Saving or stripping rural industry: an analysis of privatization and efficiency in China

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Abstract

This paper describes the process of privatization of China's Township Enterprises. Findings from a recent field survey by the authors show how far privatization has proceeded and how it has affected firm performance. The pervasiveness and impact of privatization are readily apparent. The privatization in the mid-1990s was deep and fundamental. More than 50% of local government-owned firms have transferred their shares to the private sector, partially or completely. Privatization is widespread, regardless of what definition we use (share shifting, controlling interest shifting, or complete). Although we do not find any evidence in our descriptive statistics that private and privatized firms outperform government ones, the private sector does appear to be beginning to manage its firms (e.g., labor and inventories) somewhat differently. Our multivariate analysis, however, finds a positive impact of privatization on technical efficiency. Efficiency of China's rural industries, including agro-industrial firms, would rise, if township enterprises privatized. The impact of privatization, however, does not occur immediately. Transitional costs apparently reduce private firm efficiency in the year that firms are being privatized. It is possible to surmise that as privatized firms complete their ownership transition and continue to learn how to adapt to China's business environment that the gains could rise further. However, we cannot say if the gain in efficiency is enough to make rural industries competitive in the future. © 2000 Published by Elsevier Science B.V.

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1. Introduction

China's Township and Village Enterprises (TVEs), including rural industries participating in the agro-industrial sector, drove growth during the first 15 years of China's reform (Rozelle and Boisvert, 1994). The growth of TVEs, however, has slowed since 1993. The share of the national industrial output contributed by TVEs grew much slower than other subsectors in the rural economy, expanding only 5% points while private firms grew from 10 to 26%.

As China puts together the tenth 5-year plan and struggles with ways to pull out of the current recession, a fierce debate has arisen regarding the future role that TVEs should be expected to play in the recovery of the general economy and specific sectors in the coming years (Dang, 1999; Jiang, 1999; World Bank, 1999). On one side, researchers argue that the recent slow growth of TVEs is a signal of their inefficiency. Rural industry is not worth saving. Especially in industries such as those in the agro-industrial sector which traditionally have had its roots in urban regions,

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rural industries are not needed. Privatization merely legitimizes asset stripping and programs to support the transition to new ownership forms is just another way to get access to government or bank funds and these "reforms" will not lead to greater efficiency (Lu, 1998; PBC, 1998; Sun, 1998).

In contrast, another group of academics and policy makers believe rural industries have an important role to play in China's economic future and the future of agro-industrialization (Du, 1999). The sluggish current performance actually can be interpreted as a direct consequence of rural industry's past success. Along with the rest of the sluggish domestic and external economy, rural industries are only going through the trough of a business cycle and the current rash of bankruptcies is part of a healthy shakedown. The responsiveness of the sector has shown its ability to evolve and remain competitive in the past (Chen and Rozelle, 1999), and the recent move towards privatization may be more evidence of its continued flexibility (Jin and Qian, 1998).

The general goal of our paper is an attempt to contribute information that will help illuminate the main issues that are being debated about the past, current, and future success of rural industry. We have three specific objectives. First, we want to describe the privatization process that is currently underway in rural China. Second, we want to understand the economic forces that push firms to privatize. Finally, we want to assess the impact of the movement on firm performance. In the pursuit of the latter two objectives, our empirical work will test three hypotheses: (1) privatization is the result of pressures that are associated with changes in financial and product markets; (2) privatization of rural industrial firms in rural China leads to a rise in efficiency; (3) human capital characteristics of the manager are an important factor in the rise of efficiency of rural firms. We believe if there is evidence that shifts in ownership are leading to greater efficiency, there is greater reason to support the reforms and search for policies that will make rural industries even more productive. Our work examine the rural industrial sector, in general, but since such a large part of agro-industrialization is in the rural sector and such a large part of rural industry's output has come from agro-industries, our analysis, which does not differentiate among sectors, is still relevant.

2. China's agro-industrial sector and our survey

During the past 20 years, China's agricultural sector has become more market-oriented and commercialized. In addition to the many other trends (World Bank, 1999), the agro-industrial sector has begun to emerge as a vibrant sector. In accordance with China's classification standards, agro-processing includes activities in food, drink, tobacco processing, textile, clothing and leather, timber and timber products, including furniture manufacturing, paper and paper processing, printing and publication, and rubber processing.

