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Barriers to Efficiency and the Privatization of Township-Village Enterprises*

Xiangming Fang and Rodney B.W. Smith[†]

Department of Applied Economics

University of Minnesota

Saint Paul, MN 55108

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[†]Graduate student and Associate Professor, respectively

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1 Introduction

In 1978, China opened its borders to the West and initiated several social and economic reforms. Since that time, the world has watched China rapidly evolve into an economic power, with an annual growth rate in per capita gross domestic product of over 8 percent. Rural reforms have had the longest history and are considered among the most successful of the reforms implemented by the Chinese Central Government: e.g., the rural household contract responsibility system and the development of rural enterprises.

As noted by Liu (2000) much of the growth has been attributed to the emergence of China's non-state sector. In 1978, state-owned enterprises (SOEs) accounted for 78% of national industrial output; by 1993 that percentage had shrunk to 43%, with non-state enterprises providing 57% of total production. During this period, a particularly dynamic segment of the non-state sector had been the rural enterprise sector, which grew from providing 9% of national industrial output in 1978 to providing 36% in 1993 (Che and Qian, 1998). Rural enterprises consist of two ownership types: Township-Village Enterprises (TVEs) and private enterprises. TVEs are not private enterprises, nor state-owned enterprises (SOEs). Instead, they are rural community (township or village) enterprises that, in principle, are owned by local residents, but in fact controlled by community governments (Chang and Wang, 1994; Che and Qian, 1998).

Unlike the large-scale privatization of SOEs in Eastern Europe and the former Soviet Union, China relied heavily on TVEs to transition from a planned economy to a market oriented economy. Between 1979 and 1993, the TVEs share of national industrial output expanded from 9 percent to 27 percent, while the share of rural private enterprises increased

from 0 to 9 percent (China Statistical Yearbook, 1994). By 1993, TVEs produced over 40% of China's exports and employed more than 40% of the nation's industrial workers (Bowles and Dong, 1997). After 1993, however, the economic performance of TVEs in terms of profit per capita began a downward spiral, and eventually China witnessed the large-scale privatization of TVEs. According to a recent survey of over 600 firms in Eastern China, 65 percent of these firms were privatized between 1993 and 2000 (Brandt, Li and Roberts, 2000).

This paper uses Nerlovian type measures to compare the economic performance of private enterprises and Township-Village enterprises during the pre-1994 and post-1994 years, and introduces decomposition measures to help explain their relative performances.

1.1 TVEs and Economic Reforms

We believe an understanding of the decline in TVE economic performance is benefitted by examining the relationship between TVEs and local governments. From both a legal and practical point of view, Che and Qian (1998, page 7) characterize TVE governance as having three properties:

- (i) All community enterprises within one community are owned collectively by the residents of that community;
- (ii) The decisions of managers of these enterprises are restricted mostly to daily operations; and
- (iii) The community government exercises strategic control rights over these enterprises on behalf of the community residents.

Since the community government plays a critical role in TVE governance, we begin our study of TVE performance with a discussion of the goals of a typical community (village or township) government. Jin and Qian (1998) claim the major objectives of the community government include: (i) increasing the government's revenue, (ii) creating more non-farm

employment, and (iii) increasing rural income. In addition, Whiting (1996) notes the total gross output of a community serves as a major indicator of the local government's political performance. The importance of total gross output is suggested by the observation that local leaders index TVE manager compensation to output and profits (Whiting, 1996).

Qian (1999) divides the period 1978 – 1999 into two stages. The first stage, 1978 – 1993, was dominated by incentive schemes called “particularistic contracting.”¹ With such schemes the incentives of economic agents were improved, while simultaneously protecting the interests of stakeholders. Through experiments and institutional innovations, a variety of transitional institutions emerged, with many of them taking unconventional forms. Qian observed that although many of the institutional arrangements were “second-best, they were quite effective in providing the right economic incentives.”

