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A MODEL OF THE BEHAVIOUR OF VIETNAMESE SOEs DURING THE REFORM PERIOD

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With a steady growth rate of Gross Domestic Product in the range of 7 per cent and single digit inflation rate per year for the 1991-2000 period, Vietnam provides an example of successful economic reform for a transitional economy.[1] Contributing to this growth rate is an annual growth rate of output of 13.7 per cent in the industrial sector. State owned enterprises (SOEs) recorded a growth rate of 12.3 per cent and accounted for nearly half of industrial output. The high growth rate of the SOE sector has generally been attributed to the various reform measures, implemented from the early 1980s and intensified from the late 1980s, which focused on replacing the old management mechanism and structure with new market-oriented ones, liberalising the operation of SOEs as well as giving them greater incentive, and diversifying their ownership. The reform, however, has not been able to establish all institutions, which are essential for the controlling and managing the SOE operation. As well, SOE operating environment is generally seen as uncompetitive created by different kinds of protections and privileges given to them. As a result, the SOE sector is largely seen as inefficient. In addition, many SOEs are making full use the weak controlling and managing mechanism to appropriate public property for their own interests.

In an attempt to understand the behaviour of SOEs in their operation, this paper reports the construction of an econometric model designed to analyse the effects of government policies on the behaviour of industrial SOEs in Vietnam during the period under study.[2] Part 1 describes the model, beginning with the specification of the production function of SOEs. The section following describes the income and utility functions assumed. A section on the production function, which includes a workers' effort variable, concludes part 1. Part 2 is about the determinants of total factor productivity (TFP) and analysis of

[1] The author would like to thank Dr. Suiwah Leung; Pro. Ron Duncan and Dr. Tom Kompas for their useful comments. All the errors remain the author's own.

the level of TFP at different stages of the reform process. Part 3 focuses on the profitability and the optimal level of indirect costs of production (i.e., marketing and administrative expenses) from the point of view of the SOE. It outlines a framework for the analysis of the effects on profit and indirect costs of subsidy policies and the assessment criteria applied to SOEs. Part 4 concludes.

1. The model

1.1. The production function

As in several other studies, it is supposed that the production function follows a Cobb-Douglas form[3]

$$Y(L,K,M) = AL^{a_1}K^{a_2}M^{a_3} \tag{1}$$

In this equation, Y is the value of total output; L is the labour input, measured in terms of number of workers; K is the value of fixed capital; M is the value of all intermediate inputs; and A is total factor productivity (TFP).[4] It is assumed that $0<\alpha_i<1$ for each i and $\alpha_1 + \alpha_2 + \alpha_3 = 1$ or constant returns to scale. In this model, workers and managers are assumed to have the same role in the production process. This is because under the centrally planned mechanism, the manager received the plans from higher authorities and instructed workers to implement them. Managers and workers did not have to worry about what, how and at what cost to produce. Neither did they worry about at what price and to whom to sell the products. After the major reform of the central planning mechanism in the late 1980s, government policies assigned to the collective of workers the responsibility for drawing up the general production strategy. A particular year's production plan, even though proposed by managers and supportive units, had to be

[2] The model is based on the work by McMillan, Whalley and Zhu (1989); Che (1997); Che, Kompas and Vousden (1999); and Sicular (1994).

approved by the workers' congress. The manager again had the responsibility to instruct workers to implement that production plan. Under this process the manager, therefore, did not have the important role in a firm's operation as is seen in Western experience.

It has long been claimed that the productivity of a firm can be enhanced when workers are given material incentives (in the form of bonuses or profits sharing) to work harder and more efficiently. The underlying assumption is that the workers' effort, motivation and skills will be increased (Weitzman and Kruse 1990). In the context of Vietnamese SOEs, sharing in a firm's profits should enhance workers' efforts and lead to higher productivity of the firm.[5] To capture this fact, it is assumed that when workers receive bonuses (share in firm's profits), the effort level, e, that they choose to exert in the production process will increase. This effort level, which is assumed to be no less than 1 $(e \geq 1)$, will multiplicatively augment the labour input, giving a measure of effective units of labour.[6] The production function now can be rewritten as

$$Y(L,K,M,e) = A(Le)^{a_1} K^{a_2} M^{a_3} \qquad (2)$$

so that if workers receive bonuses, that is $e > 1$, then the production function becomes as in equation (2). Otherwise, $e = 1$ and the production function remains in its initial form of equation (1).

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[3] Empirical work indeed confirms this functional form for production. For more details, see Vu (2001).
[4] See Appendix A for definition and calculation of TFP.
[5] This is because the old wage payment system was designed to ensure the basic necessities of life for all society members. The wage level was low and was based on egalitarian principles. As a result, workers did not concentrate on their work but shirked and paid more attention to other work that brought in additional income.
[6] This follows McMillan, Whalley and Zhu (1989) and Che (1997).

