Township and Village Enterprises in China

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Township and Village Enterprises (TVEs) have played a significant role in the growth of the Chinese economy since the economic reforms of 1978. This article analyses the productive efficiency of a cross-section of TVEs in the manufacturing sector. TVEs are found to be much more efficient than comparable state-owned enterprises (SOEs). They are also competitive in international markets. Their management which responds to market forces and their outward-orientation have contributed to their productive efficiency. The analysis concludes that efficient management, which successfully exploits the endowments and resources of the country rather than the nature of ownership of production entities, is crucial to the success of manufacturing firms.

I. INTRODUCTION

Township and Village Enterprises (TVEs) have played a significant role in the growth of the Chinese economy since the economic reforms of 1978

II. CHARACTERISTICS OF TVES

TVEs are economic units which are either collectively owned by local residents in the rural areas of China or mainly owned and controlled by the peasants.[3] The broad concept of TVEs includes, in addition to the collectively-owned enterprises, other rural non-state enterprises such as the enterprises owned and run by individual peasants (Appendix 1).[4] The share of the privately-owned enterprises in total industrial output of TVEs as a whole has increased in the late 1990s from 33 per cent in 1995 to 54 per cent in 1999. The collectively-owned township and village enterprises, however, continue to attract attention because of their unique characteristics and their rapid growth in the past two decades. This study is confined to an analysis of the productive efficiency of the collectively-owned TVEs.

The industrial value-added of TVEs reached RMB 1881 billion (US$227 billion) in 2000, accounting for 47 per cent of China's total industrial output. They employ a total of 127 million people, accounting for 18 per cent of the total labour force of the country and 25 per cent of the rural labour force. In the year 1999 their exports reached US$94 billion, accounting for 48 per cent of the country's total exports. The average annual real growth rate of their exports over the ten-year period 1988–99 was as high as 28 per cent, exceeding that of China's total exports at around 13 per cent over the same period. The composition of their exports has shifted over the years from primary and unskilled labour-intensive products towards relatively skilled labour-intensive products.[5] TVEs have experienced faster productivity growth than SOEs based on a low starting point since the reforms in 1978 [*Jefferson et al., 1992; Woo et al. 1993; Weitzman and Xu, 1994; Zheng et al., 1998*], while SOEs revealed some catch up in efficiency in the late 1990s [*Zhang et al., 2001*].

Collectively-owned TVEs exhibit an number of distinctive characteristics: they are publicly owned but market-orientated; they are small in size, enjoy a high degree of autonomy of operations; they are much more outward-orientated than SOEs; they are subject to hard budget constraints (Table 1). In general collectively owned TVEs are the property of local residents, but rights of ownership on their behalf is exercised by the town and village governments. The profits of TVEs are an important source of local government revenues. Although they are publicly owned, TVEs are subject to a hard budget constraint. They have very limited access to loans from the formal financial system such as the state owned banks and the Rural Credit Cooperatives (*Qian and Roland, 1998*). They may go bankrupt if they lose money.

The management of TVEs is executed by the township and village leaders who act as entrepreneurs, or by hired managers. Day to day management functions have been increasingly developed to professional

TABLE 1

INDUSTRY CHARACTERISTICS OF TVEs AND SOEs, 1995

100 million yuan, yuan/worker

	Exports/ Labour	Exports/ Output	Stock of Foreign Capital	Capital labour ratio	Output per firm	Number of employees	Net fixed assets per firm	Industries reported to be loss making (% of total)
SOE	5132	0.17[a]	0.79	27773	36	338	22	68
	(6310)	(0.12)	(1.69)	(17410)	(95)	(553)	(64)	
TVE	11591	0.26[a]	2.84	20052	7	84	2	2
	(17293)	(0.15)	(5.44)	(11408)	(6)	(49)	(2)	
t-statistic	0.00	0.07	0.00	0.00	0.00	0.00	0.00	