During the first stage, both state and market institutions were imperfect, and the existing institutions offered the TVEs and private enterprises both advantages and disadvantages. First, with community government assistance, TVEs were thought to have better access to bank loans (Wong, 1988, 1991). During this period, China's banking systems essentially functioned as government cashiers, and operated on political rather than commercial principles. Also, state banks were believed to be more willing to lend to TVEs because of “ideological discrimination” against private enterprises (Jin and Qian, 1998). Second, China's economy was characterized by declining, but still functioning central government planning institutions and emerging, but weak market institutions (Nee, 1992). By using the community government's political power and their own collective identity, TVEs were believed to have easier access to SOE's technologies and have better access to inputs that were in short supply

¹Particularistic contracting were contracts between the government and subordinate units. Examples include: agricultural contracting between the government and farm households; fiscal contracting between the central and local governments; and industrial profit contracting between the government and state enterprises (Qian, 1999).

(Chang and Wang, 1994; Jin and Qian, 1998). On the other hand, private property rights tended to give private enterprise owners and managers more of an incentive to improve technical efficiency and seek ever more efficient ways to secure scarce inputs. Also, in order to achieve their community objectives, local governments often induced TVEs to adopt output targets or labor hiring goals that pushed TVEs away from profit-maximizing or technically efficient production practices.

The above observations suggest at least three ways in which the relationship between local governments and TVEs might yield the TVE an economic advantage or disadvantage over private enterprises: credit access, technology adoption and input allocation, and output/labor distortions. Accordingly, between 1979 – 1993, even if private enterprises adopted superior technologies, the overall efficiency of TVEs could be at least as good as that of private enterprises due to the possible institutional advantages of easier access to capital and input supplies.

The second period began in 1994, and continues through 2002. Qian (1999) notes:

By the end of 1993, living standards had significantly improved on a widespread basis, the state sector was no longer the dominant part of the economy, and most old revolutionaries were gone from the political scene. All of these changes facilitated a strategic shift in the official ideology to completely abandon central planning and embrace a market system with private ownership. Since 1994, particularistic contracting is being replaced by universalistic rules² and market-supporting institutions based on the rule of law and incorporation of international best practices being established.

Hence, in addition to governmental and market institutions having become more evolved and sophisticated, TVEs started to lose the relative advantages associated with the previous

²Universalistic rules refer to uniform rules like tax reform and ownership reform that apply to all enterprises regardless of ownership structure.

institutional environment. More specifically, beginning in the mid-1990s, banking reforms were initiated that provided banks incentives to allocate scarce financial resources to the most productive uses: in essence, the reforms made banks independent, profit-driven units. The impetus for such a move was likely engendered by the TVEs' increased debt levels and poor debt servicing behavior. Local governments began regarding TVEs with high levels of debt as burdensome, and began to see the problem with not using market forces to discipline TVE performance (Smyth, Wang, Kiang, 2001).

Another institutional detail of note relates to tax and fiscal reforms. With the local government objectives noted above (labor and output goals, tax revenues), during the 1980s TVEs were easier to tax and control than private enterprises, and hence, were the governance structure of choice for the local governments. However, in 1994 China introduced major tax and fiscal reforms. These reforms were more closely aligned with international practices and strengthened the tax collection power of local governments (Qian, 1999). The reforms also gave local governments more autonomy, but at the expense of increased fiscal responsibility – as central government transfers to locals began to fall. The cut-back in central government transfers forced the locals to become more self-sufficient, and the primary source of local government funding became the tax revenues raised from TVEs and private enterprises. As noted above, TVE revenues began to fall relative to private enterprises, and TVEs were much worse at repaying debts than private enterprises. The combination of falling TVE profits/tax revenues and poor TVE debt servicing led to a shift in bank and local government lending preferences, with and private enterprises becoming the preferable institution (Smyth, Wang and Kiang, 2001; Naughton, 1994).

Along with the improvement of governmental and market institutions, TVEs also lost their relative advantage over private enterprises in getting scarce inputs, while retaining the burden of meeting labor hiring and output targets.

