rural TVEs using a panel of industrial enterprises in Nanjing municipality for the period from 1994 to 2001. First, in the two sectors, we study the impact of the reform program characterized as "grasp the large and let go of the small," under which small and medium enterprises are likely to be privatized fully but the government retains ownership of large SOEs and converts them into shareholding companies. Second, we investigate the effects of reforms in ownership rights on firm performance using labor productivity, total factor productivity (TFP), and profitability in the two sectors. As such, we contrast reform in urban and rural enterprises using an integrated survey.

We find two sharp differences in the reform strategies of the SOEs and TVEs. First, the changes in the SOE sector were more gradual and involved a more limited transfer of property rights to private investors than did those affecting TVEs. Second, the privatization of SOEs exhibited selection bias as the worse performing enterprises were the principal targets of reforms; in contrast, pre-reform performance did not play a role in determining the TVEs selected for privatization. In our analysis, we discern strong, positive effects of privatization on the economic performance of the reformed SOEs by all three measures. We also find that, among reformed urban enterprises, those in which private ownership accounts for less than 50% of shares perform better than those in which the majority of shares are privately owned. Evidence of positive

privatization effects is also found for TVEs; however, compared with SOEs, the estimates are smaller and more sensitive to both model specification and choice of the performance measure. Using the records of TVEs as a benchmark for comparison, our findings suggest that China's evolutionary approach to privatizing large-scale public enterprises has been effective.

The remainder of the paper is organized as follows. Section 2 describes the data set and examines the differences in privatization strategies between the different types of public enterprises, including differences in selection of the order of privatization. Section 3 outlines the methodology and the issues to be explored by econometric analysis. The results are reported in Section 4. Section 5 summarizes the results, provides interpretive remarks, and mentions some limitations of the analysis.

2. Data description and preliminary analysis

The data come from a survey of 168 manufacturing enterprises undertaken in cooperation with China's National Bureau of Statistics (NBS) in the summer of 2002. Sample enterprises were selected randomly in the Nanjing metropolitan area and in 7 counties under the jurisdiction of the Nanjing municipal government. As the capital of Jiangsu, a fast growing coastal province that was the heartland of China's rural collective sector from the 1970s to the 1990s, Nanjing provides a desirable sample site for comparing the privatization experiences of urban and rural public enterprises in China. Distributed over 46 4-digit industrial branches, the sample of 168 firms accounts for 8.6% of the 1963 manufacturing firms having 5 million or more *yuan* in annual sales in Nanjing city and for 26% of the 634 public enterprises that had undergone enterprise restructuring (*gaizhi*) by 2002.¹ The data were collected by means of an enterprise survey, which provides information on industrial codes, ownership categories, output, sales revenue, fixed assets, equity, employment, labor compensation, intermediate inputs, investment expenditures on new technologies, and profits, and also a manager survey, which provides information on the privatization process and reform methods.

The enterprise panel covers the period from 1994, the year in which China's industrial enterprises adopted a new accounting system, to 2001. We focus on 165 enterprises whose pre-reform ownership categories can be identified using information obtained from the two surveys. In accordance with the ownership classification of 1994, there are 60 SOEs, 10 urban collectives (UCs), and 95 TVEs in the sample.² Three differences between the urban and rural enterprises appear likely to affect their reform methods and outcomes. First, as can be seen from Table 1, a typical SOE is substantially larger than either a UC or a TVE, whereas a UC is bigger than a TVE. The scale difference implies that privatization of urban public enterprises is subject to a more binding wealth constraint than TVEs because of the small number of buyers wealthy enough to purchase most shares. Hence, the feasible choices of reform policies generate a more dispersed ownership structure for large privatized enterprises.

¹ Although the rural enterprises are small relative to the urban ones, those in the sample are large by the standards of rural enterprises. For example, a typical rural enterprise in the sample employed about 218 workers, whereas the average rural industrial enterprise in Jiangsu employed only 15 workers according to NBS (2001, pp. 410–411). Moreover, the population of 634 *gaizhi* or reformed enterprises does not include any bankrupt enterprises, although bankruptcy is one of the main ownership restructuring methods in China. Hence, our sample is biased upwards in firm performance relative to the population of industrial public enterprises in Nanjing.

² Prior to privatization, these enterprises were affiliated with governments at various levels, with 12 being owned by the central government, 2 by the provincial government, 56 by municipal or county governments, and 95 by township governments.

Table 1
Summary statistics of the sample enterprises (1994–2001)

	All enterprises	Urban sector SOEs	UCs	Rural sector TVEs
<i>Sales revenue (million yuan)</i>				
Mean	235.52	615.64	29.04	19.87
Standard deviation	1100.77	1769.84	36.37	28.88
<i>Value added</i>				
Mean (million yuan)	50.29	128.89	12.00	5.25
Standard deviation	233.54	376.04	22.27	7.32
<i>Capital assets (million yuan)</i>				
Mean	115.97	313.96	7.42	4.04
Standard deviation	652.69	1,059.12	9.74	6.92
<i>Employment (workers)</i>				
Mean	1224.45	2972.18	429.89	217.45
Standard deviation	3343.32	5109.55	398.60	210.32
<i>Materials (million yuan)</i>				
Mean	156.98	400.63	23.44	18.87
Standard deviation	724.06	1,166.82	27.13	25.77
<i>Equity</i>				
Mean (million yuan)	77.81	208.47	8.49	3.57
Standard deviation	427.42	692.50	12.15	6.66
<i>Leverage</i>				
Mean	0.48	0.53	0.28	0.44
Standard deviation	6.74	2.77	1.15	2.51
<i>Loan per worker</i>				
Mean (1000 yuan)	11.13	23.35	2.91	4.16
Standard deviation	35.58	55.35	12.66	10.88
No. of firms	165	60	10	95

Notes. (1) The statistics presented in this table are derived from the enterprise panel data set.

(2) Sales revenues, value added, capital assets and materials are in 1994 prices.

Labor relations are another major area in which urban public enterprises have differed from rural ones, at least in the past. Up until the late 1990s, SOEs and large UCs were obligated to provide job security and welfare benefits, such as medical care and retirement pensions, to their employees. In contrast, the labor obligations of TVEs were more flexible because rural workers did not have the same entitlements to social welfare and protection as did urban workers. Thus, labor issues may make SOEs and UCs less attractive than rural TVEs to private investors. Finally, urban and rural enterprises differ sharply in reform experiences prior to the ownership restructuring in the late 1990s. From their inception, TVEs were typically subject to harder budget constraints than SOEs and also more market-oriented. In the early 1980s, both SOEs and TVEs adopted a production responsibility system in which managers and workers received bonuses if the enterprise achieved the targets set for output, production costs, profits and taxes. In the late 1980s, many township governments in Jiangsu province replaced the production responsibility system with more rigorous incentive contracts, as [Chen and Rozelle \(1999\)](#), [Ho et al. \(2003\)](#),

and Chang et al. (2003) discuss.³ However, the production responsibility system remained the predominant form of incentive contracts in SOEs. Thus, TVEs have consistently outperformed SOEs, as Jefferson (1999) demonstrates. Because SOEs were located farther away from the production frontier than private firms prior to the property rights restructuring, privatization should have a more positive effect on firm performance for SOEs than for TVEs.

We now examine empirically the impact of these institutional differences on privatization policies. Although the 165 sample enterprises were all classified by our Chinese collaborators as *gaizhi-qiy*e, which is the Chinese term for enterprises that have undergone a system change, *gaizhi* did not lead to any immediate substantive change in ownership structure for an appreciable proportion of the enterprises, especially the SOEs and the UCs.⁴ To discern the scope and pace of privatization, we derive three reform indicators. First, we consider whether or not the ownership classification of an enterprise had changed, judging by the ownership code reported in the enterprise panel data.⁵ During the period of investigation, 38 of the 60 SOEs changed ownership classification as 11 became shareholding companies, 20 transformed into limited companies that were not wholly owned by the state, 5 became shareholding cooperatives, and 2 were converted to private limited companies. We define these enterprises as reformed SOEs for our empirical analysis. With respect to the 10 UCs, 3 became shareholding cooperatives and 5 were converted to limited companies. Except for four enterprises, the 95 TVEs changed ownership classification with 23 becoming shareholding cooperatives, 6 transforming into limited companies, and 62 converting to private firms. Because shareholding cooperatives are usually regarded as one type of collective firms in the literature, only those UCs and TVEs that transformed into limited liability companies or private firms are classified as reformed ones in our empirical investigation following Jefferson et al. (2003).⁶

The other two indicators are derived from information on equity ownership obtained from the enterprise panel. Because the sample of UCs is small and the ownership structure of UCs is more similar to that of SOEs than TVEs, SOEs and UCs are combined as one group, denoted urban enterprises, for some of our work.⁷ One of the privatization indicators is a categorical measure derived by dividing the urban and the rural enterprises each into three classes, namely 100 percent publicly owned, majority publicly owned such that public ownership is less than 100

³ For example, under one new incentive contract called the pledged net assets contract system (*jing zhichan diya chenbao*), managerial candidates predict the increase in the net asset value of the enterprise under their tenure and put up a fixed amount of their personal wealth if they overpredict. This scheme is intended to make managers more responsible for investment decisions and to prevent asset stripping.