The agro-industrial sector's growth rate during the reform period (1978–1999) has increased and nearly maintained its proportion of industrial output, despite the emergence of a number of other modern industrial sectors (ZGTJNJ, 1980–1998). In the pre-reform period, the three main subsectors in the agro-industrial sector — food, textiles, and paper — grew by 7% annually. While respectable in the context of many developing countries, the growth of the three industries was 4% points less than industry as a whole and 2% points less than light industry's average growth rate. After 1978, however, the sector almost doubled its annual growth rate to more than 14%. Moreover, while many countries experienced a declining importance of agro-industries during this stage of development, in China between 1988 and 1996, during the height of the nation's industrial expansion, agro-industry's share of total industrial output stayed around 30% (Du, 1999).

One of the most unique characteristics of China's development is that rural industry produced about 45% of the output of the agro-processing subsector in 1997, although some subsectors have more rural participation than others (Du, 1999). China's emphasis on consumer products in the early 1980s, the period in which TVEs were most encouraged, in part accounts for this high percentage over all (Huang, 1999). However, because of the remaining influence of socialist planning when food processing was located close to the city, the destination for most of the processed food, more than 70% of food processing is still in urban areas. In contrast, a much higher proportion of later-developing, consumer-oriented industries, such as clothing (70%) and furniture manufacturing (more than 80%), is located in the rural sector.

The concentration of industries regionally also varies across China, and may in part account for the low percentage of agro-processing firms in our sample of firms which were randomly selected from firms in two east coast provinces. While the presence of food processing firms are largely concentrated in the east (including urban and rural firms), in some subsectors, a large and growing proportion are in the central and western regions of the country (such as food processing). Only 16% of our study's sample firms belonged to the agro-industrial sector. The firms, however, do account for more than 20% of the aggregated output of sample firms. [1]

2.1. The survey and the data

To understand the privatization process of the agro-industrial and other sectors and to help illuminate issues central to the debate on the future of rural industry, we conducted a survey of 168 enterprises in 15 counties in Jiangsu and Zhejiang Provinces, two of China's better off-coastal provinces, one that is north of Shanghai and the other that is south. The survey concentrated only on township enterprises (TEs) and focused on the period from 1994 to 1997. We chose 1994 as the initial year of our inquiry because most privatization has occurred since the mid-1990s.

The sampling procedure was designed to ensure we randomly chose a diverse and broad-based set of sample regions. We drew eight counties from Jiangsu Province and seven counties from Zhejiang Provinces after stratifying all of the counties in each province into three income groups. Within each county, we chose four townships also by stratifying on the basis of income. In total, we conducted surveys in 59 townships. Firm selection also followed several pre-defined rules to ensure we had a sample of firms that would facilitate our analysis.

The firm survey form includes two main parts, a set of tables to collect a comprehensive set of financial accounting data that was filled in by the firm accounting staff, and a sit-down survey with the firm manager. The manager survey focused on collecting detailed in-

formation about ownership, property rights, corporate governance, production and marketing activities, and the human capital characteristics of the manager. Four years of data for all key variables were collected on each firm, either from recollection or firm records.

3. The process of privatization and increased efficiency in China

Privatization in rural China, in both the TE sector, in general, and agro-industrial sector, in particular, is a complex process that involves the shift of control and alienation rights from the township leadership to an individual. The shift is one of degree, sometimes involving the complete transfer of rights, and other times, partial. Most typically, privatization is the sale of *all or part* of the firm to one owner (usually the old manager of the firm) or to several owners (sometimes, though not always, including the employees). In some cases, the firm is purchased during an auction. Most frequently, the buyer negotiates with a designated representative of the township leadership.

The process of negotiation is very time consuming. During our interviews in privatized firms, managers could still vividly describe the process of negotiation. The most frequent comments were about how long the discussions lasted, the red tape that was sometimes forced on them by township officials, and the general disruption that occurred during the process. An average evaluation takes 26 days, during which an evaluation team composed of township officers, county officers, and CPAs stay in the firm, read all the accounting records, and evaluate the firms assets. To negotiate the best deal, firm managers told us that they virtually spend their entire time preparing for and participating in the evaluation. The manager also needs to allocate time and effort into arranging finance for the new firm. According to our data, an average manager pays 838 000 yuan for his own shares of the firm. About half of this money is borrowed from the bank, a government agency, or other individuals.

Depending on the extent of the shift of control and alienation rights, it is possible to define three types of privatization. Under the first definition of privatization (privatization definition 1 — called "share shifting privatization"), a privatized firm is any TE in 1994 (fully owned; those with majority share; those with

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[1] Of our sample firms, the following industries accounted for the following percentages of firm numbers: textiles, 8%; food processing, 2%; leather and clothing, 2%; others, 4%.

minority share) that shifted any part of its shares to private individuals. Under the second definition (privatization definition 2 — called "controlling-interest shifting privatization"), a privatized firm is any TE in 1994 (fully owned; those with majority share) that transferred enough shares to private individuals to give them a majority share. Under the third (privatization definition 3 — "complete privatization"), a privatized firm is any TE (fully owned; those with majority share; those with minority share) that shifted all of its shares to private owners. In a complete privatization, township leaders dispose of all of their formal ownership interests in the firm.