The above observations suggest that institutional factors could have influenced the relative economic performance of TVEs and private enterprises, and hence offer explanations for why private enterprises eventually emerged as the dominant institution for allocating resources in post-1994 China. Qian (1999) and others suggest pre- and post-1994 institutions might have influenced TVE and private enterprise: access to credit, technology adoption, input allocation efficiencies, and forced inefficient output/labor decisions. In what follows we outline a simple procedure for uncovering evidence of relative advantages and disadvantages offered TVEs and private enterprises in the first- and second-stages of China's economic reform periods. Specifically, we define profit and revenue based measures of overall technical efficiency, and decompose the measures into components that highlight the existence of credit constraints, output target constraints, labor hiring constraints, and evidence of allocative inefficiencies.

2 Simple Model

Before developing a formal model, we feel it is instructive to discuss briefly the structure of a typical rural community in China. The economic agents in rural China can be conveniently divided into four major groups: TVEs, private enterprises (PEs), farmers, and local governments (LGs). In what follows we assume TVEs and PEs both produce the same composite good using labor, physical capital, and intermediate inputs. Furthermore, we assume TVEs and PEs have the same technology, and assume that physical capital is a fixed input..

The rural economy in question consists of four representative agents: a single representative farmer, a TVE, a PE, and a LG. We assume the central government chooses the set of institutional reforms, and the institutional reforms influence the banks' (LG) loan decisions and the LG's preferences. For example, banking reforms that transform government banks into commercial banks are typically accompanied by a shift in the lending preferences of the

LG and bank: from favoring SOEs and TVEs, to favoring PEs.

Given the institutional environment, the local governments choose effort levels to allocate in helping the TVE and PE get loans, and chooses output targets and minimum employment levels. Then, given the credit, output-target, and minimum employment levels, TVEs and PEs choose their constrained profit maximizing output, labor, and material input decisions.

Let $E_j(I)$ represent the loan secured by the LG for the type- j enterprise given institutional environment I . Here $j = 1, 2$ indexes enterprise type with 1 representing the TVE, and 2 representing the PE.

2.1 TVE and PE Preferences

Let $f(l, m, K)$ represent TVE and PE's output technology, where l is labor input, m is material input, and K is physical/fixed capital. Without any local government interference and perfect capital markets, the TVE and PE are assumed to choose labor and variable/intermediate inputs to maximize profit subject to the technology $f(\cdot)$. Let

$$\pi^* = \max_{l_j, m_j, Y_j} \{pY_j - wl_j - rm_j : Y_j \leq f(l_j, m_j, K_j)\}, \quad (1)$$

$j = 1, 2$. Here Y_j represents the output level produced by enterprise- j , l_j and m_j represents the respective labor and material input demanded by that enterprise, and K_j represents the enterprise's endowment of physical capital. The parameter p is the price of output, w is the wage rate, and r is the price of material inputs. Solving the maximization problem (1), we get the profit maximizing level of labor, material input, and output $(l_j^*, m_j^*, Y_j^*) = (l^*(K_j), m^*(K_j), Y^*(K_j))$, $j = 1, 2$.

With LG interference, the PE or TVE might be induced to choose input and output levels that deviate from the profit maximizing levels (l_j^*, m_j^*, Y_j^*) . Also, poorly functioning credit markets could lead to credit allocations that constrain profit opportunities. Under expenditure, output-target, and minimum-labor constraints, the firms' constrained profit

maximization program is given by:

$$\pi_j(E_j, \bar{Y}_j, \bar{l}_j) = \max_{l_j, m_j, Y_j} \{pY_j - wl_j - rm_j : Y_j \leq f(l_j, m_j, K_j), wl_j + rm_j \leq E_j, \bar{Y}_j \leq Y_j, \bar{l}_j \leq l_j\}, \quad (2)$$

where \bar{Y}_j is the output target and \bar{l}_j is the minimum labor employment goal, $j = 1, 2$.