⁴ A firm is classified as a *gaizhi* enterprise by NBS if it has been converted into a shareholding company, a limited liability company, or a shareholding cooperative, or if it is sold or leased to inside private individuals, or outside investors, i.e. private individuals or other SOEs. Thus, an SOE could undergo reform by being converted into a shareholding company even though 100% of the shares could continue to be owned by the state.

⁵ The ownership code of the data uses a four-category classification for the period from 1994 to 1997 and a 23-category classification for the period from 1998 to 2001. The information from the survey of managers is used to help identify the ownership category of a few enterprises that had changed ownership prior to 1994.

⁶ Theoretically, shareholding cooperatives are enterprises in which dividends are distributed according to share ownership but major decisions are made based on the principle of one vote per member. In practice, some privatized TVEs that did not meet this criterion were registered as shareholding cooperatives according to Ho et al. (2003). Excluding shareholding cooperatives from reformed UCs and TVEs enables us to focus on the impact of transformation of collective enterprises into conventional firms.

⁷ As with the SOEs, the average proportion of equity owned by private investors is 24.4 percent in 2001; only two of the ten UCs were transformed to majority private ownership, while three became majority publicly owned, and five remained under 100 percent public ownership.

percent but still more than 50 percent, and majority private owned so that private ownership is between 50 and 100 percent. Our last indicator is a continuous measure of privatization, namely the proportion of equity owned by private individuals.

The summary statistics shown in Table 2 provide information about the reform process. The statistics reported in the first part of that table reveal sharp contrasts in the scope and pace of change between different types of public enterprises. Specifically, the reform process began earlier but proceeded more slowly in the urban SOEs and UCs compared with the TVEs. Based on the indicators of ownership-category shift, 10 to 13 percent of the UCs and SOEs had undergone substantive restructuring by 1994, but the proportion rose to between 50 and 63 percent only in 2001. By contrast, ownership change did not begin in the TVEs until 1996; however, nearly three quarters of the enterprises had been converted into partially privatized limited companies or wholly privately owned firms by 2001. Moreover, compared with TVEs, the scope of privatization for the two types of urban public enterprises was fairly limited. By 2001, only 25.4 percent of the equity of the urban enterprises was owned by private investors on average, and only 16.7 percent of the urban enterprises were majority privately owned. In contrast, private investors owned 68.9 percent of the equity and had majority ownership in 72.9 percent of the TVEs.

The descriptive statistics reported in the remaining parts of Table 2 provide information on the privatization methods adopted by urban and rural enterprises. As was the case in many Central

Table 2
Summary statistics on ownership reforms
Distribution of sample firms by ownership categories

Year	1994	1995	1996	1997	1998	1999	2000	2001
<i>SOEs</i>	54	54	58	59	60	60	60	60
State-owned	47	46	46	46	36	28	22	22
Shareholding company	2	2	3	3	8	10	10	11
Limited company	5	6	9	10	12	17	21	20
Shareholding cooperative	0	0	0	0	3	4	5	5
Private firm	0	0	0	0	1	1	2	2
% Reformed	13.0	14.8	20.7	22.0	40.0	46.7	63.3	63.3
<i>UCs</i>	10	10	10	10	10	10	10	10
Collective	8	9	9	9	6	5	3	2
Shareholding cooperative	0	0	0	0	2	2	3	3
Limited company	1	1	1	1	2	3	4	5
% Reformed	10.0	10.0	10.0	10.0	20.0	30.0	40.0	50.0
<i>TVEs</i>	87	89	91	93	95	95	95	95
Collective	87	89	89	88	65	46	13	4
Shareholding cooperative	0	0	0	0	13	21	23	23
Limited company	0	0	0	2	3	4	6	6
Private firm	0	0	2	3	14	24	53	62
% Reformed	0.0	0.0	2.2	5.4	17.9	29.5	62.1	71.6

(continued on next page)

Table 2 (continued)

*Extent of privatization**By categorical measure:*

Year	Urban enterprises			Rural enterprises		
	Proportion of firms with ownership			Proportion of firms with ownership		
	100% public	Majority public	Majority private	100% public	Majority public	Majority private
1994	0.770	0.230	0.0	0.929	0.071	0.0
1995	0.785	0.215	0.0	0.899	0.101	0.0
1996	0.768	0.203	0.029	0.828	0.129	0.043
1997	0.775	0.197	0.028	0.779	0.137	0.084
1998	0.625	0.264	0.111	0.594	0.177	0.229
1999	0.556	0.333	0.111	0.427	0.187	0.386
2000	0.486	0.400	0.111	0.125	0.208	0.656
2001	0.428	0.400	0.171	0.094	0.167	0.729

By continuous measure:

Year	Urban enterprises		Rural enterprises	
	Average share of equity owned		Average share of equity owned	
	Publicly	Privately	Publicly	Privately
1994	0.962	0.038	0.994	0.006
1995	0.965	0.035	0.980	0.020
1996	0.928	0.072	0.928	0.072
1997	0.925	0.075	0.896	0.104
1998	0.850	0.150	0.754	0.246
1999	0.829	0.171	0.628	0.372
2000	0.800	0.200	0.354	0.645
2001	0.746	0.254	0.311	0.689

Distribution of private ownership

	Urban enterprises			Rural enterprises		
	Management	Employees	Outsiders	Management	Employees	Outsiders
Right after reform	0.416	0.218	0.366	0.531	0.179	0.289
In 2001	0.369	0.337	0.294	0.613	0.162	0.225

Payments by inside private investors

	Urban enterprises		Rural enterprises	
	Management	Employees	Management	Employees
Average payment expected as % of the value of share they purchased	76.05%	88.01%	86.19%	83.72%
Payment arrangement:				
Proportion of investors paying a lump sum up front	80.48%	93.55%	73.33%	86.20%

Notes. (1) A firm is defined as reformed if it has undergone restructuring by changing its ownership code according to China's National Bureau of Statistics.

(2) Urban enterprises include SOEs and UCs. The two types of urban public enterprises are combined because the number of urban collectives in the sample is small and the two types of firms are similar in terms of extent of privatization.

(3) The statistics presented prior to the heading "Distribution of private ownership" are obtained from the enterprise panel data and those reported in the remaining portions of the table are from the manager survey.

and Eastern European countries, both the urban and rural enterprises were privatized primarily to enterprise insiders, i.e., managers and employees. However, the distribution of equity ownership between managerial and non-managerial employees in former SOEs and UCs differs from that in former TVEs. In contrast to the growing managerial ownership concentration observed among privatized rural enterprises, the proportion of private equity owned by employees in the urban enterprises was rising over time and the distribution between managers and employees became more or less equally split by 2001. However, privatization of urban and rural enterprises in China did not use free or substantially subsidized transfers of public assets as did the mass privatizations in some countries in Central and Eastern Europe. On average, the managers and employees in both sectors were expected to pay 76 to 88 percent, respectively, of the value of the shares they acquired.⁸ In addition, 73 to 94 percent of the inside private investors, respectively, paid the full amount up front. Although the divestiture of government ownership was the primary component of share sales, many firms issued shares to private investors to raise funds. Having inside private investors pay for their share acquisition is desirable not only for collecting state revenues and raising new capital but it may also have stronger incentive effects than those accompanying free transfers.⁹

Having reviewed inter-sectoral differences in enterprise restructuring, we investigate the effectiveness of privatization in improving economic performance. We examine three aspects of firm performance, namely, labor productivity, total factor productivity (TFP), and profits per unit of fixed assets. TFP and profitability provide comprehensive measures of technical and economic efficiency. Labor productivity is introduced as a partial indicator that is particularly sensitive to changes in the workforce and capital stock. We measure labor productivity using two indicators, i.e., value-added per worker and sales revenues per worker. Value-added and sales revenues are both converted to 1994 constant RMB values using the ex-factory price index of industrial products as the deflator. A TFP index is derived from a production function regression. In the estimation, output is measured by sales revenue and non-labor current inputs are total expenses on energy and raw materials. Labor is the number of employees at year-end, and capital is the net value of fixed assets (NVFA). The value of material inputs is converted to 1994 constant prices using the same deflator as for sales revenue and value added. The real value of NVFA is calculated using the recursive method developed by Jefferson et al. (1992) and the price index of investment in fixed assets. The factor shares used for computing the TFP index are obtained under the assumptions that a Cobb–Douglas production function characterizes the firms' technology and that its parameters apply to both the urban and rural enterprises.¹⁰ The estimated factor shares are 0.15 for labor, 0.07 for capital, and 0.78 for material inputs. As a measure of profitability, we take total profits divided by original value of fixed assets. All the price deflators are obtained from *China's Statistical Yearbook*.