Depending on the definition, the scope of the firms that are classified as township and those that are private differs. When using a share shifting definition (under privatization definition 1), a TE includes only those firms with 100% controlling interests held by the township and a private enterprise includes those with any shares held by private individuals. In the rest of the paper, we focus primarily on share shifting as our definition of privatization, although it is understood that in some cases (about 5% of the "privatizations") the firm remains under the control of township leaders since they have retained a majority position in the firm.

3.1. Privatization in rural China

According to our data, in the early 1990s, leader-owned TEs dominated the rural landscape. In 1994, of the 168 firms in the sample, the township fully owned 134 firms. Private owners partially owned four firms jointly with township leaders and fully owned 30 of them. Hence in 1998, about 82% of these firms were fully or partially township owned and only 18% were fully private.

In the last 5 years, however, rural firms have experienced a dramatic move away its traditional collectively owned type of enterprise. Between 1994 and 1997, 88 firms privatized, all but one of them originally a fully owned TE. The number of fully private firms more than tripled from 30 to 93. There was almost no difference in the privatization of agro-industrial firms when compared to the sample as a whole.

The proportion of number of firms undergoing privatization is striking (Table 1). Using the share shifting definition, the broadest measure of privatization, more than 52% of the sample firms became private (column 1). Although the proportion of firms privatizing grows progressively less as the definition becomes more restrictive, considering only firms that became 100% private, 34% privatized (column 3).

Table 1
Ownership structure of industry *after privatization* under alternative definitions of privatization in 59 sample townships in Jiangsu and Zhejiang provinces, 1997[a]

Firm type	Proportion of firms in each type of privatization category		
	Share shifting (privatization definition 1)[b]	Controlling interest shifting (privatization definition 2)[b]	Complete (privatization definition 3)[b]
Township enterprises[c]	28	34	48
Privatized	52	47	34
Always private[d]	20	19	18

[a] Source: authors' data.

[b] Under privatization definition 1 (henceforth "share shifting privatization"), a privatized firm is any township enterprise (TE) in 1994 (fully owned) that shifted any part of its shares to private individuals. Under privatization definition 2 (henceforth "controlling-interest shifting privatization"), a privatized firm is any TE in 1994 (fully owned; those with majority share) that transferred enough shares to private individuals to give them a majority share. Under privatization definition 3 (henceforth "complete privatization"), a privatized firm is any TE (fully owned; those with majority share; those with minority share) that shifted all of its shares to private owners, and has hence lost all of its ownership interest in the firm.

[c] Under privatization definition 1, a TE includes only those firms with 100% controlling interests held by the township. Under privatization definition 2, a TE includes all firms in which the township holds a majority of the shares. Under privatization definition 3, a TE includes all firms with any shares held by the township.

[d] Under privatization definition 1, a private enterprise includes firms with any shares held by private individuals. Under privatization definition 2, a private enterprise includes all firms in which private individuals hold a majority of the shares. Under privatization definition 3, a private enterprise includes only those firms with 100% controlling interest held by private individuals.

The ownership of private individuals, especially management, increases sharply during the privatization movement. The government share of the firms that were privatized between 1994 and 1997 (according to the share shifting definition) fell from 85 to 30%. Managers of the firms increased their personal shares the most, rising from 11 to 48%. Other individuals, including workers and outside investors, increased their holdings in the privatized firms from 4 to 22%.

3.2. Comparing performance indicators

To examine the impact of privatization, we use the change in four financial indicators: revenue to employment ratio; revenue to capital ratio; profit to employment ratio; profit to capital ratio. The 1994 level of the performance indicator for each firm was deducted from the 1997 level. Although these are partial measures of efficiency, we are trying to see if such performance indicators of privatized firms increase slower or faster than those of township-owned enterprises. We also examine several management variables, such as changes in accounts receivables and layoffs.

Descriptive analysis with the partial productivity measures provides no clear evidence of superior performance by private firms, including those in the agro-industrial sector. Point estimates of all four financial indicators actually show township firms outperforming private firms when using the complete control definition of privatization. When using the other definitions, TEs do best in five out of the eight

comparisons. We carried out a two-sided t-test between the mean of TE and the mean of privatized TEs (private firms), and results are reported in the last two rows of Table 2. All tests are accepted at 5% significance level that the pairs are equal. TEs and privatized TEs perform nearly the same according to these measures.

