《研究ノート》

The Seniority Paying System and a Human Capital Obsolescence in the Labor Management Firm

Atsuyuki FUKAURA

I. INTRODUCTION

Recent works on the labor management firm (LMF) have been conducted to analyze a Japanese-style management. By considering the adjustment cost for the investment, Iwai (1989) has rationalized the seniority paying system in the LMF and verified it is the most efficient scheme for the LMF. But his assumption that the old workers have no contribution to output is counter factual. Turning our attention to a real world, we easily recognize the old workers matter a great deal, i. e., the old cannot work beside the production lines but their experiences can be devoted to other supplemental sectors.

The main novelty is that we take into account the old generation's effort to catch up with the young generation. This effort effects the total production in some manners, and is regarded as the alternative qualitative adjustment channel for the labor input. We can discuss that this "qualitative" aspect is closely related to the seniority paying system. Much of emphasis in what follows focuses on how to characterize this "qualitative" features.

In Section II, we introduce the basic framework that concentrates on the way through which the old workers contribute to the whole production. The main part, Section III, deals with the seniority paying system and some related topics are remarked in Section IV. Concluding remarks

follow.

II. MODEL AND SOLUTIONS

Notations we will use are given as follows,

L_i:labor input, $i=1,2$ where 1 means young generation and

    2 means old one,

n_i:labor growth rate, $L_1 : L_2 = 1 + n : 1$, for simplicity,

    we set $L_2 = 1$,

K:capital input, where $K_1 = K_2 = K$,

k_i:capital-labor ratio. They can be written as

    $k_1 = K_1/L_1$, $k_2 = K_2/1 = K_1(1+n)/L_1 = k_1(1+n)$

$Y_i = F(K_i, L_i)$,

where $Y_1 = L_1 f(k_1)$, $Y_2 = L_2 f(k_2) = f(k_2)$; output,

w_i:wage rate,

r:constant rental price for capital,

$\Psi(n)$:adjustment cost for labor input,

    where Ψ_n, $\Psi_{nn} > 0$.

The budget constraint can be expressed as follows,

$$(1+n)w_1 + w_2 + 2Kr + \Psi(n) = (1+n)f(k_1) + \theta(n)f(k_2) \qquad [1]$$

$\theta(n)$ is the induced incentive of the old workers when the youngers are entried. This is observable for the LMF.

    Uzawa(1965)'s method to divide the human capital two sectors perfectly is not realistic because, in the ordinary Japanese firms, emplyees are required to be "all-round players" so the vague division would be dominated. In these circumstances, an interaction between sectors is significant factor for an efficient management. Moreover, concentrating the fact that the work division corresponds roughly to the seniority, it is reason-

able to focus our attention on the old-young workers' interactions, inter-generational interaction. An basic idea is that new input embodies "new knowledge", which has been discussed by some authers(Romer(1986), Lucas(1988)).

Subject to this constraint, the LMF determines k_1, w_1, w_2, n, so as to maximize the utility function defined over the received wage rate,

$$u=u(w_1, w_2)$$ [2]

Standard mathematical results characterize an interior solution by means of necessary conditions, that is,

$$r=f'(k_1)$$ [3]

$$\frac{\partial u/\partial w_1}{\partial u/\partial w_2}= 1 +n$$ [4]

$$w_1 -\frac{\partial \Psi}{\partial n}=\frac{\partial Y_1}{\partial n}+\frac{\partial \theta Y_2}{\partial n}$$

$$=f(k_1) -\frac{K}{1+n} f'(k_1) +\frac{\partial\theta}{\partial n} f(k_2)$$ [5]

III. IMPLICATIONS

III - 1   The seniority paying system in the LMF

[3] and [4] are well known conditions, but note that [4] charc-terizes the growth-oriented feature of the LMF(see Iwai(1989)). [5] shows an optimal growth rate of labor, which is determined where a marginal cost(LHS)equals to a marginal benefit(RHS). [5] yields

$$w_1 =f(k_1) -\frac{K}{1+n} f'(k_1) -\frac{\partial \Psi}{\partial n}+\frac{\partial\theta}{\partial n} f(k_2)$$ [6]

Hence,

$$\frac{\partial w_1}{\partial n} = \frac{\left(\frac{\partial Y}{\partial L}\frac{\partial L}{\partial n}\right)}{\partial n} - \frac{\partial^2 \Psi}{\partial n^2} + \frac{\partial^2 \theta}{\partial n^2} f(k_2).$$ [7]

Then,

$$\frac{\partial w_1}{\partial n} = -\frac{\partial^2 \Psi}{\partial n^2} + \frac{\partial^2 \theta}{\partial n^2} f(k_2) + Y_{LL}$$ [8]

where we use $\partial L_1/\partial n = 1$ and $\partial^2 L_1/\partial n^2 = 0$.