⁸ The value of a sample firm was determined by one of two main methods, either negotiation between the government and the enterprise or assessment by an outside evaluator. External evaluation accounted for about 82 and 91% of the SOEs and UCs and 48% of the TVEs. Garnaut et al. (2003) and Ho et al. (2003) provide more information on the privatization process for SOEs and for TVEs, respectively.

⁹ Using the ratio of the up front payment to the value of the shares acquired at the time of privatization as a measure of the completeness of ownership transfer, Li and Rozelle (2004) find that this ratio is positively correlated with labor productivity for privatized TVEs.

¹⁰ In the estimation of the factor shares, we use fixed-effects panel data analysis. To control for common macroeconomic shocks, we include time effects. Under this specification, we can not reject the hypothesis that the production function exhibits constant returns to scale. The hypothesis that the two types of enterprises share the same production function was also tested and we could not reject it at the conventional level of significance.

Table 3
Summary statistics of performance indicators (1995–2001): Part I

	Un-ref. SOEs	Ref. SOEs		Un-ref. UCs	Ref. UCs		Un-ref. TVEs	Ref. TVEs	
		Before	After		Before	After		Before	After
<i>Average annual rate of growth</i>									
<i>Value-added per worker</i>									
Mean	0.072	-0.047	0.134	-0.008	-0.084	-0.202	0.097	0.096	0.109
Std. Dev	0.603	0.649	0.509	0.673	0.819	0.940	0.534	0.689	0.479
Median	0.094	0.052	0.109	0.048	-0.039	-0.078	0.073	0.064	0.116
<i>Log revenue per worker</i>									
Mean	0.107	-0.027	0.139	0.009	-0.060	-0.099	0.102	0.164	0.088
Std. Dev	0.549	0.454	0.480	0.478	0.417	0.520	0.444	0.559	0.356
Median	0.133	0.026	0.116	0.037	-0.055	-0.007	0.084	0.104	0.078
<i>TFP</i>									
Mean	0.015	-0.098	0.101	-0.106	-0.145	-0.194	0.082	0.056	0.127
Std. Dev	0.589	0.632	0.506	0.682	0.808	0.997	0.527	0.684	0.481
Median	0.078	0.008	0.089	-0.050	-0.054	-0.033	0.094	0.054	0.131
<i>Average level of</i>									
<i>Profits per unit of assets</i>									
Mean	-0.011	-0.006	0.033	0.023	0.012	-0.008	0.058	0.051	0.067
Std. Dev	0.101	0.072	0.081	0.069	0.066	0.077	0.087	0.096	0.111
Median	0.002	0.002	0.012	0.012	0.006	-0.041	0.048	0.035	0.029
No. firms	22	38	38	5	5	5	27	68	68

Summary statistics of performance indicators (1995–2001): Part II

	Urban enterprises					Rural enterprises				
	100% public owned	Majority public		Majority private		100% public owned	Majority public		Majority private	
		Before	After	Before	After		Before	After	Before	After
<i>Average annual rate of growth</i>										
<i>Value-added per worker</i>										
Mean	0.056	-0.119	0.120	0.075	0.045	0.063	0.112	0.128	0.104	0.087
Std. Dev	0.640	0.573	0.621	0.406	0.512	0.453	0.656	0.583	0.660	0.484
Median	0.068	0.017	0.078	0.104	0.086	0.046	0.073	0.136	0.061	0.107
<i>Log revenue per worker</i>										
Mean	0.099	-0.115	0.162	0.121	0.027	0.060	0.153	0.148	0.151	0.081
Std. Dev	0.463	0.620	0.520	0.384	0.415	0.409	0.425	0.329	0.558	0.394
Median	0.119	-0.025	0.116	0.075	0.069	0.040	0.068	0.124	0.084	0.094
<i>TFP</i>										
Mean	0.000	-0.165	0.092	0.047	-0.013	0.042	0.074	0.125	0.065	0.100
Std. Dev.	0.599	0.573	0.645	0.412	0.531	0.498	0.634	0.567	0.652	0.483
Median	0.046	-0.041	0.077	0.101	0.033	0.075	0.068	0.103	0.043	0.114
<i>Average level of</i>										
<i>Profits per unit of assets</i>										
Mean	-0.005	-0.016	0.036	0.007	0.024	0.038	0.033	0.053	0.060	0.067
Std. Dev.	0.051	0.152	0.090	0.056	0.045	0.061	0.057	0.091	0.105	0.103
Median	0.002	0.003	0.013	0.005	0.017	0.040	0.034	0.045	0.039	0.034
No. of firms	30	28	28	12	12	10	16	16	69	69

Table 3 presents summary statistics on annual rates of growth of the two labor productivity measures and of TFP along with the levels of profits per unit of assets from 1994 to 2001.¹¹ Part I presents statistics grouping enterprises into unreformed and reformed SOEs, UCs and TVEs with the results for eventually-reformed enterprises separated into before and after categories. Comparing the three types of unreformed enterprises, we observe a familiar ranking in which SOEs and UCs are trailing behind TVEs by most measures. A comparison of the performance records of the eventually reformed enterprises with those of their never-reformed counterparts suggests that SOEs and UCs that were soon to be reformed are underperforming considerably relative to their counterparts that were not later reformed. In contrast, the corresponding gap between pre-reform and never-reformed TVEs is negligible by most measures. The performance of both reformed SOEs and TVEs improves in the post-reform period, but the magnitude of change in the reformed SOEs is more striking with a sharp reverse of the trends of declining labor productivity and TFP and a turnaround from loss-making to profitability. In contrast, restructuring failed to arrest the further deterioration of performance by UCs.

Part II of Table 3 presents summary statistics using the alternate classification of urban and rural enterprises by degree of privatization as of the terminal year. The performance data of enterprises ending up with some private ownership are separated into before and after reform. As with the reformed versus unreformed SOEs and UCs, the urban enterprises that were eventually partially privatized but with a majority public ownership are less profitable and have lower rates of productivity growth before privatization than do those that remained 100 percent publicly owned. In contrast, the eventually privatized TVEs are more productive on average and also more productive and more profitable prior to privatization than are the TVEs that remained fully owned by local governments. Turning to post-privatization performance, urban enterprises that were partially but less than 50% privatized display remarkable improvement by all performance measures. The post-privatization records of the majority private urban enterprises are mixed with lower rates of growth in labor productivity and TFP and higher profit rates. Similar to the reformed TVEs defined on the basis of shifts in category of ownership, post-reform improvement in the two types of privatized rural enterprises is observed for some but not all indicators. Although Table 3 is informative, we consider it to be inappropriate for drawing inferences concerning the performance-ownership relationship because the patterns revealed by these summary statistics may be attributable to many factors. Hence, we study the impact of other possible factors in our econometric analysis in the next section.

3. Issues to be explored and econometric methodology

To compare the strategies and impacts of privatization on rural and urban sectors, we consider four main issues. First, we investigate the relative effectiveness of privatization in improving economic and financial performance in rural versus urban enterprises. Given that SOEs and UCs were likely to be located further away from the production frontier than TVEs prior to ownership restructuring, the two kinds of urban enterprise are expected to have experienced more pronounced positive effects. However, despite the greater potential gain from privatization, we showed in the last section that reform in the urban sector is associated with a slower and more limited shift to private ownership with less concentration of ownership in the hands of managers.

¹¹ Annual rates of growth of labor productivity and TFP are calculated as the difference in the value of the variable in log form between period $t - 1$ and period t . We do not report the growth rate for profits because this variable has a large number of observations with negative values.

This raises an empirical question as to the extent to which the advantage of the urban sector in terms of the probable scope for improvement has actually materialized.

