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Comparisons of Managerial Behaviors of the Socialist State Firms

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§ 1 Introduction

The economic theory of the socialist state firms has studied in many literatures of comparative economics. These were many kinds of objective functions of socialist managers who managed the state firms. The purpose of this paper is to compare the equilibrium conditions of different objective functions of socialist managers in the socialist countries.

§ 2 A Simple Model

In this paper we will discuss about the following four kinds of socialist state firms. The first is the output maximization state firm which was under the classical Stalinism many years ago in the Soviet Union. We call this the Stalinist state firm. The second is the profit maximization state firm which was discussed in a decentralized socialist economic system by O. Lange and A. Lerner. We call this the Lange-Lerner state firm. The third is the profit-rate maximization state firm which is the modern Soviet and Chinese State firm. We call this the modern Soviet-Chinese state firm. The

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last is the profit per worker maximization firm which is the similar to a labor-managed firm in Yugoslavia. We call this the labor-managed firm. We will compare these four kinds of socialist firms. First we will compare the optimal conditions.

(1) The Stalinist state firm

The manager of the Stalinist state firm intends to maximize the output Y . We suppose that the shape of cost function $C(Y)$ is given in figure I. When the price of output P is fixed by the state authorities, we are able to formalize the managerial behavior of the Stalinist state firm as follows,

$$\begin{array}{ll} \text{maximize} & Y, \\ \text{subject to} & P \cdot Y - C(Y) \geq 0. \end{array} \quad \text{--- (1)}$$

The latter inequality means a non-negative profit condition. The optimal condition is as follows,

$$AC = P. \quad \text{--- (2)}$$

Here AC is an average cost.

(2) The Lange-Lerner state firm

The manager of the Lange-Lerner state firm is going to maximize the total profit (π).

$$\text{maximize} \quad \pi = P \cdot Y - C(Y). \quad \text{--- (3)}$$

The optimal condition is the equation (4) and (5).

$$\frac{d\pi}{dY} = 0, \quad \dots\dots\dots P = MC, \quad \text{--- (4)}$$

$$\frac{d^2\pi}{dY^2} < 0, \quad \dots\dots\dots \frac{d^2C}{dY^2} < 0. \quad \text{--- (5)}$$

Here MC is a marginal cost.

(3) The modern Soviet-Chinese state firm

The manager of the modern Soviet-Chinese state firm wants to maximize the profit rate as J. Berliner formalized in his model.

$$\text{maximize} \quad \frac{\pi}{C} = \frac{P \cdot Y - C(Y)}{C(Y)}. \quad \text{--- (6)}$$

The optimal condition of this firm is as follows,

$$\frac{d\left(\frac{\pi}{C}\right)}{dY} = 0, \quad \dots\dots AC = MC, \quad \text{--- (7)}$$

$$\frac{d^2\left(\frac{\pi}{C}\right)}{dY^2} < 0, \quad \dots\dots -\frac{C'' P \cdot Y}{C^2} < 0. \quad \text{--- (8)}$$

(4) The Labor-managed firm

The manager of the Labor-managed firm intends to maximize the profit per worker.

$$\text{maximize} \quad \frac{\pi}{L} = \frac{P \cdot Y - C(Y)}{L}. \quad \text{--- (9)}$$

Here L is an input of labor. The optimal condition of this firm is as follows,

$$\frac{d\left(\frac{\pi}{L}\right)}{dY} = 0 \quad \dots\dots P = MC + \frac{1}{\xi} AC, \quad \text{---- (10)}$$