1.2. The income and utility functions

The income of a typical worker is assumed to be derived from three sources: the normal wages from working, the gains from manipulating indirect costs of production and a share of profits or a bonus payment. This assumption is represented as

$$i = w + \gamma_2 + b_1 * Pw\ planned\ profits + b_2 * Pw\ non\text{-}planned\ profits \qquad (3)$$

In this equation, i is total income; w is normal wages as determined by government policies;[7] γ_2 is the income from manipulating indirect costs of production;[8] b_1 is the share (of planned profits) received by the worker and b_2 is the share (of non-planned profits) received by the worker.[9] The values of b_1 and b_2 vary between zero and one, inclusive. *Pw planned profits* and *Pw non-planned profits* are planned and non-planned profits levels per worker, which are defined as *total planned* and *total non-planned profits* divided by *total labour*. *Total planned profits* were determined in the plans and generally were fixed. This level may not be, and likely would not be, the same as the level which the firm would achieve if it were free to maximise profits. As the total number of workers in a particular year is fixed, so *pw planned profits* level is also fixed at a level say, $\overline{Pwplannedprofits}$. Because the firm chooses the level of non-planned production, there is no reason why *total non-planned profits* were not the profit level at which total direct cost was minimised.[10] So the *total non-planned profit* level can be found by

$$Total\ non\text{-}planned\ Profits = (p_y Y - TC(Y) - \Pi - \Psi)(1 - t) \qquad (4)$$

[7] Wages are normally determined through government policies. Actual wages paid are calculated by SOEs based on those policies and need to be approved by higher authorities.

[8] This is the income received from artificially manipulating marketing and administrative expenses - the two components of indirect costs of production. See paragraphs below for more details.

[9] Planned profits refer to profits of the planned production (all production before 1981 and the first plan after 1981). Non-planned profits are profits of the non-planned production (the second and third production plan after 1981 and all production after 1989).

[10] Direct total cost refers to all direct expenses of producing a certain level of output. This is to be distinguished from indirect cost, which includes such items as administrative and marketing expenses and which is used to calculate before-tax profits.

$$TC(Y) = wL + rK + p_m M \tag{5}$$

$$\boldsymbol{Y} = \boldsymbol{Y}_1 + \boldsymbol{Y}_2 \tag{6}$$

$$Pw\ non\text{-}planned\ profits = \frac{Total Nonplanned\ Profits}{L} = [p_y y - tc(y) - \boldsymbol{p} - \boldsymbol{y}_1 - \boldsymbol{y}_2](1-t) \tag{7}$$

In these equations, p_y is the price of output; Y is total output; y is per worker output; $TC(Y)$ is total direct cost of producing Y output (it is assumed that this is the true cost and hence the profit maximising cost level);[11] $tc(y)$ is per worker total direct cost of producing y output; w is the wage rate; r is the price of capital; p_m is the price of intermediate inputs; Π is all fixed taxes; π is per worker fixed taxes; $\boldsymbol{Y}$ is indirect production cost, in which $\boldsymbol{Y}_1$ is assumed to be all legitimate indirect expenses and $\boldsymbol{Y}_2$ is manipulated indirect expenses;[12] $\boldsymbol{y}_1$ is per worker legitimate indirect expenses; $\boldsymbol{y}_2$ is per worker manipulated indirect expenses; and t is the profit tax rate.

For the utility function, it is supposed that workers like to have as much income as they can but that they dislike working hard or exerting more effort, so that each worker has a utility function of the following form.

$$U(i,\boldsymbol{e}) = i - \frac{\boldsymbol{e}^z}{z\boldsymbol{d}} \tag{8}$$

where $\delta > 0$, $\partial U(i,\boldsymbol{e})/\partial i > 0$ and $\partial U(i,\boldsymbol{e})/\partial \boldsymbol{e} < 0$ and $\partial^2 U(i,\boldsymbol{e})/\partial \boldsymbol{e}^2 < 0$, and the value of z is such that

[11] In the partial reform period (in the 1980s), an SOE was still under the control of different bodies and it is unlikely that it could manipulate the direct cost of production even with the non-planned production. This assumption may not hold after SOEs received further autonomy in 1989. However, here it is assumed that this is a true direct cost even after they received more autonomy.

[12] Until the full reform period (from 1989), indirect expenses were calculated to include the legitimate parts of costs only, because under the control of different bodies, an SOE found it very difficult to manipulate these indirect expenses. After SOEs had greater autonomy, however, it is very likely that they modified these indirect expenses for their own benefit.

$$z-1=\boldsymbol{e}\ \frac{\partial^2 U(i,\boldsymbol{e})/\partial \boldsymbol{e}^2}{\partial U(i,\boldsymbol{e})/\partial \boldsymbol{e}} \tag{9}$$

and measures the curvature of the utility function.