	Wage rate	Workers with university level education (% of total)	Workers with secondary level education (% of total)	Managerial staff (% of total)	Engineers (% of total)	Non-production workers (% of total)	Non-production net fixed assets (% of total)	Payment on piece rates (% of total)
SOE	5209	8	83	12	7	34	27	62
	(1680)	(4)	(5)	(6)	(4)	(8)	(9)	(40)
TVE	4199	2	82	11	7	23	17	86
	(1048)	(3)	(6)	(2)	(2)	(5)	(18)	(10)
t-statistic	0.00	0.00	0.01	0.00	0.13	1	0.00	0.00

Notes: 1. The figures presented here are unweighted averages of all industries in TVE and SOE sectors respectively.
2. The standard deviations are shown in parentheses.
3. The t-statistic tests the null hypothesis of the equality between SOE and TVE sectors; data listed here are probabilities associated with Students's t-test.
[a] Weighted average.

Source: Calculated from 'The Third National Industrial Census of P.R.China', 1995.

managers. Managerial remuneration systems of TVEs have evolved over the years, changing from the fixed wage contract to profit sharing contracts and fixed payment schemes, which are essentially lease agreements.

The remuneration of workers as opposed to managers in most TVEs is tied to performance. Workers are mostly paid by piece rates. TVEs are able to acquire high quality engineers because their salaries and wage payments methods are tied to performance. TVEs also enjoy a high degree of freedom in their management of labour. They can recruit and lay off workers depending on demand conditions for their output. The average skill level of employees, however, is relatively low in the TVE sector. Most of the workers are from the countryside with very little training and skills.

Most TVEs have positioned their business in areas with severe shortages of output or where SOEs have been weak. They have taken advantage of China's endowments of cheap labour and specialised in the production of labour or resource-intensive products such as textiles, clothing, food processing, and toys. With the gradual opening up of the economy, TVEs have also attracted substantial volumes of export-orientated FDI (Table 2)

III. PRODUCTIVE EFFICIENCY OF TVES

A. Methods of Estimation

There are three principal approaches to the measurement of productive efficiency: ratio analysis such as labour productivity and capital productivity, econometric approach such as the stochastic frontier model, and programming approach such as the data envelopment analysis. Total factor productivity (TFP) provides a comprehensive guide to efficiency than partial productivity. It takes into account the contribution of factors, other than raw labour and capital, such as managerial skills and technical know-how. A Solow-type TFP index based on the Cobb-Douglas production function with constant returns to scale is as follows [*Good et al., 1997*]:

$$TFP = Y / / (L^{\alpha} K^{1-\alpha})$$

where *TFP* = total factor productivity, *Y*= value-added, *L* = labour, *K* = capital. At cost-minimising levels of inputs, α denotes the share of labour in total output and 1- α denotes the share of capital in total output. However, estimation of TFP is subject to several well-known problems.

In the programming approach, for a sample of n firms, if X and Y are the observations on inputs and outputs, assuming variable returns to scale, the firm's efficiency score, θ, is the solution to the linear programme problem:

$$\begin{aligned} &Min_{\theta,\lambda}\theta \\ &\text{st.} \quad \theta x_i - X\lambda \geq 0 \\ &\qquad -y_i + Y\lambda \geq 0 \\ &\qquad \lambda_i \geq 0 \\ &\qquad \Sigma\lambda_i = 1 \qquad\qquad i = 1,\ldots,n. \end{aligned}$$

where θ is a scalar and λ is a nx1 vector of constants. The efficiency score ranges from 0 to 1. If $\theta_k = 1$, the kth decision making unit (DMU) is deemed to be technically efficient.

The strength of the programming approach lies not only in its lack of parameterisation, but also in that no assumptions are made about the form of the production function. Instead, a best-practice function is built empirically from observed inputs and outputs. The main shortcoming of this technique is that there is no provision for statistical noise or measurement error in the model [*Greene, 1997; Norman and Stoker, 1991*]. The econometric approach, however, has its main advantage in that measurement error can be minimised and hypotheses can be tested with statistical rigour. It is restricted by the main drawback that the production function is assumed to be known and to be homogeneous across firms or sectors.