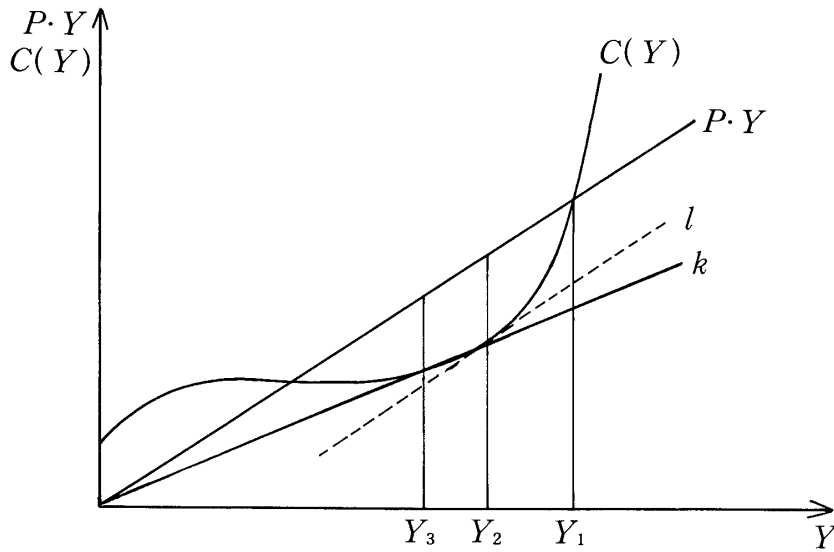
$$\frac{d^2\left(\frac{\pi}{L}\right)}{dY^2} < 0 \quad \dots\dots 2\left(\frac{dL}{dY}\right)^2 (PY - C) \cdot L + 3\left(\frac{dL}{dY}\right) (C' - P) L^2 \quad \text{--- (11)}$$

$$- C' \left(\frac{dL}{dY}\right) L^3 - C'' L^3 < 0.$$

Here ξ is as follows,

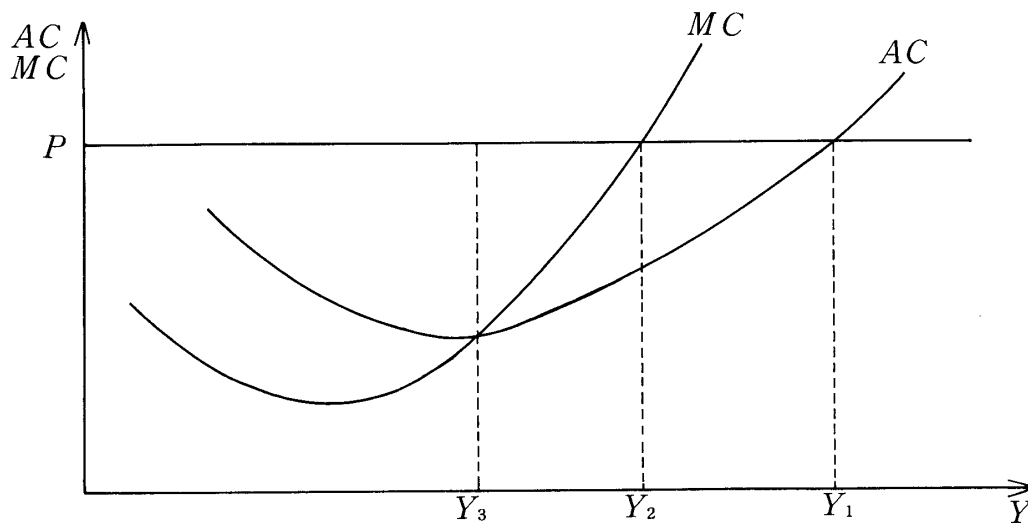
$$\xi = \frac{L}{Y} \cdot \frac{dY}{dL} > 0. \quad \text{--- (12)}$$

Next we compare the optimal output in a graphical analysis.



(Figure 1)

The line l is parallel to $P \cdot Y$ line and the line k is the tangent to the cost function through the origin. Y_1 , Y_2 and Y_3 are the optimal output of the Stalinist state firm, the Lange-Lerner state firm and the modern Soviet-Chinese state firm respectively.



(Figure 2)

From figure 2 shows that the optimal output of the Stalinist state firm is the most output. We have a following relations among Y_1 , Y_2 and Y_3

$$Y_3 \leq Y_2 \leq Y_1 \quad \text{--- (13)}$$

The optimal output of the labor-manged firm apparently is less than the optimal output of the Lange-Lerner state firm. Therefore, we get the following alternative relations among Y_1 , Y_2 , Y_3 and Y_4

$$Y_4 \leq Y_3 \leq Y_2 \leq Y_1 \text{ or } Y_3 \leq Y_4 \leq Y_2 \leq Y_1. \quad \text{--- (14)}$$

Last we compare the supply curves of these firms. The supply curve of the Stalinist state firm is the average cost curve and it has a non-negative gradient.