Even if there is no evidence of immediate improvement to measures of partial efficiency, there might still be some positive steps taken by managers of privatized firms that could lead to better performance in the longer run (see Li, 2000 for the figures that support these statements). Because of the trouble many managers in our sample and elsewhere have had in collecting accounts receivables, we look at the proportion of this "asset" as a percentage of total working capital. In contemporary China, when this ratio is high it is a sign that the firm will be having difficulty in the future. Frequently, accounts receivables never get repaid and often become bad debt. In more extreme cases, receivables are created when money is "loaned" illicitly to a friend or colleague who have no intention of paying it back. Reducing the scope of accounts receivables is often thought of as being a way that improving firms can show their shift towards higher efficiency. According to this logic, there is some evidence that privatization affects firm manager behavior. Although we observe little difference between township and private firms in the year of privatization, after firms have been privatized for more than 1 year, their account receivables to working capital ratio falls.

Table 2
Changes in revenue and profit indicators by ownership type in 168 sample rural enterprises in china, 1994–1997[a]

Firm types for alternative definitions of privatization	Number of observations	Per capita revenue change [HL1] (1997–1994) (000 yuan)	Revenue/capital ratio change (1997–1994)	Per capita profit change (1997–1994) (000 yuan)	Profit/capital ratio change (1997–1994)
Township enterprises (TE)	$n=39$	28 (51)	0.11 (1.24)	2.4 (9.0)	−0.001 (0.08)
Privatized TE	$n=63$	20 (39)	−0.02 (0.69)	1.4 (7.2)	0.01 (0.10)
Private enterprises	$n=23$	11 (32)	−0.27 (0.97)	−3.1 (14)	−0.01 (0.13)
Null hypotheses of t-test		t-Ratios			
TE=Privatized TE		0.84	0.60	0.59	0.61
TE=Private enterprises		1.61*	1.34*	1.69*	0.30

* Significance levels at 0.1.

[a] Per capita revenue (profit) change=1997 per capita revenue (profit)−1994 per capita revenue (profit); revenue (profit) capital ratio change=1997 revenue (profit) capital ratio−1994 revenue (profit) capital ratio. Revenue is the total sales (production) value of that year; profit is net profit; capital is the year end capital stock value.

The propensity to cut payroll and layoff workers also may differentiate private and privatized firms from township leader-run enterprises. Both the currently private firms and a subset of those firms privatized for at least 1 year have a higher propensity to layoff workers than TEs. If over employment is a source of inefficiency, then privatization may help improve firm performance by cutting the employment of firms to more profitable levels.

In summary, our sample suggests that rural China has experienced a massive privatization movement in the mid-1990s. The shift in ownership shares and firm ownership forms show that privatization is fundamental and widespread. But our descriptive examination of financial and management indicators provide mixed evidence on the relative shift of performance by different firms in different ownership categories. Although few studies have even compared such indicators, the descriptive analysis does little to solve the debate on whether privatization increases or decreases profitability.

4. Methods and results

In this section, we undertake a three-step process to examine the effect of privatization on the technical efficiency of China's rural industrial sector. We begin by estimating a production function using a 4-year panel of 168 firms. Our focus will be the coefficient of the variable in the production function that represents the ownership of the firm. We call this initial regression our "base" model. If we find that ownership does not have a significant effect on efficiency by running on the basis of the base regression, we will extend our analysis in two ways. First, we will run a selection model, given that there might be a selection bias of firms being privatized (e.g., maybe the best firms are not privatized). Second, we run a dynamic model, using both the current year ownership dummy and the previous year's ownership dummy, since it may be that the impact of privatization is more gradual and not show up in the year of privatization. For all of the steps in the analysis, we also examine if there is any statistical difference between agro-industrial firms and other firms. Since we find no significance differences, we only present the results for the full sample.

4.1. The base model: a 4-year panel

The approach used in this study involves the estimation of a Cobb–Douglas production function for 168 firms across 4 years. Following Forsund et al. (1980) and Kumbhakar (1991), the production function can be written as

$$y_{i,t} = g(I_{i,t}) \prod_k x_{i,t,k}^{\beta_k} e^{\mu_i + \lambda_t + v_{i,t}} \qquad (1)$$

where the subscripts i indexes firms, t indexes time, and k indexes inputs (the number of inputs plus one). The dependent variable y is firm output and x is its input vector including two types of capital, labor, and the human capital of the manager. The function, g, is an indicator function of ownership, $I_{i,t}$, where $I_{i,t}=1$ if firm i is private in period t, including the year of privatization, and 0 otherwise. Here, we assume that the technical inefficiency caused by the incentives that are inherent to the ownership status of the firm, and the inefficiency is measured by an ownership dummy. We assume $g(I_t) = e^{I_t}$ for analytical convenience.