2.2 Local Government Preferences

Those familiar with the structure of Chinese townships and villages know that local governments were very much involved in the affairs of TVEs and exercised much control over them (Chang and Wang, 1994; Naughton, 1994; Bowles and Dong, 1999). Ho (1994) suggests that during the 1980s, the relationship between LGs and TVEs were quite similar to that between SOEs and the central or provincial government during the pre-reform days. As discussed in section 2, local governments were concerned with increasing its own revenue, increasing rural income, creating non-farm employment, and increasing output productivity (Whiting, 1996; Jin and Qian, 1998).

Local government revenues R come from two major sources: (i) taxes on TVE and PE output and/or profit, and (ii) fixed administrative fees imposed on TVEs and PEs, and (typically fixed) fees collected from agricultural production. Since revenues of the second type are essentially lump-sum, we assume R is a function of π_1 and π_2 . Non-farm employment, denoted $L = l_1 + l_2$, is the sum of labor hired by the two firms. Similarly total output, denoted $Y = Y_1 + Y_2$, is the sum of output produced by both firms. Farmer income comes from two sources: revenue from the agricultural production and revenue from the non-farm employment. In our analysis, we assume the LG assigns little value to the agricultural income component of farmer income. The LG is interested in the level of non-farm income, and proxy non-farm income by the units of labor employed by the TVE and PE. Hence, according to the above discussion, it is reasonable to represent the LG's preference by the

function $V(\pi_1, \pi_2, Y, L)$. We assume V is nondecreasing and strictly concave in each of its arguments.

Usually the LG signs a managerial contract with the TVE manager that ties manager compensation to output and profit levels (Whiting, 1996), suggesting the LG likely influences TVE production choices. Also, a survey conducted by Raiser (1997) suggests LGs induced over 16 per cent of the TVEs to meet minimum labor hiring goals. In what follows we assume the LG has some but different influence over the output choice or hiring decisions of the PE and TVE. Also, we assume the local government exerts some but different effort in securing loans for the PE and TVE. Then, under such assumptions the LG optimization problem is given by:

$$\begin{aligned} \hat{V}(l^*, Y^*, I) = & \max_{e_1, e_2, l_1, l_2, Y_1, Y_2} \{V[\pi_1(E_1(I), Y_1, l_1), \pi_2(E_2(I), Y_2, l_2), l_1 + l_2, Y_1 + Y_2] \quad (3) \\ & - C^1(E_1(I), Y_1 - Y_1^*, l_1 - l_1^*) - C^2(E_2(I), Y_2 - Y_2^*, l_2 - l_2^*) \\ & \text{subject to } Y_1 - Y_1^* \geq 0, l_1 - l_1^* \geq 0, Y_2 - Y_2^* \geq 0, l_2 - l_2^* \geq 0\}. \end{aligned}$$

Here, $C^j(E_j, Y_j - Y^*, l_j - l^*)$ is the effort cost to the LG of raising E_j in loans for firm j , while inducing the firm to produce Y_j units of output and hire l_j employees. We assume C^j is non-decreasing and convex in each of its arguments, and for all (e, l, Y) , $C^1(E, l, Y) < C^2(E, l, Y)$ and $C_i^1(E, l, Y) < C_i^2(E, l, Y)$, $i = 2, 3$. The assumptions on C^1 and C^2 imply that compared with TVEs, inducing PEs to choose output targets or minimum employment levels is more difficult/costly for the LG.

The solution to (3), denoted $(\bar{E}_1, \bar{l}_1, \bar{Y}_1, \bar{E}_2, \bar{l}_2, \bar{Y}_2)$, might involve output-targets and minimum employment goals that are inconsistent with profit maximization. Also, depending on the institutional regime I , LG efforts might result in loan amounts where $\bar{E}_1 \neq \bar{E}_2$. The prior discussion would suggest that before 1994 \bar{E}_1 might be larger than \bar{E}_2 , but post-1994 this might not be the case.

Since no well-defined theoretical framework is used to specify the structural and be-

havioral models of the LG in the transition economy, we will attempt to identify the LG influence via the TVE's and PE's observed production behavior. In the empirical section we conduct an exercise that assumes the observed employment and output levels of TVEs and PEs are levels induced by LGs. Likewise, the observed expenditure constraint is assumed to be consistent with LG efforts and institutional factors.