1.3. The worker-effort production function

Dividing both sides of the production function (2) above by L to obtain

$$y(k,m,\boldsymbol{e}) = Ak^{a_2}m^{a_3}\boldsymbol{e}^{a_1} \tag{10}$$

where y, k, m are per worker level of output, capital and intermediate inputs, respectively. Substituting this reduced production function (10) into (7), then (3) and finally to the utility function (8), it becomes

$$\begin{aligned} U(\boldsymbol{e}) &= w+\boldsymbol{y}_2+\boldsymbol{b}_1 * \overline{Pwplannedprofits}+\boldsymbol{b}_2[(p_y Ak^{a_2}m^{a_3}\boldsymbol{e}^{a_1} \\ &-tc(y)-\boldsymbol{p}-\boldsymbol{y}_1-\boldsymbol{y}_2)](1-t)-\frac{\boldsymbol{e}^z}{z\boldsymbol{d}} \end{aligned} \tag{11}$$

When a firm maximises non-planned profits, it also means that the firm minimises its total direct production costs - *TC(Y)*. So the firm's problem is

$$\underset{L,K,M}{Min}\ TC(Y) = wL + rK + p_m M \tag{12}$$

subject to

$$Y(L,K,M) = AL^{a_1}K^{a_2}M^{a_3} \tag{13}$$

In the form of a Lagrangian equation, the problem becomes

$$\pounds = wL + rK + p_m M + \boldsymbol{l}(Y - AL^{a_1}K^{a_2}M^{a_3}) \tag{14}$$

with first order necessary conditions given by

$$\frac{\partial \pounds}{\partial L} = w - \boldsymbol{l}A\boldsymbol{a}_1 L^{a_1-1}K^{a_2}M^{a_3} = 0 \tag{15}$$

$$\frac{\partial \pounds}{\partial K} = r - \boldsymbol{l}A\boldsymbol{a}_2 L^{a_1}K^{a_2-1}M^{a_3} = 0 \tag{16}$$

$$\frac{\partial \pounds}{\partial M} = p_m - \lambda A \alpha_3 L^{\alpha_1} K^{\alpha_2} M^{\alpha_3 - 1} = 0 \tag{17}$$

and $$\frac{\partial \pounds}{\partial \lambda} = Y - AL^{\alpha_1} K^{\alpha_2} M^{\alpha_3} = 0 \tag{18}$$

After some manipulation, the total cost function becomes

$$TC(Y) = \frac{Y}{A} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_3^{\alpha_3}} \tag{19}$$

or in per worker terms,

$$tc(y) = k^{\alpha_2} m^{\alpha_3} \varepsilon^{\alpha_1} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_3^{\alpha_3}} \tag{20}$$

Substituting (20) back into the utility function (11) gives

$$\begin{aligned} U(\varepsilon) = {} & w + \gamma_2 + \beta_1 * \overline{Pwplannedprofits} + \beta_2 (p_y A k^{\alpha_2} m^{\alpha_3} \\ & - k^{\alpha_2} m^{\alpha_3} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_3^{\alpha_3}})(1-t)\varepsilon^{\alpha_1} - \frac{\varepsilon^{z}}{z\delta} - \beta_2 (\pi + \gamma_1 + \gamma_2)(1-t) \end{aligned} \tag{21}$$

Given this utility maximisation problem, solutions can be found for two cases: first, where "indirect costs of production", γ, are exogenous and second, where "indirect costs of production" are endogenous. The first case occurs when an SOE cannot manipulate "indirect costs of production" and the other case is when the SOE can manipulate these kinds of expenses.

1.3.1. The case of exogenous "indirect costs of production"

During the pre-reform and the partial reform periods, an SOE could not manipulate any type of expenses, as all expenses were specified in the production plans and under the tight control and inspection of different bodies in the management hierarchy. This means that all elements of the "indirect costs" were legitimate and the income of a worker, therefore, did not include any element from manipulating indirect costs, so that $\gamma_2 = 0$. The utility function now becomes

$$U(e) = w + b_1 * \overline{Pwplannedprofits} + b_2(p_y Ak^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)e^{a_1} - \frac{e^z}{zd} - b_2(p + y_1)(1-t) \quad (22)$$

The workers' problem is to choose their effort level, e, to maximise the utility as specified in equation 22. Solving this gives the optimal effort level

$$e^* = [db_2(p_y Ak^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)a_1]^{\frac{1}{z-a_1}} \quad (23)$$

As assumed earlier, $e = 1$ when a worker does not receive any bonuses. This happens when $t = 1$ (profits tax rate is 100%) and/or b_2 equal 0 (no share of profits) and/or $p_y Ak^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} \leq 0$ (profits are non-positive) and $e>1$ otherwise.