What appears in [8] states that the cost change when n is increased is devided to 1) a lowering of marginal productivity, 2) an increase of adjustment cost and 3) an induced incentive. It is worth to note that they all are the complementary adjustment channels for labor input. Neglecting Ψ and θ, we go back to the classical world. Considering only Ψ, Iwai(1989)'s conclusions are derived, that is, [8] is negative then the LMF constructs the wage profile based on the seniority rule.

III − 2   effort function

(a)   The nature of $\theta(n)$

If θ'' has the negative sign then Iwai's conclusion is strengthened, however, the contrary case requires a little complicate consideration. When θ'' is positive but sufficiently small, i.e., $\theta'' < \varepsilon (\varepsilon > 0)$, then the LMF adopts the seniority paying system (ε is a value of θ'' when [5] $= 0$. Here we focus only on the behavior of θ in order to clarify its prominency).

We cannot determine the sign of θ'' without the solid micro-foundations for θ function. But to conjecture the behavior of our model, we will infer the shape as follows. First, we assume

$$\theta(0) = 1.$$ [9]

When the new labor input is equal to the old, the olders keep their effort constant. This may occur when all worker is identical or substitutional. Second,

$$\frac{\partial \theta (n)}{\partial n} \bigg|_{n=0} > 0 \qquad\qquad [10]$$

The first young worker will induce an extra effort of the olders. It is not unrealistic to assume that the marginal effort diminishes as n is increased, partly because the olders does not persevere forever and partly because the new knowledge becomes the common one as the newers become the majority. See Fig$-$1 . If $\theta"<\varepsilon$, the seniority paying system is established. The plausible $\theta (n)$ is also depicted.
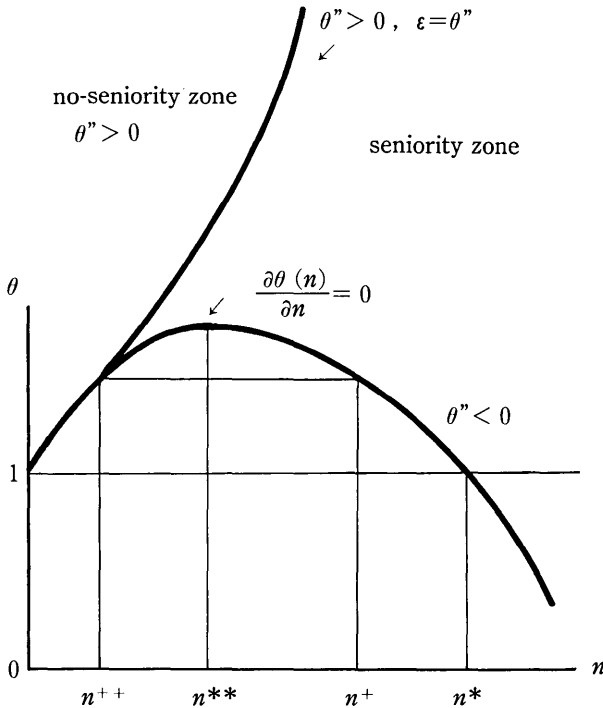

Fig$-$1

(b) Optimal labor growth rate

　　The role of $\theta (n)$is clarified by considering the labor growth rate. Because any points on $\theta (n)$satisfies the first order condition for n, so we can

not determine an unique optimal rate. This is because the effort function provides the qualitative adjustment channel for labor input.

At $0 < n < n^{**}$, because the higher wage corresponds to the higher effort, the seniority paying system implies a paying to one's effort or contribution, not only on the seniority itself. Hence, the seniority paying system do consistent with the productivity and works as an incentive scheme. However, for $n^{**} < n$ where the old workers contract their effort, and for $n^{*} < n$, the olders are degraded to the "in-active input", i.e., the *human capital obsolescence* arises.