B. Data and Results

The data used for estimation of various efficiency indicators are taken from 'The Third National Industrial Census of China' for 179 industries in both TVE and SOE sectors in the year 1995. The data envelopment analysis approach employs value-added in current prices as the measure of ou

ong with comparable estimates for SOEs (Figure 1). In the year 1995, the average technical efficiency score for TVEs was 85 per cent higher than that for comparable SOEs. Six industries are found to be technically efficient, including one SOE industry and five TVE industries. TVEs' total factor productivity (TFP) was 74 per cent higher than that for SOEs.[7] These estimates of TFP are consistent with those reported in previous studies [*Zheng et al., 1998; Jefferson, 1999*]. All the other indicators including capital productivity, labour productivity and social efficiency index attest to the relative superior efficiency of TVEs. The

TABLE 3

PERFORMANCE OF TVEs, SECTORAL ANALYSIS, 1995

SOE=1.00

Industry[1]	Technical efficiency	Total factor productivity	Value-added per fixed assets	Value-added per worker	Wage rate	Output/ firm	Capital labour ratio
Machinery equipment	2	3.28	9.53	1.92	0.85	0.32	0.70

their observed superior productive efficiency [*Grossman and Helpman, 1990; Egan and Mody, 1992; Balasubramnayam et al., 1996; Clerides, 1998*]. It could, however, be argued that it is only the relatively efficient firms which enter the world markets. The causation is from efficiency to exports and not the other way round [*Henriques and Sadorsky, 1996; Yamada, 1998; Bernard and Jensen 1999; Aw et al., 2000*]. Whilst there is no firm statistical evidence to support either of these contentions, the fact remains that exposure of TVEs to international competition has been to their advantage. In addition, the sizeable volumes of FDI that TVEs have attracted may also serve as efficient conduits for the transmission of technology and managerial know-how.

Several other factors besides their outward-orientation could be conjectured to have played a role in the observed superior productive efficiency of TVEs. We discuss some of these factors prior to subjecting them to a rigorous statistical test.

Management is one of the major factors which contributes to productive efficiency. Efficient management serves to minimise costs of production, reduce transaction costs within firms, improves product quality and efficient utilisation of resources. However, when managers are not responsible for the consequences of their actions, with wages predetermined, there are opportunities for free-riding, the degree of X-inefficiency increases [*Leibenstein, 1978*]. Performance related payments to managers, frequently observed in the TVEs, might be one method of reducing X-inefficiency. The incorporation of accountability through a hard-budget constraint, performance payment schemes for managers and piece rate payments for workers may contribute to the growth of X-efficiency in the TVE sector.

Increased autonomy over managerial decision-making and a stake in the firm's profits may also contribute to efficient operations. Usually the larger the fraction of the total profits the enterprise is allowed to retain, the stronger will be the motivation to improve productive efficiency on the part of managers. A high degree of autonomy over decision-making is accorded to managers in most TVEs.

The nature of ownership of firms could also impact on productive efficiency of firms. The property rights model suggests that public ownership attenuates property rights, reduces incentives to minimize costs and encourages free-riding. Agency theory, however, suggests that when ownership is separated from management, the objectives of managers and owners may diverge. Individuals in the firm will not minimise costs for a given level of output. Such principal-agent relationship is regarded as an important source of X-inefficiency [*Leibenstein, 1978; Button and Weyman-Jones, 1992*]. A number of empirical studies have investigated the comparative efficiency of different ownership structures, but no strong

evidence has been provided in favour of one system or the other [*Byrnes et al., 1986; Ferrier, 1993*].

TVEs in China, however, fit none of the commonly observed patterns of ownership and management. TVEs are nominally owned by the local residents, but controlled, managed and supported by the local governments and they respond to market forces. Their ownership is similar to that of SOEs to the extent that they are all publicly owned. Such public ownership may provide some institutional advantages over private firms in solving the agency problem [*Bowles and Dong, 1996*]. Also, the assignment of property rights to the local government may be an efficient response to Chinese institutional constraints [*Chang and Wang, 1994*]. Weitzman and Xu [*1994*] though argue that the demographic stability of China's rural communities and the Confucian tradition have promoted the emergence of a co-operative culture, which renders well-defined private property rights unnecessary for the promotion of entrepreneurial activity and productivity.[10] Ownership at the local government level may not be entirely without the sort of problems posed by central government ownership [*Sachs and Woo, 1997*].