3 Methodology

To investigate how these factors such as access to credit, technology adoption, input allocation efficiencies, and forced inefficient output/labor decisions influence TVEs and PEs profit-maximizing behavior, we need an empirical method which could include all these factors into the profit maximization model.

Following the work by Shepard on indirect production theory, Chambers (1982) developed an analytical framework to use in analyzing optimization problems in the face of expenditure constraints. Lee and Chambers (1986) developed a theory of short-run expenditure constrained profit maximization and econometrically tested it using US agricultural data. Later, Fare, Grosskopf and Lee (1990), or FGL, developed a nonparametric alternative to the Lee and Chambers model for testing expenditure constraints. They applied this model to a sample of California rice farms. Arnade and Gopinath (2000), or AG, extended the FGL approach to test for the presence of expenditure constraints and output-target constraints as sources of inefficiency, and examined economic performance in 73 Russian crop production regions.

As outlined in FGL and AG, this model consists of a series of linear programming problems. Similar to the nonparametric efficiency measures to which they are related, this linear programming approach produce individual measures of performance too and therefore allows us to identify whether an individual enterprise faces expenditure constraints, revenue

(output) constraints, or employment constraints and the associated loss in profits resulting from respective constraints. This method also provides us a measure of profits lost to the other sources excluding expenditure, revenue (output) and employment constraints.

Assume there are $k = 1, \dots, K$ observations of inputs x^k and outputs y^k , where $x^k = (x_1^k, \dots, x_n^k, \dots, x_N^k) \in R_+^N$ and $y^k = (y_1^k, \dots, y_m^k, \dots, y_M^k) \in R_+^M$. The k observations may be for the same firm over time or many firms at one point of time. Following Fare *et al.* (1985) and others, we represent PE and TVE technology by the piece-wise linear relation

$$T = \left\{ (x, y) : \sum_{k=1}^K z^k y_m^k \geq y_m, m = 1, \dots, M; \sum_{k=1}^K z^k x_n^k \leq x_n, n = 1, \dots, N; \sum_{k=1}^K z^k = 1, z \in R_+^K \right\}, \quad (4)$$

where z^k is the “intensity variable” for activity k , and $z = (z^1, \dots, z^k, \dots, z^K)$. The first two constraints in (4) ensure that all input/output combinations in T are technically feasible, while the last constraint admits variable returns to scale. The three constraints in (4) serve to form convex combinations of the observed input and output data.

To incorporate the expenditure constraint, we need to partition the inputs. Suppose inputs can be partitioned into variable inputs x_v and fixed inputs x_f . For each input vector $k = 1, \dots, K$, let $x^k = (x_v^k, x_f^k)$, where $x_v^k = (x_{v_1}^k, \dots, x_{v_i}^k, \dots, x_{v_I}^k)$, and $x_f^k = (x_{f_{I+1}}^k, \dots, x_{f_N}^k)$. Denote output prices by $P = (p_1, \dots, p_M) \in R_+^M$ and variable input prices by $W_v = (w_{v_1}, \dots, w_{v_i}, \dots, w_{v_I})$. All enterprises are assumed to take the same input and output prices for each input and output, hence the superscript k is dropped from all price vectors.

To introduce expenditure, revenue (output), and employment constraints into model, let the maximum allowable expenditure be denoted E , minimum revenue be denoted R_c , and minimum employment be denoted N . Following AG, the expenditure constraint for enterprise k can be represented by:

$$w_{v_1} x_{v_1}^k + \dots + w_{v_I} x_{v_I}^k \leq E^k, \quad (5)$$

the revenue constraint for enterprise k can be represented by:

$$p_1 y_1^k + \cdots + p_M y_M^k \geq R_c^k, \quad (6)$$

while the employment constraint for enterprise k can be represented by:

$$x_{v_1} \geq N^k \quad (7)$$

where we let input x_{v_1} denote labor.