The second issue we investigate concerns the role of government ownership in the privatization process. As reported in the last section, ownership reform has not resulted in a complete withdrawal of state ownership from the sample enterprises. Rather, a large number of reformed enterprises exhibit mixtures of public and private ownership with many remaining under majority public ownership, especially in the urban sector. Conventional arguments for privatization predict that the gain of reform will be maximized by a complete withdrawal of state ownership. However, the descriptive evidence presented in the last section suggests that continuing state ownership has not been harmful. State presence may actually play a positive role in raising productivity and profitability of reformed enterprises in the transitional situation of China in the late 1990s. In the presence of imperfect information, the retention of state equity reduces ex-ante uncertainty and risk for private investors and, consequently, helps the enterprise raise new capital.¹² Moreover, enterprises in which the government has a continuing interest may be more effective in dealing with labor disputes resulting from enterprise restructuring than those owned entirely by private investors, according to Dong (2003). Furthermore, in the absence of well-developed factor markets, government ownership may help the divested enterprise gain access to new technology, capital, and managerial personnel. Nevertheless, all the aforementioned benefits of state ownership come with the costs resulting from continued state interference, soft budget constraints, and agency problems. In this paper, we examine the role of government ownership during the process of privatization both by comparing the performance of partially privatized enterprises under public majority ownership to those owned primarily by private investors and by examining the relationships between performance measures and a continuous private ownership share variable. The two approaches offer complementary ways of testing whether partial privatization can serve as an effective interim strategy during the transition to a market system.

A third issue is the effect of insider privatization. The experience of Central and Eastern European countries suggests that the performance of privatized enterprises is often affected by the form of privatization. As we showed in the last section, the divestiture of firms to enterprise insiders has been the principal method of privatization for both urban and rural enterprises in our sample. Barberis et al. (1996) and Aghion and Blanchard (1996), among others, have voiced objections to insider privatization and argue that the transfer of ownership rights to managers and employees makes it more difficult to introduce changes that are crucial to restructuring but in conflict with the interest of these insider owners, e.g., replacing incompetent managers and downsizing the existing workforce. Ellerman (1993) and Stiglitz (2000) view insider privatization more positively; they emphasize the incentive effects of worker participation and the advantage of involving stakeholders in the privatization process. Studies of the impacts of insider privatization on firm performance in Eastern Europe and the former Soviet Union have produced mixed results, as Brown et al. (2003) report. Since most private ownership in our sample is by insiders, we provide a perspective on the efficacy of inside ownership in China, but explicit comparisons with other forms of privatization are beyond the scope of our analysis.

Finally, we examine the pattern of selection bias in the privatization process because firms may not have been selected randomly for privatization but the order may have been chosen for economic and political reasons. Gupta et al. (2001) show theoretically that it is Pareto efficient

¹² Jefferson et al. (2005) find that the state share of assets in SOEs converted to shareholding corporations declined not due to any withdrawal of state equity from these firms but because of their ability to attract private shareholders after assuming their new form.

for the government to pick the least efficient firms for privatization first because these firms are in the greatest need for restructuring. In contrast, governments that are concerned about the political cost of unemployment and seek to maximize public support for privatization tend to privatize better-performing firms first. In studies of privatization in Eastern Europe, Gupta et al. (2001), Earle and Telegdy (2001) and Brown et al. (2003) find that firms slated for privatization tend to be those with better pre-privatization performance records. Table 3 suggests that pre-reform efficiency may have influenced privatization in different ways in urban versus rural parts of the Nanjing area. Hence, we study the pattern of selection bias and, within the limitations imposed by our data, we control for selectivity bias to obtain consistent estimates of the effects of privatization.

We consider three regression models. The first is a standard panel data treatment model for policy effect evaluation as used in Frydman et al. (1999). In this framework, reform, measured by the two sets of categorical indicators is expressed as the treatment variable and possible selection bias is controlled for by group fixed effects. Letting i index firms, j index ownership types, k index industrial branches, and t index time periods, the panel treatment model takes the following form:

$$P_{it} = \alpha_0 + \sum_j \alpha_j D_{ji} + \sum_j \beta_j R_{jit} + \sum_t \delta_t YEAR_{it} + \sum_k \theta_k IND_{ki} + \gamma X_{it} + u_{it}. \quad (1)$$

In this model, P_{it} is a measure of firm performance, namely the annual rate of growth of value added per worker, sales revenue per worker, and the TFP index along with profits per unit of capital assets. The growth rate is derived as the difference in the value of the respective variable in log form between period t and period $t - 1$. In addition, D_{ji} is a time-invariant dummy variable equal to one if firm i is registered as ownership type j in the last period of investigation and zero otherwise. Hence, the set of dummy variables controls for the type the enterprise was destined to become. Moreover, R_{jit} is a privatization variable equal to one if firm i operates as ownership type j in period t and zero otherwise. The dummy variables $YEAR_{it}$ and IND_{ki} are time and industrial branch indicators reflecting changes in technology, the macro-environment, and the market structure over time and across industries.¹³ The vector X_{it} consists of other time-variant variables that may affect the performance indicator, P_{it} . Finally, u_{it} is a random disturbance term.

For time-variant covariates, X_{it} , we control first for initial performance with the one-period lagged value of the relevant performance variable. In the three regressions for productivity, lagged bank loans per worker is introduced to control for the fact that urban enterprises have better access to credit markets than do rural ones. In assessing the impact of reform and privatization on financial performance, we control for leverage, defined as the ratio of liability to equity lagged by one period.¹⁴ We also take into account the differences in firm size by introducing the one period lagged value of employment in log form. The summary statistics for time-variant control variables included in X_{it} are presented in Table 1.

The parameters β_j measure the treatment effects, i.e. the impact of a shift to ownership type j on firm performance. Hence, a comparison of the estimates of β_j provides information on the difference in reform effects between different types of enterprises. The fixed group effect, α_j ,

¹³ Due to lack of information, we are unable to control for potential variation between counties nor for the potential effects of monopoly in the group fixed effects model. Because our data is from a single municipal area, geographic variation should be minor. Also, regional and potential monopoly effects are addressed by our firm fixed effects model.

¹⁴ Bank loans are not used in the profits model because they are correlated with leverage.

captures the difference in performance between ownership types due to unobservable group-specific characteristics. After controlling for the reform effects, α_j represents the pre-reform performance of firms in that ownership category relative to the omitted group, which is either unreformed SOEs or urban enterprises under 100% public ownership depending on the regression. Using the estimates of α_j , we investigate the role played by pre-reform performance in the selection of firms for privatization.

Although the group fixed-effects model has the advantage of discerning the pattern of selection bias, this specification imposes a strong assumption that the firms within each group have similar unobserved characteristics associated with performance outcomes. If the time-invariant performance attributes vary across firms within the group and firm fixed effects are correlated with the selection of firms for privatization, the estimates of the privatization effects, i.e. β_j , are biased and inconsistent. To examine the robustness of the estimates from Eq. (1), we estimate the effects of privatization on firm performance with a firm fixed-effects model. This model is specified as

$$P_{it} = \alpha_i + \sum_j \beta_j R_{jit} + \sum_t \delta_t YEAR_{it} + \lambda X_{it} + u_{it} \quad (2)$$

where α_i is a firm-specific fixed effect that controls for both observable, e.g. industrial or regional differences, and unobservable time-invariant attributes.

For Eqs. (1) and (2), we estimate the privatization effects by dividing the enterprises into different ownership groups. One limitation of the group-effects specification is that the number of firms in some ownership types, e.g. the group of firms under majority private ownership in the urban sector, is small; consequently, precise estimates of the privatization effects for such a group may not be obtainable. To overcome this limitation and to check the sensitivity of the estimates to privatization indicators, we introduce a third regression model in which the degree of privatization is measured by a continuous variable, i.e., the proportion of equity owned by private investors, PS_{it} . We specify:

$$P_{it} = \alpha_i + \theta_1 PS_{it} + \theta_2 PS_{it} \times TVE_i + \theta_3 PS_{it}^2 + \theta_4 PS_{it}^2 \times TVE_i + \sum_t \delta_t YEAR_{it} + \lambda X_{it} + u_{it} \quad (3)$$

where TVE_i is a dummy variable equal to one if the firm is a rural firm and zero otherwise. A concave relation between performance and the share of private ownership would imply that $\theta_1 > 0$ and $\theta_3 < 0$. The estimates of θ_2 and θ_4 discern the differences in the impact of changing mix of public and private ownership on performance between the urban and the rural enterprises. As with Eq. (2), unobservable time invariant firm attributes in Eq. (3) are controlled for as firm-specific fixed effects.