Although they are both publicly owned, the management style of TVEs is considerably different from that of SOEs. TVEs are subject to the discipline of the market. The incorporation of accountability and exposure of publicly-owned firms to market forces compels TVEs to minimise costs and maximise efficiency. Loss making enterprises are not bailed out by the state nor or they allowed to cream off all the profits they make. While loss-making firms go bankrupt, the successful ones share their profits with the local governments. The so-called agency problem is greatly reduced in the case of these contractual arrangements as managers' fortunes depend upon the efficiency with which they manage the enterprises. The unique combination of public ownership with market-orientated management of TVEs may have helped them overcome both the moral hazard and agency problems. The market environment in which the enterprises operate motivates entrepreneurship, allows managers to experiment and innovate, but it also holds them accountable for their actions. For these reasons TVEs may not only be more efficient than the SOEs, but they may also be as productive as those firms which are owned privately [*Pitt and Putterman, 1992; Dong and Putterman, 1997*].

The foregoing hypotheses and suggestions though are subject to one major qualification. It is that the nature of ownership per se may not be a significant determinant of productive efficiency. Much more important may be factors such as style of management, scale effects, proportion of resources devoted to non-production activities such as social services, degree of managerial autonomy and other enterprise specific factors. A carefully designed econometric study of the productive efficiency of

China's rural enterprises suggests as much [*Jefferson, 1999*]. The study finds that when these and other policy-orientated variables are controlled for, the productive performance of TVEs were not unambiguously higher than that of SOEs. The present study, however, relates to the performance of the two groups in the year 1995 and relies on a data set different from that used by Jefferson. In any case, the statistical results of the present study discussed below endorses the Jefferson proposition, but argues that the sort of factors which promote productive efficiency were more frequently to be found in the case of TVEs than the SOEs.

In sum, outward orientation, efficient management and the unique combination of public ownership with market-orientated management are factors which may have contributed to the productive efficiency of TVEs. The influence of these and other factors on the observed productive efficiency of TVEs is analysed below in the context of a statistical model.

A. Model

We employ regression analysis to estimate the impact of the factors discussed earlier on the productive efficiency of TVEs. The equation to be estimated in logarithms is of the following form:

$$PE_i = \alpha + \beta_1 EX_i + \beta_2 MS_i + \beta_3 WS_i + \beta_4 FS_i + \beta_5 KI_i + \beta_6 DO_i + \mu \qquad (1)$$

where $i = 1, \ldots, N$ indexes industry, PE = productive efficiency, EX = outward orientation, MS = a vector of management variables such as incentive schemes, degree of autonomy and types of managerial contract, WS = labour skills, FS = firm size, KI = capital intensity, DO = sector dummy, 1 for TVEs and 0 for SOEs. Two alternative measures of productive efficiency, labour productivity (VAL) and technical efficiency (TE), are regressed upon the independent variables listed above respectively.

In the estimation of technical efficiency, the efficiency scores have an upper bound of 1.0 and a lower bound of 0.0, the ordinary least squares estimates would be inconsistent. Therefore, the regression model for technical efficiency is specified in form of the Tobit model as follows [*Tobin, 1958; Zheng, 1998*].