The error term consists of three parts: (i) a firm-specific effect, μ_i, (ii) a time-specific effect, λ_t, and (iii) white noise $v_{i,t}$. We assume μ_i, λ_t, and $v_{i,t}$ are normally distributed with zero means and that μ_i, λ_t, and $v_{i,t}$ are independent of each other and are uncorrelated with the other right-hand side regressors (as is assumed in random effect models, Schmidt and Sickles, 1984; Hsiao, 1986). Since we assume that the technical inefficiency that is not explained by ownership and management's human capital is firm-specific, it is captured by μ_i.[2] Consistent with these assumptions, we use a random effects estimating framework throughout the analysis.

Taking logs of Eq. (1), we get a Cobb–Douglas production function:

$$\log y_{i,t} = I_{i,t}\gamma + \sum_k \log x_{i,t,k}\beta_k + \mu_i + \lambda_t + v_{i,t} \quad (2)$$

This is exactly the classical panel data form with random individual firm and time-specific effects (Hsiao, 1986). To control for industrial differences, we add industrial dummies in the model. Assuming all indus-

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[2] Unlike in the traditional frontier analysis literature, since we also have a time-invariant constant term in x, μ_i does not have to have a negative mean; it is incorporated in the constant term.

tries have the same marginal rates of technical substitution of capital and labor seems naive, but we do not find significant differences when we try a variable coefficients model and our estimates of the main coefficients of interest are robust to the selection of the estimating assumptions in this dimension.

We use annual sales value as a measure of each year's production for the firm. This is done primarily because we need to aggregate the production of firms that produce a diversified line of products. The independent variables used in the study include: (1) two types of capital, the amount of fixed and working capital measured in real 1994 yuan; (2) two types of labor, the quantity of high- and low-skilled labor measures in man-year equivalents; and (3) measures of the manager's human capital: the manager's age, education, place of birth (i.e., from the local township or not), former managing experience, experience as a government cadre, and the time that the manager has held a managerial position in the sample firm. We also include squared terms to allow for non-linear impacts of some of the human capital variables. A set of dummies for 10 industrial categories is used. The ownership dummy, as described above, is our variable of interest.

The results of our estimations of the base model show a high degree of fit and are largely as expected and robust to changes in specification (Table 3, columns 1 and 2). The *R*-square statistics on OLS versions of the equations are above 0.75. Many signs of the coefficients are the expected sign and highly significant. For example, fixed capital, working capital, high- and low-skilled labor have the expected signs and significant coefficients. Few of the human capital variables, however, are significant, a result that may not be too surprising in our panel analysis since there is little variation in many of the human capital variables over the sample period of our study.

In this first attempt, however, our analysis does not find an impact of privatization on firm efficiency. The low *t*-ratio on the coefficients of the privatization dummy variable implies that privatized and collective firms are equally efficient in a relative sense (Table 3, columns 1 and 2, row 1). Before drawing a conclusion, however, we need to consider the two problems with this initial approach that we anticipated and addressed above. It may be that some firms with a certain set of characteristics systematically decide to privatize, and

that these characteristics also affect firm performance. For example, it may be that local leaders only privatize firms that are performing poorly. If so, the indicator variable in the naïve regression could be correlated with the error term of the output equation, resulting in an endogeneity problem. The second reason for the poor results may be related to the dynamics of ownership change. It may be that newly privatized firms do not show any efficiency benefits immediately because of high transition costs. Efficiency increases may take one or more years to be realized. To address this problem, we lag the ownership dummy in a later part of our analysis.

4.2. Controlling for selection bias

To address the selection problem (or the potential problem that ownership is endogenous in the determination of firm performance), we use Heckman's two-step method (Willis and Rosen, 1979; Maddala, 1983). The first step of Heckman's method is to run a probit model that can identify the exogenous variables that affect the ownership decisions. The statistical challenge, however, is to come up with a set of instruments that can explain privatization, but not be a determinant of firm performance except through its impact on ownership. We follow Li et al. (1999), which shows that improvements in the product market environment and capital markets affect firm ownership decisions. To measure product market competitiveness, we use an index developed by Yang (1998).[3] The idea is that, ceteris paribus, the more competitive a village's economic environment is, the more likely it will be that leaders will be induced to privatize its firms (Chen and Rozelle, 1999). Drawing on a survey of banks in the same locality as each sample firm, we also measure capital market liberalization as the extent to which local leaders have explicit policies that encourage bank branch managers to develop an efficient loan portfolio (which, according to many bankers that we interviewed means they are allowed and encouraged to make loans to private firms, and by extension will encourage firms to privatize). An indicator vari-

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[3] The competition index is based on Yang (1998), who estimates the figures for the nation and essentially attempts to understand on an industry by industry basis which sector is most competitive and which sector is characterized by high market power. We include the competition index for each firm's sector.