Substituting this optimal value of effort e^* in equation (23) back into the reduced form of the production function (10), assuming that e is greater than unity (if e is equal to 1, it returns to the normal production function (1)), (10) becomes

$$y(k,m) = Ak^{a_2 + a_2 \frac{1}{z-a_1}} m^{a_3 + a_3 \frac{1}{z-a_1}} (da_1)^{\frac{1}{z-a_1}} [b_2(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} \quad (24)$$

or

$$y(k,m) = TFPk^{\frac{a_2(z-a_1)+a_2}{z-a_1}} m^{\frac{a_3(z-a_1)+a_3}{z-a_1}} \quad (25)$$

where

$$TFP = A(da_1)^{\frac{1}{z-a_1}} [b_2(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} \quad (26)$$

Multiplying both sides of (25) by L, it gives

$$Y(L,K,M) = TFP * L^a K^b M^c \quad (27)$$

where

$$a = [\boldsymbol{a}_1(z - \boldsymbol{a}_1) + \boldsymbol{a}_1 - 1]/(z - \boldsymbol{a}_1)$$
$$b = [\boldsymbol{a}_2(z - \boldsymbol{a}_1) + \boldsymbol{a}_2]/(z - \boldsymbol{a}_1) \quad \text{and} \tag{28}$$
$$c = [\boldsymbol{a}_3(z - \boldsymbol{a}_1) + \boldsymbol{a}_3]/(z - \boldsymbol{a}_1)$$

Clearly, this function, which incorporates the effort level of the workers into the normal production function, also has a Cobb-Douglas form and constant returns to scale.

1.3.2. The case of endogenous "indirect costs of production"

The abandonment of centrally planned economic management, marked by Decision 217/HDBT and other measures that followed, has totally changed the operation of SOEs in Vietnam. They now have much greater freedom to decide what and how much to produce and where to source inputs. They are also allowed to hire and fire employees and set wages, within policy guidelines. They now only have to pay taxes and other levies as stipulated by law. All after-tax profits belong to SOEs, hence effectively turning managers and employees into owners. In addition, SOEs now are not under as tight and direct control and inspection of different bodies as before. This relaxation of control, as seen in standard principal-agent literature, enables SOEs to try different ways to benefit themselves, especially through not replacing controlling mechanisms.[13] Being the effective owners, the managers and workers of an SOE naturally want to maximise their residual earnings. This is done by the standard method of minimising the direct costs of producing a given quantity of output. However, an SOE can do even better by minimising production costs and at the same time minimising profits tax, as profits tax is seen as another expense that it has to pay. Profits tax is minimised by minimising before-tax profits, which in turn requires the inflation of expenditure. Given the

[13] Such mechanisms include: (1) competitive factor and product markets with free entry and exit; (2) a competitive managerial and labour market; and (3) a competitive stock market (Fama and Jensen 1983). None of these mechanisms has been fully established and respected in Vietnam. The appointment and promotion of SOEs managers is rarely based on entrepreneurial and managerial skills but more often on political as well as other non-economic criteria. Further, it is complicated to fire workers and there are substantial obstacles to entry into certain industries. A stock market is still at a very early stage of development and accounting standards are not seriously obeyed.

constraints on wages and other legitimate expenses of direct production cost, which an SOE finds difficult to manipulate, it tends to manipulate indirect production costs, γ, in arriving at before-tax profits.[14]

As assumed earlier, γ consists of two parts, γ_1, which includes all the legitimate indirect expenses, and γ_2, the manipulated indirect expenses. The utility function now is

$$U(\epsilon,\gamma_2) = w+\gamma_2 + \beta_1 * \overline{Pwplannedprofits} + \beta_2 (p_y A k^{\alpha_2} m^{\alpha_3} - k^{\alpha_2} m^{\alpha_3} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1}\alpha_2^{\alpha_2}\alpha_3^{\alpha_3}})(1-t)\epsilon^{\alpha_1} - \frac{\epsilon^z}{z\delta} - \beta_2(\pi+\gamma_1+\gamma_2)(1-t) \tag{29}$$

The decision problem of a worker now is to choose effort level, ϵ, and the level of manipulated indirect expenses, γ_2, to maximise utility. Again, using standard calculus, the optimal level of effort exerted by workers, which turns out to be the same as in the previous case when "indirect costs of production" were exogenous, is given in equation (30)

$$\epsilon^* = [\delta\beta_2 (p_y A k^{\alpha_2} m^{\alpha_3} - k^{\alpha_2} m^{\alpha_3} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1}\alpha_2^{\alpha_2}\alpha_3^{\alpha_3}})(1-t)\alpha_1]^{\frac{1}{z-\alpha_1}} \tag{30}$$

For the optimal level of "manipulated indirect expenses ", as marginal utility of γ_2 is $1-\beta_2(1-t)$, which is always larger than zero, the firm finds it better to keep inflating the "manipulated indirect expenses" category.[15] Nevertheless, it is obvious that the firm can not keep inflating the expenses category indefinitely, as doing this will cause profits to be abnormally negative. Depending on government regulations, the firm will choose the

[14] According to normal accounting standards, before-tax profit is calculated as total sales revenue minus total indirect taxes, minus total direct production costs minus total indirect production costs. All the items with minus signs need to be associated with total sales revenue.