$$PE_i = \begin{cases} \alpha + \beta X_i + \mu & \text{if } \alpha + \beta X_i + \mu < 0 \\ 0 & \text{otherwise} \end{cases} \qquad (2)$$

where X_i is a vector of independent

It is derived from 'The Data of The Third National Industrial Census of P.R. China'. The second set of data relates to panel data for TVEs in 29 provinces of China over the time period 1987–98. These data are collected from the *China Township and Village Enterprises Yearbook* and the *China Agricultural Statistical Yearbook*. This data set covers most of the TVEs during their period of rapid growth. It not only enables us to investigate the dynamic effects of the determinants on efficiency, but also takes into

which equals to 1 for TVEs and 0 for SOEs, are used as control variables. Because of possible endogeneity between openness and productive efficiency, we first apply the Wu-Hausman specification test to test for endogeneity. Management intensity (MS), workforce skills (WS), capital intensity (KI), firm size (FS), market size (MARKS), comparative advantage[11] (CA), and policy dummy (DI) are used as predetermined variables. If endogeneity is detected between openness and productive efficiency, we utilise the 2-stage least square (2SLS) for labour productivity

TABLE 4

ESTIMATION RESULTS OF DETERMINANTS OF PRODUCTIVE EFFICIENCY FOR POOLED DATA

Independent Variable	Efficiency measures: Labour productivity OLS	Labour productivity 2SLS	Technical efficiency TOBIT	Technical efficiency 2S-TOBIT
CONS	3.578***	3.829***	-2.066***	-1.876***
	(0.000)	(0.000)	(0.000)	(0.000)
DO	1.356***	1.560***	1.411***	1.563***
	(0.000)	(0.000)	(0.000)	(0.000)
LEX	0.029***	0.076***	0.013	0.047***
	(0.001)	(0.000)	(0.112)	(0.000)
LSM	0.157***	0.173***	0.128***	0.139***
	(0.000)	(0.000)	(0.000)	(0.000)
LWS	0.123***	0.178***	0.121***	0.160***
	(0.000)	(0.000)	(0.000)	(0.000)
LFS	0.074***	0.114***	0.035**	0.064***
	(0.000)	(0.000)	(0.019)	(0.000)
LKI	0.366***	0.290***	-0.170***	-0.225
	(0.000)	(0.000)	(0.000)	(0.000)
Number of observations	358	358	358	358
Adjusted R^2	0.546	0.505		
Log likelihood			−137.054	−129.54

Note: ***Significant at the one per cent level; ** Significant at the five per cent level; p-values are shown in parentheses.

significant positive coefficients. Results for the equation based on technical efficiency as the dependent variable are similar to that for labour productivity.

Table 5 presents the results for the three-stage least squares (3SLS) estimation of labour productivity of TVEs and SOEs.[13] Outward orientation (EX) exerts a significant positive effect on the productivity of TVEs, while it is insignificant in the case of the SOE sector. The Wald statistic at 8.828 suggests that the estimated coefficient of outward orientation variable in the TVE equation is significantly different from that in the SOE equation at the one per cent significance level (Table 6), indicating the contribution of outward orientation to the productive efficiency of TVEs.

Management intensity (MS) is positively correlated with productive efficiency in the TVE sector and the coefficient of management intensity (MS) variable is statistically significant. A one per cent increase in bonuses per employee is seen to increase labour productivity of TVEs by 0.18 per cent. These variables are, however, insignificant in the SOE equation. The Wald test indicates that the difference between the two coefficients is statistically significant. These results suggest that, in the TVE sector,

TABLE 5

ESTIMATES OF LABOUR PRODUCTIVITY OF TVE AND SOE SECTORS

Independent Variable	3SLS		SURE	
	TVE	SOE	TVE	SOE
Intercept	6.337***	-1.381	6.221***	-1.393
	(0.000)	(0.122)	(0.000)	(0.118)
LEX	0.041***	-0.012	0.026***	-0.002
	(0.003)	(0.317)	(0.006)	(0.869)
LMS	0.180***	-0.007	0.180***	-0.002
	(0.000)	(0.851)	(0.000)	(0.963)
LWS	0.102***	0.599***	0.082***	0.602***
	(0.001)	(0.000)	(0.002)	(0.000)
LFS	0.046**	0.074***	0.033**	0.075***
	(0.012)	(0.000)	(0.042)	(0.000)
LKI	0.212***	0.609***	0.232***	0.603***
	(0.000)	(0.000)	(0.000)	(0.000)
N	179	179	179	179

The coefficients of the firm size (FS) variable in both equations are significantly positive, and the Wald statistic shows the difference between them is statistically insignificant. This suggests that, irrespective of the ownership structure the firm adopts, productivity and size are related. The test on the determinants of technical efficiency in the two sectors also lends evidence supporting the positive contribution of outward-orientation and management to the superior productive efficiency of TVEs (Table 7).