We estimate Eq. (1) by Ordinary Least Squares (OLS) and Eqs. (2) and (3) by the panel fixed-effects technique.¹⁵ Our estimates of ownership reform effects are consistent only if selection bias is dealt with appropriately. Because the data do not provide us with variables that are correlated with ownership change but not with performance or performance potentials, we are unable

¹⁵ Because our data are noisy, we also estimated Eq. (1) with the robust OLS method of Huber (1964), which reduces the weights on outliers, and obtained estimates similar to those reported for OLS. For the three productivity measures, we also assessed the impacts of ownership restructuring on performance by using a production function regression framework and found qualitatively similar results. We present the growth-based specification because it permits us to control for initial performance.

to use the instrumental variable approach to test for and control for selection bias. Instead we use group dummies or firm fixed effects to control for potential simultaneous bias of reform indicators. To examine whether this approach has addressed selection bias properly, we test the strict exogeneity of reform variables by adding the values of respective reform variables in period $t + 1$ to Eqs. (1) to (3) and testing whether the coefficients on these variables are jointly equal to zero, as Wooldridge (2002, p. 285) suggests.¹⁶ Note that we estimate the regression models assuming that the urban and the rural sectors are characterized by the same production technology. To check the sensitivity of our results, we estimate Eqs. (1) to (3) separately for each sector and find the estimates to be similar to those obtained from the combined sample. We now turn to an examination of the main estimation results.

4. The empirical results

The estimates of the regression models (1), (2), and (3) are presented in three tables in this section. The tests for strict exogeneity of the variables on ownership reforms or privatization are reported at the bottom of each table. These tests fail to reject the null hypothesis that reform or privatization indicators are strictly exogenous¹⁷ at the 5 percent level of significance in all runs except one. The test results suggest that selection bias has been controlled for adequately in all three regression models and the estimates obtained are consistent. In addition, the F statistics presented in each table show that each regression equation is highly significant with p -values approaching zero.

Although the coefficients on reform or privatization variables are our primary interest, we discuss first the estimates of the control variables.¹⁸ As expected, the initial level of performance has a significantly negative coefficient in all runs and it displays a salient trend of convergence in performance among sample firms. Also consistent with economic intuition, the estimates for loans per worker indicate that access to bank credit has significantly positive effects on the growth of value-added per worker, revenues per worker, and TFP. In addition, the estimates for leverage show that firms with a higher ratio of long-term debt to equity are less profitable. The coefficient on firm size is negative in all runs and significant at the 10 percent level or higher in some cases. Evidently, other things being equal, large firms are less productive and less profitable than small ones. The intuitive plausibility and statistical significance of the estimates for these conventional control variables reassure us of the adequacy of the model specifications. We turn now to an examination of the patterns of selection bias and the impact of reforms on firm performance.

¹⁶ Serial correlation in performance indicators also affects our ability to obtain reliable estimates of privatization effects. Bertrand et al. (2004) show that the presence of positive serial correlation can lead to severe underestimation of the standard error of the treatment effect and overestimation of t -statistics and significance levels. Thus, we estimated serial correlation coefficients of the regression residuals. The estimates we obtained indicate the presence of a low degree of negative serial correlation with the absolute value smaller than 0.10 in most of the regressions. Because the bias in t -statistics resulting from such low degrees of serial correlation is likely to be fairly small, we did not give additional attention to serial correlation. However, we did find a higher degree of serial correlation in the specifications in which the variables for labor productivity and TFP are measured by levels instead of rate of growth. We applied several methods recommended by Bertrand et al. (2004) to address concerns about serial correlation and obtained results that are not substantively different from the estimates presented in this paper.

¹⁷ In other words, the ownership or the degree of privatization in period $t + 1$ is uncorrelated with the performance indicator in period t if the initial differences between ownership types are controlled for by either group fixed effects or firm fixed effects.

¹⁸ The estimates of industrial branch and year dummies are omitted from the discussion for the sake of brevity.

To address the question of selection bias, we begin with the estimates of group effects reported in Tables 4a and 4b. The F statistics reject the hypothesis of zero group effects at the five percent level or better for two out of the four performance indicators. A portion of the group

Table 4a
Estimates of group fixed-effects model (reform effects)

	<i>Dependent variable</i>			
	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Reform effects</i>				
Ref. SOEs	0.250 (2.98)*	0.193 (2.69)*	0.263 (3.15)*	0.031 (3.52)*
Ref. UCs	-0.132 (-0.43)	-0.066 (-0.38)	-0.062 (-0.20)	0.006 (0.37)
Ref. TVEs	0.043 (0.70)	-0.039 (-0.80)	0.074 (1.22)	0.013 (1.63)
<i>Group effects</i>				
Ref. SOEs	-0.110 (-1.29)	-0.122 (-1.65)***	-0.094 (-1.11)	-0.008 (-0.79)
Un-ref. UCs	-0.029 (-0.29)	-0.031 (-0.36)	0.018 (0.19)	0.029 (2.46)**
Ref. UCs	-0.161 (-0.80)	-0.123 (-1.00)	-0.189 (-0.97)	-0.022 (-1.60)
Un-ref. TVEs	0.032 (0.37)	0.064 (0.84)	0.077 (0.97)	0.040 (3.00)*
Ref. TVEs	0.033 (0.42)	0.127 (1.64)***	0.058 (0.75)	0.031 (2.42)**
<i>Effects of covariate controls</i>				
Initial level of performance	-0.202 (-7.85)*	-0.160 (-6.48)*	-0.221 (-7.63)*	0.511 (5.54)*
Loan/worker	0.002 (4.50)*	0.002 (4.01)*	0.002 (3.92)*	-
Leverage	-	-	-	-0.0004 (-1.75)***
Firm size	-0.027 (-1.30)	0.002 (0.12)	-0.041 (-2.04)***	-0.0001 (-0.05)
Time effects	yes	yes	yes	yes
Industrial branch effects	yes	yes	yes	yes
Constant	0.735 (3.52)*	0.689 (3.89)*	0.648 (3.33)*	0.017 (0.60)
Adjusted R ²	0.12	0.11	0.13	0.368
F test on zero slope	3.62	2.40	3.98	9.25
p value	0.00	0.00	0.00	0.00
F-test	0.98	3.79	1.23	3.98
on group effects				
p value	0.43	0.00	0.29	0.00
<i>Test for strict exogeneity of reform indicators</i>				
F statistic	2.35	1.59	2.90	1.03
p value	0.07	0.19	0.03	0.38
Observations	1114	1124	1088	1123

Notes. (1) Growth in year t is the difference in the log value of a performance indicator between period t and period $t - 1$.

(2) The t statistics reported in parentheses are derived from heteroskedasticity robust standard errors.

(3) The initial level of performance is measured by the level of the respective performance indicator in period $t - 1$, i.e. the lagged value of value added in log form, revenue per worker in log form, the TFP index or profits per unit of assets.

(4) Variables for loan per worker and leverage are lagged by one period and firm size is the lagged value of total employment.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

Table 4b
Estimates of group fixed-effects model (privatization effects)

	<i>Dependent variable</i>			
	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Privatization effects</i>				
<i>Urban sector</i>				
Majority public	0.267 (3.62)*	0.237 (3.32)*	0.277 (3.76)*	0.034 (2.31)**
Majority private	0.020 (0.18)	−0.003 (−0.03)	0.034 (0.30)	0.021 (1.76)***
<i>Rural sector</i>				
Majority public	0.114 (1.44)	0.084 (1.54)	0.118 (1.48)	0.014 (1.02)
Majority private	0.020 (0.34)	−0.034 (−0.69)	0.048 (0.82)	0.008 (1.02)
<i>Group effects</i>				
<i>Urban sector</i>				
Majority public	−0.175 (−2.45)**	−0.198 (−2.87)*	−0.173 (−2.46)**	−0.015 (−1.09)
Majority private	−0.135 (−1.48)	−0.134 (−1.61)	−0.112 (−1.25)	−0.018 (−1.35)
<i>Rural sector</i>				
100% public	0.001 (0.01)	−0.041 (−0.62)	0.021 (0.25)	0.018 (1.91)***
Majority public	0.006 (0.06)	0.100 (1.53)	0.032 (0.35)	0.018 (1.47)
Majority private	0.0125 (0.18)	0.099 (1.87)***	0.020 (0.30)	0.024 (2.63)*
<i>Effects of covariate controls</i>				
<i>Initial level of performance</i>				
Loan/worker	−0.197 (−7.44)*	−0.166 (−6.48)*	−0.214 (−7.19)*	0.514 (5.50)*
Leverage	0.002 (4.43)*	0.002 (4.15)*	0.002 (3.78)*	−
Firm size	−	−	−	−0.0006 (−2.55)*
Year dummies	−0.023 (−1.20)	0.008 (0.55)	−0.040 (−2.04)**	−0.002 (−0.77)
Industry dummies	yes	yes	yes	yes
Constant	yes	yes	yes	yes
Constant	0.763 (3.77)*	0.732 (4.10)*	0.703 (3.66)*	0.037 (1.59)
Adjusted R^2	0.12	0.12	0.13	0.37
F -test on zero slope	3.61	2.32	3.83	11.04
p value	0.00	0.00	0.00	0.00
F -test	1.71	3.38	1.30	2.58
<i>on group effects</i>				
p value	0.13	0.00	0.26	0.03
<i>Test for strict exogeneity of reform indicators</i>				
F statistic	0.49	1.78	0.74	0.42
p value	0.75	0.13	0.56	0.80
Observations	1122	1122	1086	1123

Notes. (1) Growth is the difference in the log value of a performance indicator between period t and period $t - 1$.