Table 3
Panel analysis of determinants of production efficiency in 168 rural enterprises in China

Independent variables	Regression: dependent variable (revenue)			
	Base (1)	Base (2)	Dynamic (1)	Dynamic (2)
Privatization efficiency				
Private dummy (I_t), variable is 1 for all firms in all years that firms are private, including the year of privatization[a]	−0.08 (0.08)	−0.08 (0.08)	−0.19** (0.09)	−0.19** (0.09)
Private dummy (I_{t-1}), variable is 1 for all firms in all years that firms are private, *not* including the year of privatization[a]			0.26*** (0.09)	0.26*** (0.09)
Inputs				
Fixed capital	0.19*** (0.06)	0.20*** (0.05)	0.20*** (0.06)	0.20*** (0.05)
Working capital	0.52*** (0.06)	0.51*** (0.06)	0.50*** (0.06)	0.50*** (0.06)
High-skilled labor	0.12** (0.05)	0.13*** (0.05)	0.12*** (0.05)	0.14*** (0.05)
Low-skilled labor	0.26*** (0.06)	0.25*** (0.06)	0.28*** (0.06)	0.27*** (0.06)
Manager's traits				
Manager's firm experience	0.01 (0.01)		0.00 (0.01)	
Manager' firm experience, square	−0.00 (0.00)		−0.00 (0.00)	
Manager's age	−11.66 (7.8)		−9.8 (7.8)	
Manager's age, square	1.59 (1.06)		1.3 (1.1)	
Manager's hometown	−0.11 (0.15)		−0.12 (0.15)	
Manager's education	−0.33 (0.28)		−0.34 (0.28)	
Manager's education, square	0.01 (0.01)		0.01 (0.01)	
Manager's management experience	−0.07 (0.10)		−0.07 (0.10)	
Manager's government experience	−0.06 (0.11)		−0.03 (0.11)	
Observations	499	510	499	510
R-square				
Within	0.24	0.23	0.25	0.24
Between	0.84	0.83	0.84	0.84
Overall	0.77	0.78	0.77	0.77

** Significance level at 0.05.
*** Significance level at 0.01.
[a] Because of the way we have defined the dummy variables, the coefficient on I_t measures the change in firm revenue during year of privatization, and the coefficient on I_{t-1} measures the change of the firm revenue thereafter. Industry dummies not shown.

able is constructed, in which the variable is one when managers are in townships with leaders that commit themselves by policy to allow bank managers to make their own decisions and not intervene, and 0 otherwise. The two variables can identify privatization, since it is plausible that changes in "local rules or norms" have encouraged privatization. Neither variable, we argue, has a strong independent effect on efficiency except through the ownership changes. Hausman–Wu tests of the validity of exclusion restrictions show the selection of instruments are statistically valid.

The first stage probit model can be written as

$$\text{Prob(private)} = \text{Prob}(I_t = 1)$$
$$= \text{Prob}(U_a(y_a, z_a) > U_b(y_b, z_b)) \quad (3)$$

$$\text{Prob(TE)} = 1 - \text{Prob(private)} \quad (4)$$

Here, a and b are subscripts for private ownership and local government ownership, respectively. $U_a(y_a, z_a)$ is the utility of the township leader if there is a private firm in the township, and $U_b(y_b, z_b)$ is the utility if there is a government-owned firm in the township. Here, y represents productivity as before, while z is a vector of variables that determines if firms are private or township-owned.

The structural productivity equations (in logs) are as follows:

$$\log y_{a,i,t} = \sum_k \log x_{i,t,k}\beta_{a,k} + \mu_{a,i} + \lambda_{a,t} + v_{a,i,t}$$
$$\text{if } I_t = 1 \quad (5)$$

$$\log y_{b,i,t} = \sum_k \log x_{i,t,k}\beta_{b,k} + \mu_{b,i} + \lambda_{b,t} + v_{b,i,t}$$
$$\text{if } I_t = 0 \tag{6}$$

To estimate the Heckman selection model, the first step is to estimate the reduced form of the probit model,

$$\text{Prob (A is observed)}$$
$$= \text{Prob}(W\pi > \theta_i + \delta_t + \varepsilon_{it}) \tag{7}$$

where W is the vector of (z, x), and π is the vector of coefficients. The terms, θ_i, δ_t and ε_{it}, are firm-specific effects, time-specific effects and the white noise. In the second step, we calculate the inverse Mill's ratios (IMRs) from information generated by the reduced form probit model, and use these as regressors to test for selection bias. This is done by dividing the sample into two parts, one including only private firms; the other including only township-owned firms. The respective IMR measures (one associated with each part of the sample) are then added to the production function specifications, and the variable's significance is a test of the severity of selection bias.