To get the loss in profits from the expenditure, revenue (output), and employment constraints, we calculate profits with the constraints (5) – (7). The superscript k will be dropped because the variable inputs x_v and the outputs y are choice variables. In practice, E^k , R_c^k , and N^k are computed as observed expenditures on variable inputs, output revenues, and employed workers, i.e., $\sum_{i=1}^I w_{v_i} x_{v_i}^k$ is used as a proxy for E^k , $\sum_{m=1}^M p_m y_m^k$ is used as a proxy for R_c^k and $x_{v_1}^k$ is used as a proxy for N^k .

Given output and input prices, the fixed factor endowment x_f^k , and technology (4), the unrestricted short-run profit maximization problem for the k^{th} enterprise can be calculated as the solution to the following linear programming problem:

$$\begin{aligned} \pi_{uk} &= \max_{y_m, x_{v_i}, z} \sum_{m=1}^M p_m y_m - \sum_{i=1}^I w_{v_i} x_{v_i} & (8) \\ s.t. \quad & \sum_{k=1}^K z^k y_m^k \geq y_m, \quad m = 1, \dots, M \\ & \sum_{k=1}^K z^k x_{v_i}^k \leq x_{v_i}, \quad i = 1, \dots, I \\ & \sum_{k=1}^K z^k x_{f_i}^k \leq x_{f_i}^k, \quad i = I + 1, \dots, N \\ & \sum_{k=1}^K z^k = 1, \quad z \in R_+^K \end{aligned}$$

where the four constraints in (LP.1) represent the technology with I variable inputs, $N - I$ fixed inputs and M outputs. The expenditure, revenue, and employment constraints are represented by expressions (5) – (7) respectively.

For each k , consider the following definitions: (i) $\pi_{uk} \equiv \pi^k(x_f^k)$ represents the solution to (8), i.e., observation k 's solution to the profit maximization problem with no revenue, expenditure and employment constraints; (ii) $\pi_{rk} \equiv \pi^{rk}(x_f^k, R_c^k)$ represents the solution to (8) and the additional revenue constraint (6); (iii) $\pi_{ek} \equiv \pi^{ek}(x_f^k, R_c^k, E^k)$ represents the solution (8) along with the revenue and expenditure constraints (6) and (5); and (iv) $\pi_{nk} = \pi^{nk}(x_f^k, R_c^k, E^k, N^k)$ represents (8) along with the revenue, expenditure, and employment constraints (6) – (7). Finally, denote the actual observed profits for observation k as π_{ak} .

The overall efficiency measure is denoted TE^k , and defined as

$$TE^k = \frac{\pi_{ak}}{\pi_{uk}}$$

By definition, π_{ak} is always less than or equal to π_{uk} . Therefore TE^k will be less than or equal to one, with $TE^k = 1$ only if the enterprise k is overall efficient. We note, without proof, that the measures $\pi_{uk}, \pi_{rk}, \pi_{ek}$, and π_{nk} are nested relationships, and hence, allow us to decompose TE^k in into four components: actual efficiency (AE^k), revenue efficiency (RE^k), financial efficiency (FE^k), and employment efficiency (EE^k). These measures are defined as follows:

$$AE^k = \frac{\pi_{ak}}{\pi_{nk}}, EE^k = \frac{\pi_{nk}}{\pi_{ek}}, FE^k = \frac{\pi_{ek}}{\pi_{rk}} \text{ and } RE^k = \frac{\pi_{rk}}{\pi_{uk}},$$

and the overall efficiency can be expressed as the product of these four sources of efficiencies

$$TE^k = AE^k * EE^k * FE^k * RE^k.$$

The actual efficiency could be further decomposed into technical efficiency and allocative efficiency.

3.1 Data and Empirical Results

The project requires data on inputs, outputs, variable input prices, output prices, tax payment, expenditure and revenue for TVEs and private enterprises. Since we treat TVEs and

private enterprises in each province as a representative enterprise, we will use panel data of the above variables for the 30 provinces in China, and the data covers the years 1986 through 1999. We have finished collecting all the data and currently we are running the Gams programs. The empirical results will be reported soon.

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