(2) The t statistics reported in parentheses are derived from heteroskedasticity robust standard errors.

(3) Loan per worker and leverage are lagged by one period; firm size is the lagged value of the log of total employment.

(4) The initial level of performance is measured by the level of the respective performance indicator in period $t - 1$, i.e. the lagged value of value added in log form, revenue per worker in log form, the TFP index or profits per unit of assets.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

heterogeneity in performance is attributable to the longstanding gap between the two types of public enterprises. For example, rural TVEs are more productive in terms of sales revenue per worker and more profitable than are the urban SOEs and collectives. However, our primary in-

terest in group effects is to see if pre-reform performance is a characteristic on which the firm is selected for restructuring or for being transformed to a particular type of ownership. From the group fixed-effects estimates, we calculate the performance gap between firms with different ownership structure due to unobservable group attributes and present these estimates and their *t*-statistics in Table 5. From the estimates derived from the reform-effects regression, the SOEs and UCs that were picked for reform are among the firms with worse pre-reform performance records within the sector. Evidently, the pre-reform rates of growth are significantly lower for subsequently reformed SOEs at -12.2 percent in revenue per worker, relative to SOEs that are never reformed. Moreover, a significantly smaller profit per unit of assets at -5.1 percent is observed for the eventually reformed UCs prior to their restructuring. In contrast, no significant pre-reform performance gap in any performance measures is found between the reformed and unreformed TVEs.

The conjecture that the ownership reform in the urban sector was targeting the worse performing firms is supported also by the privatization-effects regressions. The estimates on the group dummy for urban majority public owned enterprises, which is significant at the five percent level, imply that the pre-privatization growth of those firms was lower by 17.5 percent in value-added per worker, by 19.8 percent in revenue per worker, and by 17.3 percent in TFP than the growth in the urban enterprises that remained 100 percent publicly owned. Pre-reform growth is also lower by all measures for urban enterprises that subsequently become majority privately owned than for the never privatized urban enterprises, although none of the performance differentials is statistically significant. The pre-reform productivity records of the majority privately owned enterprises are better than those of the minority privatized enterprises, although the differences are again insignificant. Turning to the rural enterprises and comparing eventually privatized TVEs with those remaining 100 percent publicly owned, we find that the privatized TVEs are more productive and more profitable than those remaining 100 percent publicly owned, although the gap is significant only for the measure of revenue per worker.

The estimates of selection bias provide confirmation of the contrast in privatization strategies between the urban and rural sectors. Policymakers overseeing the urban sector reforms evidently began by targeting the enterprises that had been performing or would perform most poorly without privatization. Gupta et al. (2001) argue that this strategy is Pareto efficient because it maximizes the efficiency benefits of privatization while keeping its social costs at a minimum. Although those authors find that the efficient and the politically expedient path often differed in Eastern Europe, the policy of privatizing less-efficient firms first may have minimized the political costs of privatization in China. Having already lost much of their economic security and many of their benefits, the workers in loss-making enterprises that had difficulty paying wages on time are likely to have been supportive of privatization. In contrast to the urban reform strategies, the rural sector shows no systematic relationship between pre-reform performance and privatization. The small scale of many rural firms may have made it feasible to privatize even more successful enterprises without offering deep price discounts. The lack of effective resistance to privatization from rural workers may also have made it easier for local leaders to divest most of the TVEs over a short period of two or three years, in response to the central policy of “let go of the small.”

To examine the impact of privatization on firm performance, we first consider the differences in reform effects for the group fixed-effects regressions. The estimates in Table 4a indicate that ownership restructuring has significant positive effects on the performance of reformed SOEs according to all four efficiency indicators at the one percent level. Taking the point estimates, ownership reform raises the annual rate of growth by 25.0 percent for value-added per worker, 19.3 percent for sales revenue per worker, and 26.3 percent for TFP, and it increases profit per

Table 5
Tests for differential group effects

	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Tests based on reform-effects regressions</i>				
H ₀ : reformed SOEs—unreformed SOEs = 0				
performance gap	-0.110	-0.122	-0.096	-0.008
<i>t</i> -statistic	(-1.29)	(-1.65)***	(-1.11)	(-0.79)
H ₀ : reformed UCs—unreformed UCs = 0				
performance gap	-0.132	-0.092	-0.208	-0.051
<i>t</i> -statistic	(-0.54)	(-0.52)	(-0.87)	(-2.67)**
H ₀ reformed TVEs—unreformed TVEs = 0				
performance gap	0.002	0.063	-0.020	-0.009
<i>t</i> -statistic	(0.00)	(1.38)	(-0.35)	(-1.42)
<i>Test based on privatization-effects regressions</i>				
<i>Urban enterprises:</i>				
H ₀ : majority public—100% public = 0				
performance gap	-0.175	-0.198	-0.173	-0.016
<i>t</i> statistic	(-2.45)**	(-2.87)*	(-2.46)**	(-1.09)
H ₀ : majority private—100% public = 0				
performance gap	-0.136	-0.134	-0.112	-0.018
<i>t</i> statistic	(-1.48)	(-1.61)	(-1.25)	(-1.39)
H ₀ : majority private—majority public = 0				
performance gap	0.039	0.064	0.061	-0.002
<i>t</i> statistic	(0.44)	(0.76)	(0.69)	(-0.10)
<i>Rural enterprises:</i>				
H ₀ : majority public—100% public = 0				
performance gap	0.004	0.141	0.011	0.009
<i>t</i> statistic	(0.00)	(1.99)**	(0.10)	(0.10)
H ₀ : majority private—100% public = 0				
performance gap	0.012	0.139	0.001	0.006
<i>t</i> statistic	(0.14)	(2.35)**	(0.00)	(0.81)
H ₀ : majority private—majority public = 0				
performance gap	0.008	-0.002	0.010	-0.006
<i>t</i> statistic	(0.10)	(0.00)	(0.14)	(0.75)

Notes. (1) The estimates and tests presented in this table are derived from the OLS estimates of the group-effects model presented in Table 4.

(2) The *t* statistics reported in parentheses are derived from heteroskedasticity robust standard errors.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

unit of assets by 3.1 percent. These large estimates are compatible with the findings of some empirical studies on transition economies. Frydman et al. (1999) reports that privatization increased the annual rate of growth of revenues per worker by 16.4 percent for the firms that were privatized to private financial institutions in the Czech Republic, Hungary, and Poland. Brown et al. (2003) estimate that total factor productivity in privatized firms increased by about 14 percent in Hun-

gary and 33 percent in Romania in the post-privatization period. In contrast to the pronounced positive effects observed in the state sector, none of the estimates on efficiency indicators for the urban collectives and the rural TVEs are found to be statistically significant.

Whereas the estimates presented in [Table 4a](#) shed light on the average effects of changes in ownership categories for each of the three types of public enterprises, the regression results in [Table 4b](#) permit inferences to be drawn regarding the relationship between firm performance and the proportion of ownership in private hands. These estimates document positive effects of the shift from wholly public ownership to majority public ownership in the urban sector that are statistically significant at the five percent level or better for all performance measures. The point estimates imply 26.7 percent higher growth in value-added per worker, 23.7 percent higher growth in revenues per worker, and 27.7 percent higher growth in TFP, and 3.4 percent higher profits per unit of assets for the urban enterprises that shifted to partial but not majority private ownership relative to their pre-privatization performance. For all measures except revenue per worker, the estimates also show positive reform effects for the urban enterprises owned primarily by private investors, although only the effect on profitability is moderately significant. Turning to the rural enterprises, privatization is found to have a positive effect on firm performance for both majority public and majority privately owned enterprises in all cases except revenue per worker for majority privately owned firms, although none of these estimates are statistically significant. For both urban and rural sectors, the effect of privatization is numerically larger for majority publicly owned enterprises than for the majority privately owned ones.