In addition to producing instruments for the efficiency analysis (in the second stage), the results of the first stage probit equations provide insights into the determinants of privatization (Table 4, column 1). The product market environment and the bank's policy of encouraging privatization are the two major external forces that drive the transformation to private ownership, results that are similar to those found in Li et al. (1999). Other variables, such as, those for low-skilled labor, the manager's in-firm experience, and his experiences as being a local cadre also have the expected significant effects. Although the results of the determinants of privatization analysis are interesting, further attention is beyond the scope of this paper, and we refer the reader to Li et al. (1999).

The second stage of the analysis measures the impact of ownership on efficiency. After inserting the IMR variables into Eqs. (5) and (6), we estimate the determinants of production (Table 4, columns 2 and 3). The results are mostly similar to those in the base regressions (Table 3, columns 1 and 2). The capital and labor variables are mostly significant as expected, but the t-ratios are somewhat lower. Human capital variables remain insignificant as a group. Most impor-

tantly, according to the coefficients on the IMR variables, there is at most only weak evidence of a negative selection bias for private (or privatized) firms. The IMR variable is significant only at the 10% level. There mostly is no statistically significant selection bias for the government-owned firms. On the basis of this, we conclude that selection bias is not an important issue for this sample.

4.3. Panel analysis with lagged ownership variable

The above models are static. As discussed above, however, there are reasons to believe that there may be a delay to the gain earned by privatized firms. In this section, we consider a dynamic model by introducing a lagged ownership dummy in Eq. (1). The new equation is

$$y_{i,t} = g(I_{i,t}, I_{i,t-1})\prod_k x_{i,t,k}^{\beta_k} e^{\mu_i + \lambda_t + v_{i,t}} \tag{8}$$

The new argument in g is defined as such: $I_{i,t-1} = 1$ if firm i is private in period $t-1$ and 0 otherwise. We do not have any theoretical reasons for including only one lag indicator, this is purely an empirical consideration. We could include two or more lags if we had more time periods in our data set. We assume as before that the ownership dummies enter in linear form, e.g., $g(I_{i,t}, I_{i,t-1}) = e^{\gamma_0 I_{i,t} + \gamma_1 I_{i,t-1}}$. Taking logs of Eq. (8), we get

$$\log y_{i,t} = I_{i,t}\gamma_0 + I_{i,t-1}\gamma_1 + \sum_k \log x_{i,t,k}\beta_k$$
$$+ \mu_i + \lambda_t + v_{i,t} \tag{9}$$

The results of the dynamic model provide convincing evidence that privatization does affect performance. The regression results for Eq. (9) are in Table 3, columns 3 and 4. All of the coefficients of the private dummy variables are significant. The signs of the coefficients of the current period dummies, however, are negative while those on the lagged dummies are positive. The pattern of results suggests that privatization may indeed provide better incentives for the manager that eventually leads to more efficient firms, but that these effects are not immediate. The negative signs on the contemporary indicator variable (columns 3 and 4, row 1), however, imply that it may take time for the managers to restructure the firm. Implementing

Table 4

Selection regressions (regression (1) is reduced form, probit model, of determinants of privatization in 168 rural enterprises in China; regression (2) and (3) are production frontier regressions for private firms and TE respectively with selection bias corrected if any)[a]

Independent variables	Regression: dependent variable (binary: between 1994 and 1997)		
	(1) Probit model (1=privatize)	(2) Production for private firms	(3) Production for TE
Production environment			
Bank budget hardness	0.66*** (0.25)		
Product market competitiveness	0.84*** (0.20)		
Firm inputs			
Fixed capital	0.11 (0.12)	0.08 (0.10)	0.37*** (0.06)
Working capital	0.09 (0.12)	0.53*** (0.10)	0.42*** (0.08)
High-skilled labor	−0.00 (0.11)	0.16* (0.09)	0.03 (0.06)
Low-skilled labor	−0.47*** (0.15)	0.50*** (0.11)	0.23*** (0.08)
Manager traits			
Manager's firm experience	0.02 (0.03)	0.00 (0.05)	0.01 (0.02)
Manager' firm experience, square	−0.00* (0.00)	−0.00 (0.00)	−0.00 (0.00)
Manager's age	−21.0 (14.2)	−12.5 (12.7)	−1.53 (9.16)
Manager's age, square	3.0 (2.0)	1.69 (1.71)	0.22 (1.25)
Manager's hometown	−0.20 (0.19)	−0.39** (0.19)	0.25 (0.21)
Manager's education	−0.10 (0.43)	−0.74** (0.37)	−0.01 (0.31)
Manager's education, square	0.01 (0.01)	0.01* (0.01)	0.00 (0.01)
Manager's management experience	0.01 (0.20)	0.08 (0.15)	0.05 (0.12)
Manager's government experience	−0.38* (0.21)	0.18 (0.16)	−0.00 (0.12)
Loan asset ratio	−0.20* (0.10)	0.02 (0.08)	−0.13 (0.07)
Inverse mills ratio			
IMR1		−0.45* (0.27)	
IMR0			0.05 (0.22)
Observations	516	240	259
R-square			
Within		0.17	0.28
Between		0.82	0.85
Overall		0.72	0.83