TABLE 7

ESTIMATES OF TECHNICAL EFFICIENCY IN TVE AND SOE SECTORS

Independent Variables	2S-TOBIT		TOBIT	
	TVE	SOE	TVE	SOE
C	0.501	–2.257**	0.236	–2.258**
	(0.157)	(0.020)	(0.504)	(0.020)
LEX	0.028**	0.005	0.010	-0.001
	(0.040)	(0.693)	(0.304)	(0.940)
LSM	0.166***	0.117***	0.167***	0.115***
	(0.000)	(0.005)	(0.000)	(0.006)
LWS	0.113***	0.145	0.087***	0.143
	(0.000)	(0.182)	(0.001)	(0.188)
LFS	0.014	0.004	–0.001	0.003
	(0.447)	(0.869)	(0.937)	(0.886)
LKI	–0.309***	–0.166***	–0.283***	–0.163***
	(0.000)	(0.007)	(0.000)	(0.008)
N	179	179	179	179

Note: * Significant at the ten per cent level; ** Significant at the

TABLE 8

DETERMINANTS OF PRODUCTIVE EFFICIENCY: PANEL DATA RESULTS

Independent variables	(1)	(2)
C	0.547*	1.716***
	(0.077)	(0.000)
LEX	0.157**	0.136***
	(0.001)	(0.000)
LMS1	0.108***	
	(0.010)	
LMS2		0.340***
		(0.000)
LKL	0.134	0.320***
	(0.252)	(0.000)
T	0.099***	0.022**
	(0.000)	(0.013)
DC	0.103	0.042
	(0.394)	(0.203)
N	87	145
Adjusted R^2	0.898	0.973

Note: Regression equation $LPE_{it}=\kappa+\theta LEX_{it}+\xi LMS_{it}+\eta DC_{it}+\upsilon T+\varepsilon_{it}$, where *PE* = labour productivity, *EX* = real exports per employee, *MS* = management intensity measured by real bonuses per employee (*MS1*), and real retained profits per [illegible] (*MS2*)

NOTES

1. Estimated from *China Statistical Yearbook, China Township and Village-Owned Enterprises Statistical Yearbook*, 2000.
2. Estimated from *China Township and Village-Owned Enterprises Statistical Yearbook*, various issues.
3. Law on Township and Village Enterprises, P.R. China, 1996.
4. China's industrial enterprises are subdivided into eight groups based on the nature of ownership: the state-owned enterprises (SOEs), collectively-owned enterprises, privately-owned enterprises, individually-owned enterprises, jointly-owned enterprises, share-holding enterprises, foreign-owned enterprises and other types of enterprises. The major component of TVEs is the collectively-owned enterprises (Appendix 1).
5. Estimated from *China Statistical Yearbook, China Township and Village-Owned Enterprises Statistical Yearbook* and *China Foreign Economic Statistical Yearbook*, 1999.
6. According to Zheng *et al.* [*1997*] and Avkiran [*2001*], results under variable returns to scale is usually preferred when the estimation under constant returns to scale and variable returns to scale differ. Thus in this study we report mainly estimation results under variable returns to scale (VRS).
7. Following Bernard and Jensen [*1999*], assuming the production function across industries is homogeneous, we estimate the coefficients of a Cobb-Douglas type production function of value added on capital and labour for TVEs to obtain the share for labour (α). The estimated share of labour in TVE sector for the year 1995 is 0.39.
8. The statistical test for paired samples tests the null hypothesis that the means of SOE and TVE samples are equal. The probabilities associated with t-test are all 0.00 for every indicator.
9. Preliminary estimates indicate that unit labour costs of China's TVEs in principal export industries, such as textile, apparel, leather product and footwear industry, are also lower than that in comparable industries in Indonesia, Philippines, Thailand and India, her major competitors in world markets. This is either because China's wage rates are relatively low or because her labour productivity is higher. However data for wage rates, labour and output across national boundaries may not be strictly comparable and this issue is a topic for further research).
10. Weitzman and Xu [*1994*]. For an excellent discussion on productivity and ownership structure, see Nolan [*1995*]; Sachs and Woo [*1997*]; Dong and Putterman [*1997*]; Zheng, Liu and Bigsten [*1998*].
11. Comparative advantage is measured by revealed comparative advantage index developed by Balassa [*1965*] as follows,