The regressions presented in [Tables 4a and 4b](#) control for selection bias at the group level. However, the group fixed-effects model does not control for selection bias resulting from heterogeneity in unobservable productive attributes within the group. The estimates of the firm fixed effects models reported in [Tables 6a and 6b](#) eliminate the possibility of this type of selection bias. Similar to those for group-level controls, the estimates presented in [Table 6a](#) show that the ownership reform has significant, positive effects on the growth in value-added per worker at 25.0 percent, on revenue per worker at 13.1 percent, and on TFP at 28.9 percent and also on the level of profits per unit of assets at 3.7 percent, for the reformed SOEs. Moreover, [Table 6b](#) indicates that the post-privatization performance of partially privatized but still majority publicly owned urban enterprises is significantly better by 18.4 percent for growth of value-added per worker, by 20.2 percent for growth of revenue per worker, by 20.0 percent for growth of TFP and by 4.9 percent for level of profits per unit of assets. The results of the firm fixed-effects regressions confirm that the shift from wholly public ownership to one dominated by private investors does not have any significant impact on performance among urban enterprises. However, the firm fixed-effects model in [Table 6a](#) provides a different interpretation of the effects of reform on the UCs and the TVEs. For the reformed UCs, we find statistically significant estimates of lower post-reform growth in value-added per worker and TFP. For the reformed TVEs, the estimates in [Table 6a](#) show higher post-reform growth in TFP of 11.6 percent and a post-reform level of profits higher by 2.1 percent. Moreover, the estimates in [Table 6b](#) show higher growth in revenues per worker of 15.3 percent for the partially privatized but still majority publicly owned rural enterprises and higher growth in profits of 2.2 percent for rural enterprises that became majority privately owned. However, the magnitude of the privatization effects in the TVEs is small relative to those in the reformed SOEs and those for the majority publicly owned urban enterprises. The smaller efficiency gains from ownership reforms in the rural sector are consistent with the common perception that TVEs operated closer to the production frontier than did SOEs and UCs prior to the reform.

Table 6a
Estimates of firm fixed-effects model (reform effects)

	<i>Dependent variable</i>			
	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Reform effects</i>				
Ref. SOEs	0.250 (2.76)*	0.131 (1.77)**	0.289 (3.23)*	0.037 (3.02)*
Ref. UCs	-0.403 (-1.89)***	-0.274 (-1.52)	-0.392 (-1.88)***	0.013 (0.42)
Ref. TVEs	0.062 (1.00)	0.015 (0.29)	0.116 (1.89)*	0.021 (2.36)**
<i>Effects of covariate controls</i>				
Initial level of performance	-0.681 (-22.01)*	-0.592 (-20.36)*	-0.686 (-22.24)*	0.130 (4.11)*
Loan/worker	0.002 (3.11)*	0.002 (2.63)*	0.002 (2.23)**	–
Leverage	–	–	–	-0.0005 (-1.49)
Firm size	-0.090 (-1.47)	-0.084 (-1.63)***	-0.094 (-1.54)	-0.001 (-0.13)
Time effects	yes	yes	yes	yes
Constant	2.357 (6.11)*	2.857 (8.29)*	1.885 (5.08)*	0.039 (0.77)
<i>F-test for zero slope</i>				
F statistic	42.91	36.59	44.13	5.06
p value	0.00	0.00	0.00	0.00
<i>Test for strict exogeneity of reform indicators</i>				
F statistic	1.07	1.62	1.32	0.63
p value	0.36	0.18	0.27	0.59
Observations	1114	1124	1088	1123

Notes. (1) Growth in year t is the difference in the log value of a performance indicator between period t and period $t - 1$.

(2) The t statistics are reported in parentheses.

(3) The initial level of performance is measured by the level of the respective performance indicator in period $t - 1$, i.e. the lagged value of value added in log form, revenue per worker in log form, the TFP index or profits per unit of assets.

(4) Loan per worker and leverage are lagged by one period.

(5) Firm size is the lagged value of total employment in log form.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

The estimates in Tables 4 and 6 correspond to Eqs. (1) and (2), in which the degree of privatization is measured categorically. Table 7 presents estimates of Eq. (3), which is a specification using a continuous indicator for privatization, obtained by panel fixed-effects estimation. For the urban enterprises, the estimates of all four regressions have positive coefficients on the proportion of equity owned by private individuals and negative coefficients on the squared private equity share. These estimates, all of which are significant at the five percent level or higher, suggest that the efficiency impact of privatization is increasing in private ownership at a decreasing rate for the urban enterprises. From these estimates, the proportion of private ownership that maximizes the efficiency gain of privatization for the urban enterprises is 41.1 percent for value-added per worker, 43.3 percent for revenue per worker, 42.5 percent for TFP, and 56.0 percent for profits. These results are consistent with the suggestions in Tables 4b and 6b that privatization is more effective in raising productivity for the urban sector when the transformation is to minority rather than to majority private ownership.

Table 6b
Estimates of firm fixed-effects model (privatization effects)

	<i>Dependent variable</i>			
	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Privatization effects</i>				
<i>Urban enterprises</i>				
majority public	0.184 (2.05)**	0.202 (2.70)*	0.200 (2.29)**	0.049 (3.88)**
majority private	−0.175 (−1.31)	−0.101 (−0.91)	−0.154 (−1.15)	0.019 (1.01)
<i>Rural enterprises</i>				
majority public	0.128 (1.49)	0.153 (2.12)**	0.096 (1.14)	−0.004 (−0.38)
majority private	0.043 (0.66)	0.015 (0.28)	0.092 (1.44)	0.022 (2.46)*
<i>Effects of covariate controls</i>				
Initial level of performance	−0.681 (−21.91)*	−0.594 (−20.40)*	−0.683 (−21.98)*	0.124 (3.92)*
Loan/worker	0.002 (3.23)*	0.002 (2.87)*	0.002 (2.30)**	–
Leverage	–	–	–	−0.0007 (−1.89)***
Firm size	−0.128 (−2.07)**	−0.096 (−1.86)***	−0.137 (−2.24)**	−0.007 (−0.81)
Year dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Constant	2.569 (6.67)*	2.909 (8.47)*	2.124 (5.72)*	0.071 (1.42)
<i>F-test of zero slope</i>				
F statistic	39.13	34.26	39.74	5.35
p value	0.00	0.00	0.00	0.00
<i>Test for strict exogeneity of reform indicators</i>				
F statistic	0.51	1.59	0.69	0.14
p value	0.73	0.17	0.59	0.96
Observations	1112	1122	1086	1121

Notes. (1) Growth is the difference in the log value of a performance indicator between period t and period $t - 1$.

(2) The t statistics, reported in parentheses, are derived from heteroskedasticity robust standard errors.

(3) Loan per worker and leverage are lagged one period. Firm size is the lagged value of the log of total employment.

(4) The initial level of performance is measured by the level of the respective performance indicator in period $t - 1$, i.e. the lagged value of value added in log form, of revenue per worker in log form, of the TFP index or profits per unit of assets.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

One possible concern is that firms under different types of ownership have different incentives to under- or over-report revenues and profits. For example, private owners might understate profits to avoid taxes, while managers of public firms might overstate profits if their pay, bonuses, or career prospects are favorably affected by this measure.¹⁹ In this scenario, our results for the performance of partly or wholly private compared with wholly public enterprises would be biased downward, so that our qualitative findings on the favorable effects of privatization are not placed in doubt by it. However, if the degree of understatement of revenues and profits is increasing in the proportion of private ownership, our findings that partial privatization is better than full

¹⁹ We thank one of the referees for this point.

