A Note on Law and Economic : Cost plus Fee Contract and Generalized Efficiency Wage

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— Cost plus Fee Contract and Generalized Efficiency Wages —

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1. Introduction

A purpose of this note is to analyze the relationship between the cost plus fee contract[1] and generalized efficiency wages hypothesis where not only the efficiency of the workers but also the effective utilization of raw material will be increased when the wage rate is increased.

On the other hand, according to the ordinal efficiency wages hypothesis[2], if the wage rate is increased, only the efficiency of the workers will be increased. According to the generalized efficiency wages hypothesis the elasticity of the efficiency of the workers with respect to the wage rate becomes less than 1 though according to the ordinal efficiency wages hypothesis, as is well known, the elasticity is equal to 1.

From the cost plus fee contract, the production level or the scale of the plant is assumed to be given in this note.

In the next section, a simple model will be presented. Concluding remarks will be given in the last section.

2. A Simple Model of Cost plus Fee Contract and Generalized Efficiency Wages Hypothesis

The profit, π, will be denoted by the following equation (1).

$$\pi = F-\mu(C-Z), \qquad (1)$$

where π is the profit, F is the given fee for producing the plant, the scale of which is also given from the contract, C is the real cost, Z is the given standard cost for

producing the plant, μ is the sharing rate for the firm which produces the plant.

Real Cost is denoted by the following equation (2).

$$C = wL + pm, \qquad (2)$$

where w is the wage rate, L is the amount of labor employment, p is the price of the material, m is the amount of used material.

As the scale of the plant, Q, is determined from the contract, the required amount of the labor will also be determined if the efficiency of the labor, e, is determined. However, the efficiency of the labor will depend on the wage rate in the following manner;

$$e = e(w), \qquad (3)$$

where $de(w)/dw > 0$.

Hence, the amount of the labor employment is denoted by the following equation (4).

$$L = L(Q, e(w)). \qquad (4)$$

On the other hand, the expected value of the material price, $E[p]$, is denoted by the following equation (5).

$$E[p] = \int_{\lambda}^{\theta} pf(p)dp, \qquad (5)$$

where $f(p)$ is the probability density function $\lambda \leqq p \leqq \theta$, and the expected value of the price is assumed to be given.

Further in the generalized efficiency wages model, not only the efficiency of the workers but also the effective utilization of raw material will be increased when the wage rate is increased.

Since the scale of the plant, Q, is determined from the contract, the required amount of the material will also be determined if the degree of the effective utilization of raw material, h, is determined. On the other hand, the degree of the effective utilization of raw material, h, will also depend on the wage rate in the following manner.

$$h = h(w), \text{ and } m = m(Q, h(w)), \qquad (6)$$

where $dh(w)/dw > 0$.

Hence, from (1), (2), (3), (4), (5) and (6) the expected profit, $E[\pi]$ is denoted by the

following equation (7).

$$E[\pi] = F-\mu(wL(Q, e(w))+m(Q, h(w))E[p]-Z). \quad (7)$$

Maximizing the equation (7) with respect to w yields the following first order condition (8).

$$dE[\pi]/dw = -\mu(L(Q, e(w))+w\,\partial L/\partial e(w)de(w)/dw + \partial m/\partial h(w)dh(w)/dwE[p]) = 0. \quad (8)$$

Second order condition is assumed to be satisfied.

From the first order condition (8), the following result (9) can straightforwardly be obtained[3].

$$1-\eta_w^{e(w)} = \beta\eta_w^{h(w)}, \quad (9)$$

where $\beta \equiv m(Q, e(w))E[p]/wL(Q, h(w)) > 0$.

Therefore from (9),

$$1 > \eta_w^{e(w)}, \quad (10)$$

where $\beta\eta_w^{h(w)} > 0$, as $\beta > 0$ and $\eta_w^{h(w)} > 0$, since in the generalized efficiency wages model, not only the efficiency of the workers but also the effective utilization of raw material will be increased when the wage rate is increased.

Hence, from (10) if the elasticity of the efficiency of the labor with respect to the wage rate is the decreasing function of the wage rate, then the wage rate in the generalized efficiency wages model will be higher than that in the ordinal efficiency wages model where the elasticity will be equal to 1.

3. Concluding Remarks

In this note the relationship between the cost plus fee contract and the generalized efficiency wages hypothesis where not only the efficiency of the workers but also the effective utilization of raw material will be increased when the wage rate is increased has been analyzed.

Under the generalized efficiency wages hypothesis the elasticity of the efficiency of the workers with respect to the wage rate has been derived to be less than 1, though under the ordinal efficiency wages hypothesis, as is well known, the elasticity becomes

equal to 1.

Therefore, if the elasticity of the efficiency of the labor with respect to the wage rate is the decreasing function of the wage rate, then the wage rate in the generalized efficiency wages model will be higher than that in the ordinal efficiency wages model where the elasticity will be equal to 1.

Notes

1 For the simple and excellent explanation of the cost plus fee contract, see Yamada and Sano (2009)

2 For the efficiency wage hypothesis, see Solow (1979), Blanchard, O.J., and S. Fisher (1989), Laszlo (2004), Chang, Wen-Ya und Ching-Chong Lai (1996), Watanabe (1996a, 1996b).

3 To make the analysis simple, L is specified such that $L = \frac{1}{e(w)} \bar{L}_s(\bar{Q})$, where $\bar{Q}$ is given from the contract and $\bar{L}_s(\bar{Q})$ is the standard level of required labor for producing $\bar{Q}$. In the same way, $m = \frac{1}{h(w)} \bar{m}_s(\bar{Q})$.

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