In order to maximize the older's effort level, in other words, to derive the highest incentive from the given w_2, n must be set at n^{**}, where

$$\frac{\partial \theta(n)}{\partial n} \bigg|_{n=n^{**}} = 0 . \tag{11}$$

Lazear (1981) suggests that a seniority paying system discourages shirking. In his discussion the seniority system is itself an incentive scheme by "price (wage)". In our model, to be consistent with an anti-shirking scheme, the LMF set the labor growth rate under n^{**}. In this sense, Our LMF can be equipped with the anti-shirking scheme by "quality", differently from Lazear (1981).

IV. SOME REMARKS

First, it is worth to note that the seniority paying system is not rejected even in stationary state when two generations' input are perfectly identical. In this case, the LMF faces the following problem and the first order conditions.

Max $u(w_1, w_2)$ subject to $L(w_1 + w_2) + 2\,rK = 2f(K, L)$

$u_1/u_2 = 1$, $f_L = (w_1 + w_2) / 2$, $f_K = r$.

So whether $w_1 < w_2$ or $w_1 > w_2$ depends only on the preference structure of

the LMF, that is, when the indifference curve of $u(w_1, w_2)$ tangents with the budget constraint at the upper area than the 45 degree line, the LMF would accept the seniority system. The seniority system does not depend an input decision.

Second, when $n^* < n$, the LMF cannot even produce the output if the LMF would be at stationry state, $n = 0$ so the rational LMF is never in this area. In this sense, the LMF sets an entry barrier against the outside workers at n^*.

Suppose now the LMF is at n^{**} and the labor pool is extended to n^+ by, for example, the immigration. Set aside the problem whether the foreigner has the new knowledge, $\theta(n^{++}) = \theta(n^+)$ then the LMF will contract the labor growth rate from n^* to n^{++}. As the results, the entry barrier becomes more strictly.

Third, we can infer why most Japanese firm adopts the seniority paying system. The seniority system is desirable when

$$\theta"f(k_2) < \Psi" - Y_{LL}. \tag{[12]}$$

If the production function is linear then $Y_{LL} = 0$. If so, it is more easy to satisfy[12]. Put differently, when the input ratio is fixed, the seniority system is easily established. Whether the Japanese firms take on these characters or not must be questionable, however, here may be an important key concept to consider the seniority paying system in Japan. Suppose an accepting the foreign workers enlarges $\Psi"$ (it is a reasonable assumption) then w_1, foreigner's wage, must be decreased because the seniority system becomes more intensive, i.e., [8] become smaller. Moreover, $\theta"$ may also be increased because of the demolalization. If so, n^{++} and n^{**} are declined then the entry barrier will be more enhanced.

If $\theta"$ or $f(k_1)$ increase with $\Psi"$ proportionally then no change will be arised. This means the olders work more than before to accept the

foreigners and not to contradict with the existing seniority system. This, however, is not a probable story. From above discussions, we do suspect that the openness of labor market never bring the desirable results.

V. CONCLUSION

We have examined the several features of the LMF. The effort induced by the new employees and their fresh knowledge plays a key role. Our conclusions are summarized as follows. First, the adjustment cost cannot determine the optimal labor growth rate definitely. Second, the effort function serves the qualitative adjustment mechanism, Third, under the special conditions, the LMF can determine the optimal labor input level. These results are able to give some implications for the Japanese economy.

There are many directions in which we can extend our analysis. First, we have not fully scrutinized the shape and nature of the effort function, so our analysis depends on some intuition, then, we must find the micro-foundation of $\theta(n)$ (the forthcoming paper intends on doing it). Second, we have formalized the effort effect by $\theta'f(k_2)$ because production technology is $\theta f(k_2)$. If we treat it as $f(k_2, \theta)$ like Romer (1989) then the effort effect would be $f'\theta'$. This must be more general form. Third, it is most interesting trial to treat $\theta(n)$ as a stochastic form. Because $\theta(n)$ can be seen a technological shock so we can find a way for the business cycle theory. These problems will be no doubt an important area of the future research.

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