Table 7
Estimates of firm fixed-effects model (by share of private ownership)

	<i>Dependent variable</i>			
	Growth of value-added per worker	Growth of revenues per worker	Growth of TFP	Value of profits/assets
<i>Private ownership effects</i>				
Private share	1.159 (2.61)*	1.122 (3.02)*	1.323 (3.00)*	0.175 (2.80)*
Private share ²	-1.409 (-2.94)*	-1.291 (-3.22)*	-1.556 (-3.30)*	-0.155 (-2.30)**
Private share × TVE	-0.758 (-1.33)	-0.503 (-1.05)	-1.026 (-1.83)**	-0.173 (-2.15)**
Private share ² × TVE	1.057 (1.75)**	0.693 (1.36)	1.365 (2.30)**	0.185 (2.16)**
<i>Rural enterprises</i>				
Private share	0.401 (1.05)	0.618 (1.93)**	0.297 (0.80)	0.002 (0.01)
Private share ²	-0.352 (-0.352)	-0.599 (-1.87)**	-0.191 (-0.52)	0.029 (0.55)
<i>F-statistics for H₀: the coefficients on private share and private share² are jointly equal to zero:</i>				
F statistic	0.75	1.88	1.50	5.81
p value	0.47	0.15	0.22	0.00
<i>Effects of covariate controls</i>				
Initial level of performance	-0.682 (-21.93)*	-0.594 (-20.45)*	-0.684 (-22.06)*	0.120 (3.77)*
Loan/worker	0.002 (3.170)*	0.002 (2.80)*	0.002 (2.31)**	-
Leverage	-	-	-	-0.0006 (-1.84)**
Firm size	-0.126 (-2.04)**	-0.094 (-1.82)**	-0.134 (-2.21)**	-0.006 (-0.70)
Year dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
Constant	2.564 (6.66)*	2.905 (8.46)*	2.119 (5.72)*	0.067 (1.35)
<i>F-test of zero slope</i>				
F statistic	39.23	34.24	40.14	5.18
p value	0.00	0.00	0.00	0.00
<i>Test for strict exogeneity of reform indicators</i>				
F statistic	0.36	1.32	0.36	0.42
p value	0.84	0.17	0.84	0.80
Observations	1112	1122	1086	1121

Notes. (1) Growth is the difference in the log value of a performance indicator between period t and period $t - 1$.

(2) The t statistics are reported in parentheses.

(3) For rural enterprises, the estimate of private share and private share² is, respectively, the sum of the coefficient on private share and the coefficient on private share multiplied by TVE dummy and the sum of the coefficient on private share² and the coefficient on private share² multiplied by TVE dummy, respectively.

* Significance levels of 1%.

** Idem, 5%.

*** Idem, 10%.

privatization could be spurious. Since we are unable to determine the degree or even to be sure of the presence of such bias in our data, we can only raise this point as a caveat. The fact that reported profitability is highest for majority private firms suggests that under-reporting may not have been too severe.²⁰

²⁰ If both the findings on productivity and those on profitability are accurate, private ownership may be more effective in relieving the enterprise of social and private demands from government officials or in reducing workers' demand for

If our estimates are reliable, state ownership appears to play a positive role at an early stage of the privatization process in Nanjing, and a gradual withdrawal of state ownership is preferable to more abrupt privatization. However, we find that the degree of privatization in a typical urban enterprise is well below the level that maximizes the efficiency gain as the mean value of the proportion of private equity ownership for the urban enterprises in 2001 stands at only 25.4 percent. The estimates of the gap between the optimal private share and its current mean range from 18.5 to 29.6 percent depending on efficiency indicators used but they are all highly significant.²¹ Our results suggest strongly that the privatization of urban public enterprises was subject to economic and political constraints, as we discussed in Section 2. Using these estimates, we can calculate the gains from privatization. Given that the mean value of the private share of the urban enterprises rose from zero at the beginning of the period to 25.4% in 2001, privatization has increased profits per unit of assets by 3.4%, the annual rate of growth of value-added per worker by 20.3 percent, the growth of revenues per worker by 20.2 percent, and the growth of TFP by 23.6 percent. Although the gain achieved already is sizeable, closing the gap entirely would have resulted in further improvement in firm performance of 3.5 percent for growth of value-added per worker, 4.2 percent for growth of revenues per worker, 4.6 percent for growth of TFP and 1.5 percent for profitability.²²

Finally, we examine the privatization effects on the rural enterprises, which are derived as the sums of the coefficients on the private ownership indicator and on that indicator interacted with the TVE dummy variable, including squared terms. A concave relationship between firm performance and the degree of privatization is also observed in the rural sector for the three productivity measures. The estimates of the coefficients on private share and squared private share have the same sign pattern as they do for urban enterprises. However, except for revenues per worker, none of these estimates are individually significant. To assess the impact of privatization, we perform *F* tests on the null hypothesis that the coefficients on private share and squared private share are jointly equal to zero in the four regressions. We are unable to reject this hypothesis at any conventional level of significance, except in the profits equation in which it has a significance level of one percent level. Consistent with some estimates of Eq. (2), significant positive effects in the privatized rural enterprises are evident only for profits. In the profits regression, the fact that the coefficients on the level of the private share as well as the squared private share are positive implies a corner solution in which profits are maximized at 100 percent private ownership.

5. Conclusion

In this paper, we consider ownership reform in urban and rural enterprises in Nanjing municipality and its environs using data from 165 enterprises covering the years 1994 to 2001. We focus on the effects of ownership change on performance and on differences in pre-reform performance between firms that were privatized and those that were not privatized. We report evidence on the impacts of the recent privatization wave in China, on which enterprises were selected for privatization, and on the impact of differences in the degree of private ownership

higher wages than in raising technical efficiency. In other words, productivity advantages may have been associated with a certain amount of state ownership in late 1990s Nanjing, but the financial benefits from these advantages may have been offset at a certain point by higher social burdens or stronger insider influences.

²¹ The test results are not reported.

²² The gains remaining to be reaped are small because of the concavity of the performance measures with respect to the share.

on productivity and profits. Based on this integrated survey, we are able to contrast directly the reforms in urban and rural firms. Our results indicate a marked difference in reform strategies. Although we find no systematic relationship between pre-reform performance and the likelihood of privatization among rural enterprises, the urban enterprises that performed worse before reform were more likely to be privatized in contrast to the experiences in transition economies in Central and Eastern Europe.

Our results also show that the effects of ownership rights reforms on firm performance vary across different types of firms. The change of ownership classification has significant positive effects for SOEs by all measures and for TVEs by some measures, but it has no significant impact for UCs. Among reformed urban enterprises, those in which private ownership accounts for less than 50 percent of shares perform better than those in which the majority of shares are owned privately, although this may be due to reporting bias. An inverted-U shaped relationship between the degree of privatization and productivity is found among reformed rural enterprises; however, the effects of privatization are more ambiguous for rural firms than for SOEs. One explanation for this difference may be that SOEs experienced softer budget constraints and more politically motivated interventions before reform than did TVEs so that they had more to gain from ownership reform. These contrasting findings for the rural and urban reforms are consistent with the approach taken by China to market-oriented reforms that emphasizes gradual experimentation at the local and sectoral levels, as discussed by Gelb et al. (1993). This strategy enabled local leaders to design and implement policy initiatives flexibly and permitted diversity in institutional changes. In the Nanjing area, the more rapid and complete privatization of rural firms, without much reference to prior performance, contrasts with the slower and less complete privatization of urban firms in which weaker performers were chosen first. Hence, we have an illustration of the Chinese approach to privatization, which shares some advantages for social and economic stability with earlier reforms.

Although our results suggest that partial privatization could serve as an effective interim strategy, most reformed SOEs in the urban sector still had not achieved the level of private ownership at which the gains in productivity and profits are maximized in the last year of our survey. Perhaps the shortage of private buyers or financing or the reluctance of officials to privatize given the resistance from urban workers can explain this finding. However, Jefferson et al. (2005) show that the share of private ownership tends to rise not by the liquidation of government asset-holding but by the addition of new private equity so that the process of privatization may be an incremental one, which still had much progress to make at the end of 2001. The relative dearth of outside ownership has meant that privately owned shares are held mostly by managers and workers in both rural and urban firms. Although we did not attempt to compare the performance of firms having more inside ownership with those having more outside owners, partly due to the limited variation on this dimension in our sample, our results counter the worst-case arguments that privatization to insiders may be worse than no privatization at all. In fact, we see improvements on the order of 11 to 20 percent for productivity and 3.4 percent for profits in privatized urban firms.

Regarding the limitations of our study, we cannot rule out the possibility that the desire to under-report revenues may increase with the degree of private ownership so that such systematic reporting errors may bias our comparison of privatization effects between majority public and majority private firms. We are able to control for location and for variation in monopoly power by firm and period fixed effects only. Moreover, although our dataset is unusually rich in information about the privatization process, only one municipal area is included in a country exhibiting considerable regional variations. Clearly, further data collection and analysis are needed.

Nonetheless, this paper is a contribution to the broader effort to understand the vast and complex process of industrial reforms in China.

Acknowledgments

This research was carried out with aid of grants from the William Davidson Institute at the University of Michigan Business School, University of Winnipeg, and Brown University. We would like to thank the Editor and two anonymous referees for their helpful comments and suggestions.

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