* Significance level 0.1.

** Significance level 0.05.

*** Significance level 0.01.

[a] Industry dummies not shown.

policies such as layoffs, transferring asset ownership, making new investments, and developing new products or new markets takes time and resources, and appears to reduce output in the year that the firm is being privatized.[4] Returns to those investments and

business moves only appear to emerge one or more years after privatization (columns 3 and 4, row 2). We also tested the hypothesis $\gamma_0 + \gamma_1 > 0$, to examine whether there is a net increase in efficiency, and we accept the hypothesis.

Using our results to understand the magnitude of the costs and benefits of privatization, we find that eventually, although not immediately, there is a net positive gain to privatization. In the year of privatization, our results suggest that the shift in ownership reduces firm revenues by 17%. After a full year of privatization, however, the shift in ownership raises revenues by 29%, leading to a net measured gain of our sample

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[4] The negative sign on the coefficient in the contemporary private dummy may have several other interpretations, such as picking up the fact that the process of privatizing a firm actually takes a long time and creates turmoil in some factories. During this time, it may be that neither leaders nor managers concentrate on operations or production. An average privatization evaluation takes 26 days, during which the local leaders and the manager devote most of their time negotiating instead of managing the firm.

from privatization of 7%.[5] Since we only allow for 1 year lag (because of lack of data), it is unclear if there are any additional efficiency gains in further years.

5. Conclusion

In this paper, we describe the process of privatization of China's Township Enterprises. The importance of rural industry in many sectors, including agro-industrialization, means that understanding the effects of privatization is a key part in increasing the effectiveness in developing industry-wide and sector-specific industrial policies. In particular, we present the findings of our own field survey and analyses to show how far privatization has proceeded and how it has affected firm performance.

The pervasiveness and impact of privatization are readily apparent. The privatization in the mid-1990s was deep and fundamental. More than 50% of local government-owned firms have transferred their shares to private sectors partially or completely. Privatization is widespread, regardless of what definition we use (share shifting, controlling interest shifting, or complete). Although we do not find any evidence in our descriptive statistics that private and privatized firms outperform government ones, the private sector does appear to be beginning to manage its firms (e.g., labor and inventories) somewhat differently. Our multivariate analysis, however, finds a positive impact of privatization on technical efficiency. Efficiency of China's rural industries, including agro-industrial firms, would rise, if TEs privatized.

The impact of privatization, however, does not occur immediately. Transitional costs apparently reduce private firm efficiency in the year that firms are being privatized. Private firms produce 5–7% more with the same inputs after the privatization has occurred

for more than 2 years. It is impossible to say how profitability will improve in the future. It is possible to surmise, however, that as privatized firms complete their ownership transition and continue to learn how to adapt to China's business environment that the gains could rise further.

Our results present evidence that rural industries in China may continue to contribute to the nation's economic growth in the future. Private firms will necessarily be a part of all industrial sectors in the future. Our analysis shows that current trends suggest private, rural firms are evolving in a positive way that may very likely give them an active role. While more work is needed, we demonstrate a rural industrial sector that is continuing to respond to the other institutional changes that are going on around it. We cannot say if the gain in efficiency is enough to make rural industries competitive in the future. But at the very least, the change is in the right direction. As such, policy makers who are calling for the suppression of rural industries, including those in the agro-industrial subsector, have no basis for their claims. It may be that additional policy changes could relax constraints that could make the gains in efficiency even greater, and rural industries could even re-assume its pivotal role in China's growth and rural employment.

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[5] The 17% reduction is calculated by transforming the measured fall in revenue in the year of privatization measured in logs (−0.19 in Table 4, columns 3 and 4, row 1) into percentage change in revenue, measured in 1994 yuan. A similar calculation is done for the gain after the year of privatization using the coefficient from Table 4, columns 3 and 4, row 2, an increase that results in a net position of privatized firms that is 7% higher, ceteris paribus, than if firms had not been privatized. The 29% rise in revenues is calculated as the increase that takes firms from a 17% fall to a 7% rise.

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