$$RCA = (X_{ij} / X_{wj}) / (\sum_j X_{ij} / \sum_j X_{wj})$$

where i is the country, j is the commodity and w is the world. Detailed information of the measurement of predetermined variables and sources of the data is given in Appendix 2.

12. The t-statistic of –3.70 for exports-residual in the labour productivity (VAL) equation and –3.55 in the technical efficiency (TE) equation suggest that there is significant endogeneity between exports and productive efficiency in the sample. Therefore we utilise the 2-Stage Least Squares (2SLS) for labour productivity (VAL) equation and 2-Stage Tobit model for technical efficiency (TE) equation. The White heteroscedasticity statistics (cross term) suggest the existence of heteroscedasticity. Thus, we adopt White's heteroscedasticity-consistent estimates for the standard errors and t-ratios.
13. When the 3SLS estimates are compared with those for the seemingly unrelated regression, Hausman specification test statistics (χ^2) which are as high as 918 strongly support the

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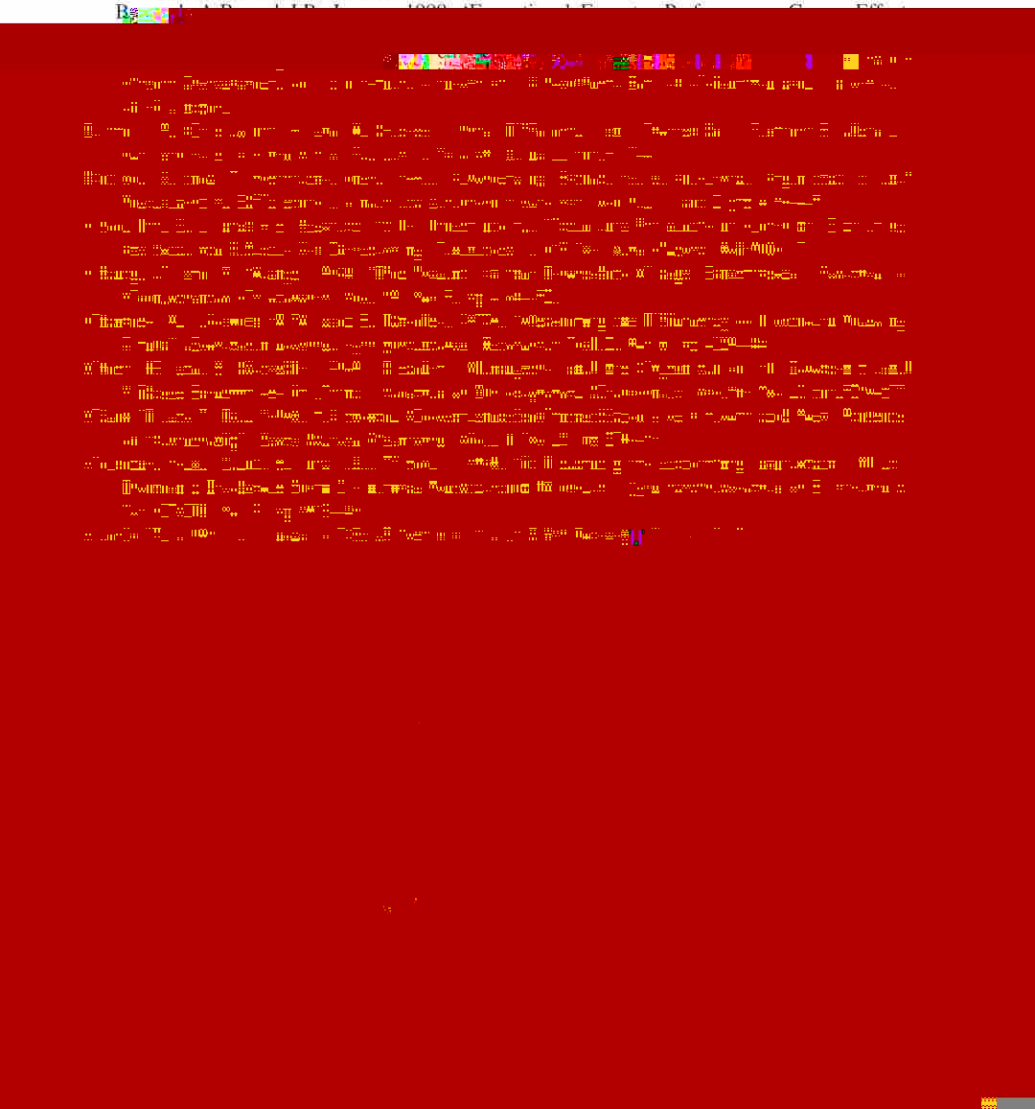