$$\frac{dP}{dY} = \frac{MC - AC}{Y} \geq 0. \quad \text{--- (15)}$$

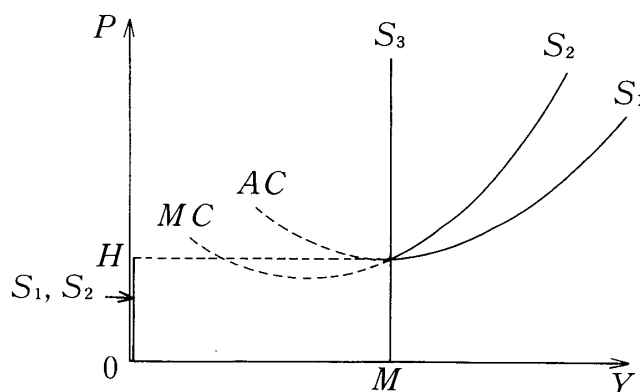
It is depicted by S_1 , curve in figure 3. Until the price reaches to \overline{OH} in figure 3, S_1 is the segment \overline{OH} . The supply curve of the Lange-Lerner state firm is the marginal cost curve and it has a positive gradient.

$$\frac{dP}{dY} = C''(Y) > 0. \quad \text{--- (16)}$$

It is depicted by S_2 curve in figure 3. Until the price reaches to \overline{OH} , S_2 is the segment \overline{OH} too. The supply curve of the modern Soviet-Chinese state firm is a vertical line. From the equation (7), we get a vertical gradient.

$$\frac{dP}{dY} = 0. \quad \text{--- (17)}$$

It is depicted by S_3 vertical line in figure 3.



(Figure 3)

But we can not mention the shape of supply curve of the labor-managed firm. From the equation (10), we get the gradient of the supply curve.

$$\frac{dP}{dY} = \frac{\left(\frac{PY-C}{L}\right) \cdot \frac{d^2L}{dY^2} + C''(Y)}{1 - \frac{1}{\xi}}. \quad \text{--- (18)}$$

It is not possible to say definitely a sign of the slope of this supply curve.

§ 3 A Neoclassical Model

In this section, we assume that the production function is a Neoclassical production function and it has following characters.

$$Y = F(L, K), \quad \text{--- (19)}$$

$$\frac{\partial F}{\partial L} = F_L > 0, \frac{\partial^2 F}{\partial L^2} = F_{LL} < 0, \frac{\partial F}{\partial K} = F_K > 0, \frac{\partial^2 F}{\partial K^2} = F_{KK} < 0, \quad \text{--- (20)}$$

$$\begin{vmatrix} F_{LL} & F_{LK} \\ F_{KL} & F_{KK} \end{vmatrix} = \Delta > 0. \quad \text{--- (21)}$$

Here L is labor and K is capital. The cost function is assumed the following function.

$$C = wL + rK + A. \quad \text{--- (22)}$$

Here w is the wage rate, r is the rate of interest and A is the fixed cost.

(1) The Stalinist state firm

The manager of the Stalinist state firm intends to maximize the output, subject to non-negative profit.

$$\left. \begin{array}{l} \text{maximize} \quad Y = F(L, K), \\ \text{subject to} \quad P \cdot Y - (wL + rK + A) \geq 0 \end{array} \right\} \quad \text{--- (23)}$$

The optimal condition is the same equation as the equation (2).

$$P = \frac{wL + rK + A}{F(L, K)}. \quad \text{--- (24)}$$

From the equation (26), when the economic parameters change, we get the following results.

$$\frac{dP}{dw} = \frac{L}{F} > 0. \quad \text{--- (25)}$$

$$\frac{dP}{dr} = \frac{K}{F} > 0. \quad \text{--- (26)}$$

$$\frac{dY}{dP} = \frac{F_L(w - P \cdot F_L) + F_K(r - P \cdot F_K)}{F}. \quad \text{--- (27)}$$

When an increase of the wage rate increases the price level and an increase of the rate of interest increases the price level and vice versa. But we can say nothing about the sign of the supply curve.