[15] This is because both β_2 (share of profits) and t (profit tax rate) range between 0 and 1, then $\beta_2(1-t)$ is strictly less than 1.

level of "manipulated indirect expenses" that is in its best interests. For the time being, suppose that the optimal level of "manipulated indirect expenses" is y^*_2.[16]

The value of optimal effort level e^* in equation (30) is substituted back into the reduced form of the production function (10) and it is assumed that e is greater than unity. Since the value of e^* is the same as that in section 1.3.1, the worker-effort production should be the same, that is

$$y(k,m) = Ak^{a_2 + a_2 \frac{1}{z-a_1}} m^{a_3 + a_3 \frac{1}{z-a_1}} (da_1)^{\frac{1}{z-a_1}} [b_2 (p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} \quad (31)$$

or

$$y(k,m) = TFPk^{\frac{a_2(z-a_1)+a_2}{z-a_1}} m^{\frac{a_3(z-a_1)+a_3}{z-a_1}} \quad (32)$$

where

$$TFP = A(da_1)^{\frac{1}{z-a_1}} [b_2 (p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} \quad (33)$$

Multiplying both sides of (33) by L gives

$$Y(L,K,M) = TFP * L^a K^b M^c \quad (34)$$

where

$$\begin{aligned} a &= [a_1(z-a_1) + a_1 - 1]/(z-a_1) \\ b &= [a_2(z-a_1) + a_2]/(z-a_1) \\ c &= [a_3(z-a_1) + a_3]/(z-a_1) \end{aligned} \quad (35)$$

This function is the same as that in section 1.3.1 as it has incorporated the effort level of the workers into the normal production function. The reported profit level, however, will be different in this case because an SOE, depending on particular circumstances,

[16] For more details, see part 3 on the options for the level of "indirect costs of production".

will manipulate the level of "manipulated indirect expenses" and hence the indirect costs of production in its best interests.[17]

2. The determinants of Total Factor Productivity

As shown through the model, different policies affecting the distribution of profits at different stages of reform had different effects on the effort level exerted by SOE workers. Higher levels of effort brought about by reform measures directly increase the production of an SOE. Indeed, as can be seen in equations (26) and (33), reform policies directly affect the value of TFP via such factors as the share of non-planned profits received by workers, b_2, the profit tax rate, t, and output price, p_y, wage rate, w, interest rate (price of capital), r, and the price of intermediate inputs, p_m. At different stages of reform, these factors have different values and hence make the value of TFP different.

2.1. The pre-reform period - before 1981

During this period, the centrally planned economic mechanism was applied to all SOEs. Under this policy regime, SOEs were given production targets as well as the needed inputs from line ministries or local people's committees. If they needed extra capital during the production process, they could borrow from the State Bank at a fixed interest rate. The outputs were transferred to trading SOEs. All the value indicators such as prices, profits and wages were predetermined in the plans. When SOEs realised profits, they were transferred back to the government; losses were made up from government budget expenditure. With this arrangement, the incomes of workers consisted only of the wages as specified in the plans.

[17] See part 3 on the profits level in different circumstances.

This mechanism has been criticised in the literature for discouraging workers from enhancing productivity. Given the assumptions made earlier, the institutional arrangements in this period, where only planned production was allowed and $\beta_1 = \beta_2 = 0$ (workers received no share of profits), did not encourage workers to exert effort beyond the level that they were supposed to generate in order to receive the fixed wages ($\epsilon = 1$). It follows that there was no incentive-based improvement in TFP growth and the TFP level remained at A.

2.2. The partial reform period - 1981 to 1988

The main reform measures during this partial reform period were designed to allow SOEs to operate under three plans. The first plan was mandatory and under this plan profits had to be transferred to the State Budget. The second plan and the third plan allowed the enterprise to buy inputs from the market and sell the output in the market. As well, the enterprise had the rights to a predetermined proportion of profits from the second and third plans.

This new arrangement increased the income of workers - via the share in profits from the second and the third plans. Here β_1 is still zero but β_2 is positive. The profit tax in this period was not relevant. Due to the presence of the non-planned element, the output price was relatively higher, and so was the price of intermediate inputs. However, profits were still positive (otherwise firms would not implement this plan).[18] Compared with the pre-reform context, these factors increased the effort level beyond the norm by

$$\Delta\epsilon = [\beta_2 (p_y A k^{\alpha_2} m^{\alpha_3} - k^{\alpha_2} m^{\alpha_3} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_3^{\alpha_3}}) \alpha_1]^{\frac{1}{z-\alpha_1}} - 1 > 0 \qquad (36)$$

[18] According to Nguyen, Tran and Vu (1995: 32), the profit rate for the second and the third plan could be from two to four times that of the first plan.