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APPENDIX 1

OWNERSHIP STRUCTURE OF CHINESE ENTERPRISES, 1995

Sector	Gross industrial output	
	Value 100million yuan	Percentage of total %
Total	80519	100
State-owned enterprises	25890	32
Collective-owned enterprises	28541	35
Private-owned enterprises	2334	03
Individual-owned enterprises	9632	12
Joint-owned enterprises	652	01
Share-holding enterprises	2727	03
Foreign invested enterprises	10660	13
Others	78	00
of which		
Township and village-owned enterprises	36257	45
of which		
Township-owned enterprises	11682	15
Village-owned enterprises	11906	15
Rural joint/co-operative enterprises	1631	02
Rural private-owned enterprises	2295	03
Rural individual-owned enterprises	8742	11

Source: The third national industrial census of China, 1995.

APPENDIX 2

DATA SOURCES AND VARIABLE MEASUREMENT

This study employs two data sets. One is a cross-industrial data set combined data derived from 'The Third National Industrial Census of P.R.China' 1995, various issues of *International Yearbook of Industrial Statistics*, UNIDO and *International Trade Statistics Yearbook*, UN. The other is a panel of data for TVEs across 29 provinces over the time period 1987–98 collected from the *China Township and Village Enterprises Yearbook* and the *China Agricultural Statistical Yearbook*. Tibet, Congqing and Hainan are omitted because of incomplete data. The measurement of variables use in the study in given below.

PE = productive efficiency. In this study we regress two measures of efficiency respectively: the labour productivity (VAL) measured by value-added per employee and technical efficiency (TE) which obtained by data envelopment analysis (DEA).

EX = outward orientation, measured by export value of the industry;

MS = management intensity, measured by bonuses per employee. In the case of the panel data set, it is measured by bonuses per employee and retained profits per employee alternatively. Bonuses of TVEs in the cross-industry data set equals to *profits payable* times the ratio of bonuses to profits payable estimated from the *Statistical Yearbook of Township and Village Enterprises*, 1995.

WS = workforce skills, measured by wage rates per production worker;

FS = firm size, measured by average output per firm in industry i to total output of industry i;

KI = capital intensity, measured by capital–labour ratio;

DO = sector dummy, 1 for TVEs and 0 for SOEs;

MARKS = market size, measured by total output of the industry;

CA = comparative advantage, measured by estimated revealed comparative advantage index developed by Balassa [1965]; the data are collected from United Nation's *International Trade Statistical Yearbook* at the three-digit level;

PI = policy dummy, which equals to 1 for the industries which are favoured by government export promoting policy and 0 for others.