(2) The Lange-Lerner state firm

The manager of the Lange-Lerner state firm is going to maximize the total profit.

$$\text{maximize } \pi = P \cdot Y - (wL + rK + A). \quad \text{--- (28)}$$

The optimal condition is as follows,

$$\frac{\partial F}{\partial L} = \frac{w}{P}. \quad \text{--- (29)}$$

$$\frac{\partial F}{\partial K} = \frac{r}{P}. \quad \text{--- (30)}$$

$$F_{LL} < 0. \quad \text{--- (31)}$$

$$\begin{vmatrix} F_{LL} & F_{LK} \\ F_{KL} & F_{KK} \end{vmatrix} = \Delta > 0. \quad \text{--- (32)}$$

The equations (31) and (32) are satisfied by our assumptions (20) and (21). When the economic parameters change, we obtain the following results.

$$\begin{bmatrix} F_{LL} & F_{LK} \\ F_{KL} & F_{KK} \end{bmatrix} \begin{bmatrix} dL \\ dK \end{bmatrix} = \begin{bmatrix} \frac{1}{P} dw & + \frac{F_L}{P} dP \\ \frac{1}{P} dr & + \frac{F_K}{P} dP \end{bmatrix} \quad \text{--- (33)}$$

$$\frac{\partial L}{\partial w} = \frac{1}{P} \cdot \frac{F_{KK}}{\Delta} < 0. \quad \text{--- (34)}$$

$$\frac{\partial L}{\partial r} = \frac{1}{P} \cdot \frac{-F_{LK}}{\Delta}. \quad \text{--- (35)}$$

$$\frac{\partial L}{\partial P} = \frac{1}{P} \cdot \frac{F_L F_{KK} - F_K F_{LK}}{\Delta}. \quad \text{--- (36)}$$

$$\frac{\partial K}{\partial w} = \frac{1}{P} \cdot \frac{-F_{KL}}{\Delta} \quad \text{--- (37)}$$

$$\frac{\partial K}{\partial r} = \frac{1}{P} \cdot \frac{F_{LL}}{\Delta} < 0. \quad \text{--- (38)}$$

$$\frac{\partial K}{\partial P} = \frac{1}{P} \cdot \frac{F_K F_{LL} - F_L F_{KL}}{\Delta}. \quad \text{--- (39)}$$

$$\frac{\partial Y}{\partial P} = \frac{1}{P} \cdot \frac{1}{\Delta} \cdot \begin{vmatrix} 0 & F_L & F_K \\ F_L & F_{LL} & F_{LK} \\ F_K & F_{KL} & F_{KK} \end{vmatrix}. \quad \text{--- (40)}$$

An increase of the wage rate decreases the demand for labor and vice versa. An increase of the rate of interest decreases the demand for capital and vice versa. If the bordered-Hessian is positive, then the supply curve has a positive slope.

(3) The modern Soviet-Chinese state firm

The manager of the modern Soviet-Chinese state firm wants to maximize the profit rate.

$$\text{maximize } \frac{\pi}{C} = \frac{P \cdot F(L, K) - (wL + rK + A)}{wL + rK + A}. \quad \text{--- (41)}$$

The optimal conditions are the equations (42), (43), (44) and (45).

$$F_L \cdot (wL + rK + A) - w \cdot F(L, K) = 0. \quad \text{--- (42)}$$

$$F_K \cdot (wL + rK + A) - r \cdot F(L, K) = 0. \quad \text{--- (43)}$$

$$F_{LL} < 0. \quad \text{--- (44)}$$

$$\begin{vmatrix} F_{LL} \cdot C & F_{LK} \cdot C + rF_L - wF_K \\ F_{KL} \cdot C + wF_K - rF_L & F_{KK} \cdot C \end{vmatrix} = \hat{\Delta} > 0. \quad \text{--- (45)}$$

When the economic parameters change, we obtain the following results.

$$\begin{aligned} & \begin{vmatrix} F_{LL} \cdot C & F_{LK} \cdot C + rF_L - wF_K \\ F_{KL} \cdot C + wF_K - rF_K & F_{KK} \cdot C \end{vmatrix} \begin{bmatrix} dL \\ dK \end{bmatrix} \\ & = \begin{bmatrix} (F - L \cdot F_L) \cdot dw - K \cdot F_L \cdot dr & - F_L \cdot dA \\ - L \cdot F_K \cdot dw & + (F - K \cdot F_K) \cdot dr - F_K \cdot dA \end{bmatrix}. \quad \text{--- (46)} \end{aligned}$$