This higher level of effort directly transformed into a higher TFP level and brought about positive growth in TFP. The increase in TFP beyond the level in the pre-reform period now is

$$\Delta TFP = A(\boldsymbol{d}\boldsymbol{a}_1)^{\frac{1}{z-a_1}}[\boldsymbol{b}_2(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{\boldsymbol{a}_1^{a_1}\boldsymbol{a}_2^{a_2}\boldsymbol{a}_3^{a_3}})]^{\frac{1}{z-a_1}} - A > 0 \tag{37}$$

With this change in the TFP level, the TFP growth rate between the pre-reform and partial reform periods is found as:

$$\frac{\Delta TFP}{A} = \frac{A(\boldsymbol{d}\boldsymbol{a}_1)^{\frac{1}{z-a_1}}[\boldsymbol{b}_2(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{\boldsymbol{a}_1^{a_1}\boldsymbol{a}_2^{a_2}\boldsymbol{a}_3^{a_3}})]^{\frac{1}{z-a_1}} - A}{A}$$

$$= (\boldsymbol{d}\boldsymbol{a}_1)^{\frac{1}{z-a_1}}[\boldsymbol{b}_2(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{\boldsymbol{a}_1^{a_1}\boldsymbol{a}_2^{a_2}\boldsymbol{a}_3^{a_3}})]^{\frac{1}{z-a_1}} - 1 > 0 \tag{38}$$

2.3. The full reform period - 1989 onwards

Decision 217/HDBT, and other measures that followed, totally changed the operation of SOEs. They now can decide what and how much to produce and where to source the inputs. They are also allowed to hire and fire employees and set wages, within policy guidelines. They now only have to pay taxes and other levies as stipulated by law. All after-tax profits belong to SOEs.

The new reforms have changed all the factors in the TFP formula. There is now no planned production and hence no planned profits. However, the tax rate became relevant after the enactment of a profit-tax law in 1989. At the same time, the value of $\boldsymbol{b}_2$ became 100 per cent, as after-tax profits belonged to SOEs. These arrangements should stimulate workers and hence their effort should be higher. Compared with the pre-reform period, effort level now increases by

$$\Delta e = [d(p_y A k^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)a_1]^{\frac{1}{z-a_1}} - 1 > 0 \tag{39}$$

As before, the higher effort level should have brought about a larger TFP level, compared with that of the pre-reform period. The change in TFP level is

$$\Delta TFP = A(da_1)^{\frac{1}{z-a_1}}[(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} - A > 0 \tag{40}$$

so that

$$\frac{\Delta TFP}{A} = \frac{A(da_1)^{\frac{1}{z-a_1}}[(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} - A}{A}$$

$$= (da_1)^{\frac{1}{z-a_1}}[(p_y A - \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t)]^{\frac{1}{z-a_1}} - 1 > 0 \tag{41}$$

With the positive change in the TFP level compared with that of the pre-reform period, reform measures in the partial and the full reform periods are thus seen to have a positive impact on the productivity of SOEs. However, reform measures could also have another impact on SOE behaviour toward profitability. The analysis of this issue is the main content of the next section.

3. The determinants of profitability and the level of "indirect costs of production"[19]

According to the model in part 1, reform policies should contribute to increases in the TFP level and the TFP growth rate over the study period. This is the direct result of allowing workers to share in the firm's profits, which enhances their work effort. However, reform policies in the full reform period should also have changed the

[19] The model in this section is based on the work by Sicular (1994).

behaviour of SOEs toward profitability and production expenses. As shown in section 1.3.2 above, the relaxation of controls over SOEs allows the workers and managers – the effective owners - to choose the level of effort, e, and also the level of "indirect costs of production", y, to maximise their utility. While the optimal level of effort can be found directly, depending as it does on such factors as the share of profits, the relative price of output and inputs, and the profit tax rate, the optimal level of "indirect costs of production" cannot be directly found. This is because the marginal utility of the manipulated indirect expenses, y_2, which is $1-b_2(1-t)$, is always larger than zero.[20] In that case an SOE finds it better to keep inflating the "manipulated indirect expenses" category. Nevertheless, it is obvious that an SOE is never able to keep inflating this expense category indefinitely, as doing so will cause profits to be abnormally negative. The level of "manipulated indirect expenses" that an SOE chooses will depend on such factors as the subsidy policy or the assessment criteria of an SOE.[21]

3.1. Subsidy policy

Current policies allow a loss-making SOE to receive some form of implicit subsidy. These could be in the form of delays in paying taxes, rolling over due debts, or writing off bad debts. Effectively, these kinds of support are the same as giving a loss-making SOE an explicit subsidy.[22] So assuming that an SOE knows that if it makes a loss, it will receive an explicit level of subsidy equal to q, what would be its behaviour in this case? The answer depends on the characteristics of the subsidy. Here, two cases are

[20] See section 1.3.2.

[21] It is possible that the level of "manipulated indirect expenses" also depends on the possibility of being caught. This is a real but difficult-to-realise threat due to the widespread connections between SOEs and government officials. The threat of being caught, therefore, has virtually no impact on the behaviour of the SOE toward profits.

[22] For example, allowing an SOE to delay paying taxes effectively means that it receives a subsidy equal to the level of taxes due.

considered: first, the subsidy level is equivalent to the amount of loss; and second, the subsidy is fixed at certain level.

3.1.1. The subsidy level is equivalent to the loss amount

In this case, the problem becomes one of choosing the effort level and the level of "manipulated indirect expenses" to maximise utility.

$$U(\boldsymbol{e},\boldsymbol{y}_2) = w + \boldsymbol{y}_2 + \boldsymbol{b}_1 * \overline{Pwplannedprofits} + \boldsymbol{b}_2 (p_y A k^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{\ a_3}}{\boldsymbol{a}_1^{a_1} \boldsymbol{a}_2^{a_2} \boldsymbol{a}_3^{a_3}})(1-t)\boldsymbol{e}^{a_1} - \frac{\boldsymbol{e}^z}{z\boldsymbol{d}} - \boldsymbol{b}_2(\boldsymbol{p} + \boldsymbol{y}_1 + \boldsymbol{y}_2)(1-t) \tag{42}$$

subject to:

$$k^{a_2} m^{a_3} \boldsymbol{e}^{a_1} \frac{w^{a_1} r^{b_2} p_m^{a_3}}{\boldsymbol{a}_1^{a_1} \boldsymbol{a}_2^{a_2} \boldsymbol{a}_3^{a_3}} + \boldsymbol{p} + \boldsymbol{y}_1 + \boldsymbol{y}_2 - p_y A k^{a_2} m^{a_3} \boldsymbol{e}^{a_1} = \boldsymbol{q} \tag{43}$$

where $\boldsymbol{q}$ is the subsidy level.

It is clear in this case that an SOE will always inflate $\boldsymbol{y}_2$ to an infinite level because all losses will be covered by government subsidy. In practice, of course, this can never happen, and the SOE will inflate the $\boldsymbol{y}_2$ to the level where the loss equals the subsidy level likely to be obtainable.

3.1.2. The subsidy is fixed at a certain level

Suppose that an SOE could receive the maximum level of subsidy of $\bar{\boldsymbol{q}}$. The problem as in the previous case is to choose the effort level and the level of "manipulated indirect expenses" to maximise utility.

$$U(\boldsymbol{e},\boldsymbol{y}_2) = w + \boldsymbol{y}_2 + \boldsymbol{b}_1 * \overline{Pwplannedprofits} + \boldsymbol{b}_2 (p_y A k^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{\ a_3}}{\boldsymbol{a}_1^{a_1} \boldsymbol{a}_2^{a_2} \boldsymbol{a}_3^{a_3}})(1-t)\boldsymbol{e}^{a_1} - \frac{\boldsymbol{e}^z}{z\boldsymbol{d}} - \boldsymbol{b}_2(\boldsymbol{p} + \boldsymbol{y}_1 + \boldsymbol{y}_2)(1-t) \tag{44}$$

subject to:

$$k^{a_2} m^{a_3} e^{a_1} \frac{w^{a_1} r^{b_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} + p + y_1 + y_2 - p_y A k^{a_2} m^{a_3} e^{a_1} = \bar{q} \tag{45}$$

Solving these equations gives the following results for the effort level and the level of "manipulated indirect expenses"

$$e^* = [d b_2 (p_y A k^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}})(1-t) a_1]^{\frac{1}{z-a_1}} \tag{46}$$

and $$y_2^* = p_y A k^{a_2} m^{a_3} e_*^{a_1} + \bar{q} - k^{a_2} m^{a_3} e_*^{a_1} \frac{w^{a_1} r^{b_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} - p - y_1 \tag{47}$$

These results show that when the firm is facing a fixed level of subsidy, it will inflate "manipulated indirect expenses" to the level equal to the sum of true profits and the fixed level of subsidy. The effort level, however, does not change.

3.2. Assessment criteria

The above case is normally not applicable to all SOEs because under normal conditions a firm will be able to make positive profits. The SOE, therefore, will not be able to claim any subsidy and it will have to pay the profits tax. However, due to the asymmetric information problem, these owners' representatives will not know the actual level of expenses.[23] The SOE, therefore, will inflate y_2 to minimise reported profits. Will it inflate y_2 to the level where it drives reported profits to zero? The answer is no, as there are factors preventing it from doing this. According to current policies, the director of an SOE making losses for three consecutive years will be fined and may be sacked. This regulation prevents SOEs from depleting all true profits. However, as they are still better off by minimising profits, they will tend to inflate y_2 to a level which leaves reported profits not at zero but equal to a predetermined positive level, say t.

[23] This follows from standard principal-agent theory. In the particular case of SOEs in Vietnam, the owner representative may not care about the actual expenses because he has no real ownership rights and also because of his possible connection with the SOE.

This level will be normally the common level among SOEs operating in the same field or at the level achieved in the previous year.