∴

$$\frac{\partial L}{\partial w} = \frac{1}{\hat{\Delta}} \{(F - L \cdot F_L) F_{KK} \cdot C + L \cdot F_K (F_{LK} \cdot C + rF_L - wF_K)\}. \quad \text{--- (47)}$$

$$\frac{\partial K}{\partial r} = \frac{1}{\hat{\Delta}} \{(F - K \cdot F_K) F_{LL} \cdot C + K \cdot F_L (F_{KL} \cdot C + wF_K - rF_L)\}. \quad \text{--- (48)}$$

$$\frac{\partial Y}{\partial P} = 0. \quad \text{--- (49)}$$

In this case, the price changes of production factors have no definite effects on the demand for production factors. The slope of supply curve in this case is vertical in the same case of a simple model.

(4) The labor-managed firm

The manager of the labor-managed firm intends to maximize the profit per worker.

$$\text{maximize } \frac{\pi}{L} = \frac{P \cdot F(L, K) - (wL + rK + A)}{L}. \quad \text{--- (50)}$$

The optimal conditions are the equations (51), (52), (53) and (54).

$$P \cdot F_L \cdot L - P \cdot F(L, K) + rK + A = 0. \quad \text{--- (51)}$$

$$P \cdot F_K - r = 0. \quad \text{--- (52)}$$

$$F_{LL} < 0. \quad \text{--- (53)}$$

$$\begin{vmatrix} F_{LL} & F_{LK} \\ F_{KL} & F_{KK} \end{vmatrix} = \Delta > 0. \quad \text{--- (54)}$$

The equations (53) and (54) are the same equations (31) and (32) of the Lange-Lerner state firm case. When the economic parameters change, we obtain the following results.

$$\begin{bmatrix} P \cdot F_{LL} \cdot L & P \cdot F_{LK} \cdot L \\ P \cdot F_{KL} & P \cdot F_{KK} \end{bmatrix} \begin{bmatrix} dL \\ dK \end{bmatrix} = \begin{bmatrix} F \cdot dP & -K \cdot dr - dA \\ -F_K \cdot dP + dr \end{bmatrix}. \quad \text{--- (55)}$$

$$\frac{dL}{dP} = \frac{1}{PL} \cdot \frac{F \cdot F_{KK} - F_K F_{LK}}{\Delta}. \quad \text{--- (56)}$$

$$\frac{dL}{dw} = 0. \quad \text{--- (57)}$$

$$\frac{dK}{dP} = \frac{1}{P \cdot L} \frac{-F_{LL}F_K - F \cdot F_{KL}}{\Delta} \quad \text{--- (58)}$$

$$\frac{dK}{dr} = \frac{1}{P \cdot L} \frac{F_{LL} - K \cdot F_{KL}}{\Delta} \quad \text{--- (59)}$$

$$\frac{dK}{dA} = \frac{1}{P \cdot L} \frac{-F_{KK}}{\Delta} > 0 \quad \text{--- (60)}$$

$$\frac{dY}{dP} = \frac{1}{P \cdot L} \frac{F_L \cdot F \cdot F_{KK} - F_L F_K F_{LK} - F_K F_K F_{LL} - F F_K F_{KL}}{\Delta} \quad \text{--- (61)}$$

In this case, a change of wage rate has no effect on the demand of labor and the slope of the supply curve is not obvious.

§4 Concluding Remarks

In a simple model case, we obtained many obvious and interesting results. The Stalinist state firm supplies the most products among the four kinds of state firm. But it has no profit. The Lange-Lerner state firm supplies more products than the other two kinds of state firm. It has the most profit among the four kinds of state firm. The modern Soviet-Chinese state firm has a vertical supply function. The Stalinist state firm and the Lange-Lerner state firm have non-negative slopes of the supply functions.

In a Neoclassical case, we obtained a few obvious results. In the case of the Stalinist state firm, when an increase of the production factor price increases the price of product and vice versa. In the case of the Lange-Lerner state firm, if the bordered-Hessian is positive, then the supply curve has a positive slope. In the case of the modern Soviet-Chinese state firm, the slope of supply curve is vertical in the same case of a simple model. In the case of the labor-managed firm, a change of wage rate has no effect on the demand of labor. Generally speaking, in the case of Neoclassical production function we obtained few obvious effects.

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