The problem now is to choose the level of "effort", e, and level of "manipulated indirect expenses", y_2, to maximise utility given that the reported profits equal a fixed level t. So for a typical worker, his problem is to maximise

$$\underset{e,y_2}{Max}\, U(e,y_2) = w + y_2 + (p_y A k^{a_2} m^{a_3} e^{a_1} - k^{a_2} m^{a_3} e^{a_1} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} - \\ - p - y_1 - y_2)(1-t) - \frac{e^z}{zd} \tag{48}$$

subject to

$$p_y A k^{a_2} m^{a_3} e^{a_1} - k^{a_2} m^{a_3} e^{a_1} \frac{w^{a_1} r^{b_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} - p - y_1 - y_2 = t \tag{49}$$

where t is a pre-determined profit level. In Lagrangian equation form, it becomes

$$\pounds = w + y_2 + GP(1-t)e^{a_1} - \frac{e^z}{dz} - (p + y_1 + y_2)(1-t) \\ + l(t - GPe^{a_1} + p + y_1 + y_2) \tag{50}$$

where $$GP = p_y A k^{a_2} m^{a_3} - k^{a_2} m^{a_3} \frac{w^{a_1} r^{a_2} p_m^{a_3}}{a_1^{a_1} a_2^{a_2} a_3^{a_3}} \tag{51}$$

First order necessary conditions are:

$$\frac{\partial \pounds}{\partial e} = a_1 GP(1-t)e^{a_1 - 1} - \frac{e^{z-1}}{d} - l a_1 GPe^{a_1 - 1} = 0 \tag{52}$$

$$\frac{\partial \pounds}{\partial y_2} = 1 + t - 1 + l = 0 \tag{53}$$

$$\frac{\partial \pounds}{\partial l} = t - GPe^{a_1} + p + y_1 + y_2 = 0 \tag{54}$$

After solving the above equations, the optimal value of effort and expenses are

$$e^* = [\delta\alpha_1 (p_y A k^{\alpha_2} m^{\alpha_3} - k^{\alpha_2} m^{\alpha_3} \frac{w^{\alpha_1} r^{\alpha_2} p_m^{\alpha_3}}{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_3^{\alpha_3}})]^{\frac{1}{z-\alpha_1}} \tag{55}$$

$$y_2^* = [\delta\alpha_1]^{\frac{\alpha_1}{z-\alpha_1}} G P^{\frac{z}{z-\alpha_1}} - \pi - \tau - y_1 \tag{56}$$

Those results show that the worker will choose the same effort level but he also tries to manipulate "manipulated indirect expenses" y_2 and hence indirect costs of production y to leave the reported profits equal to a pre-determined level so as to maximise utility.

4. Conclusion

This paper focuses on the specification of models that simulate the behaviour of SOEs before and during the reform period. By assuming that the workers' effort will be higher when they can share in the firm's profits the model suggests that the TFP level during the reform period will be higher than in pre-reform period and hence increases the TFP growth rate. The second part of the model focuses on the behaviour of SOEs when they are given greater autonomy. In conformance with standard principal-agent theory, the model shows that when the workers and managers become the effective owners of the firm, they will try to manipulate production expenses in different ways to deplete all subsidies or to minimise reported profits so as to maximise their utility.

Appendix A Total Factor Productivity and Total Factor Productivity growth

Total factor productivity (TFP) and total factor productivity growth are two indicators which measure productivity and the change in productivity over time. Compared with conventional measures of productivity like labour or capital productivity, TFP is broader as it takes into account the impact of all factors of production. TFP, therefore, is widely used to assess the success of economic reform. Suppose the production function of a firm at time *t* has the following form[24]

$$Y(t) = A(t)\, f(x_t^1; x_t^2; \ldots x_t^n) \tag{A1}$$

In this equation, *t* indicates time and the *x*s indicate the input vector (*x* ranges from *1* to *n*). *Y* is total output; *A(t)* is so-called total factor productivity (TFP) and *f* represents production function. Taking the natural log of both sides of equation (A1) and the derivative of both sides with respect to time *t* gives

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \left(\frac{Af_{x^1}}{Y}\right)\dot{x}^1 + \left(\frac{Af_{x^2}}{Y}\right)\dot{x}^2 + \ldots + \left(\frac{Af_{x^n}}{Y}\right)\dot{x}^n \tag{A2}$$

Equation (A2) can be further manipulated to become

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \left(\frac{Af_{x^1}}{Y}x^1\right)\frac{\dot{x}^1}{x^1} + \left(\frac{Af_{x^2}}{Y}x^2\right)\frac{\dot{x}^2}{x^2} + \ldots + \left(\frac{Af_{x^n}}{Y}x^n\right)\frac{\dot{x}^n}{x^n} \tag{A3}$$

In equation (A3), the components in brackets are the shares of payments to different inputs. After moving all but the first component on the right-hand-side of the equation to the left-hand-side, the remaining component on the right-hand-side represents the difference between the growth of output level and the growth of input level weighted by the share of payment of that input. This component is called TFP growth. A positive TFP growth over a period indicates higher productivity over that period. This could be the result of applying new technology or an improvement in technical efficiency or the

combination of both factors. If the reform measures brought about positive TFP growth, these reform measures are seen to have been successful in improving the performance of firms or of the economy.

[24] For more details, see Barro and Sala-I-Martin (1995).

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