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Treatment of Hawks and Doves

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The paper investigates the optimal allocation of human resources both theoretically and empirically. The theoretical part shows that some wage compression is desirable for the following two cases; (1) hawks (i.e., uncooperative and aggressive workers) work together, or are in the common work-place, and (2) hawks and doves (i.e., cooperative and less aggressive workers) work together, and seek promotion in the competitive world.
The empirical part presents the result for Japan. We find that large Japanese firms had wage compression for younger generations in order to minimize the degree of adverse effort caused by the behavior of hawks. At the same, we try to find, "Who is likely to be hawkish?"

Keywords: Human resource management, aggressive workers and less aggressive workers, wage compression
JEL Classification Numbers: J3, J5

1. Introduction

It is an interesting subject to investigate whether hawks (i.e., uncooperative or aggressive persons) and doves (i.e., cooperative or non-aggressive persons) should work together in the factory, office, or the work-place in general, whether each hawk should be separated in the work-place if there are many hawks and work-places in the firm, or whether hawks and doves should be in the common work-place. This paper is concerned with the above subjects both theoretically and empirically.

Lazear (1989) presented an interesting paper regarding these subjects, and concluded that some wage compression was desirable because harmony would be necessary among employees. This determines the optimal allocation of human resources among hawkish workers and dovish workers either in the hawkish firm or in the dovish firm.

This paper extends his paper in the following two areas. First, we present several theoretical results. Second, we show some empirical results by using employees data in several Japanese enterprises, and discuss several implications for human resource management programs in Japan. The data used here were planned to gather information on promotion in large firms. The analysis based on this data source appeared in Tachibanaki (1998) and Tachibanaki and Maruyama (2001), and is, in fact, useful for readers of this article.

It would be useful to summarize several selected theoretical and empirical findings, which were proposed previously, to understand the main stream of the literature in this field and to show in what way the conclusion obtained in this paper can be fitted in the literature.

The modern theory of incentive and contract started from the famous rank-order tournament model by Lazear and Rosen (1981). They proposed that a higher incentive would be expected if competitions are held among employees like a tennis tournament, which determine a promotion mechanism. In this competitive world a winner is promoted, and at the same time he receives a higher reward (i.e., wage) than a loser. Further contest continues among winners.

Although a tennis match can determine a winner and a loser easily, it is not so easy to identify in the real world of enterprises, "Who are capable (i.e., productive) and less capable persons?" It is also difficult to measure the actual contribution or productivity of each employee. Such difficulties encouraged economists to investigate the optimal human resource management program which is able to induce the highest level of effort from employees, and thus to produce the highest productivity. Various theories and ideas regarding the above were presented in this field. We summarize them, in particular, theories and ideas which are useful to understand the content of this paper.

One interesting idea is a relational incentive contract which was formalized in a repeated-game model. We can cite a useful survey paper by Malcomson (1999). This theory supports the following observations. Firms employ a mix of formal and relational contracts. In other words, employers are likely to hire various kinds of workers whose contracts are based on various criteria. For example, formal contracts based on a distortionary performance measure, and relational contracts based on total contribution to the firm, as summarized by Gibbons and Waldman (1999).

One important theory in this field was proposed by Waldman (1984) who made clear that promoting a worker in the firm reveals a positive signal of the worker's capability. Thus, promotion can be used as an important instrument to induce higher incentive for effort. Prendergast (1993) verified that promotion would serve as an incentive for skill acquisition through the accumulation of specific human capital. There is, however, a group of economists who believe that extra bonus payments are useful to induce higher incentive rather than promotion. The consensus, nevertheless, suggests that promotion is more significant than extra bonus to determine the level of employee incentive for effort. Thus, we regard that promotion is a great concern of employees, and construct our model based on this understanding.

It is necessary to present an idea of wage compression, before closing a short summary of the literature, because it is crucial for this paper. This idea is called a fair wage hypothesis by Akerlof and Yellen (1990), proposing that workers regard a fair wage system as one with pay differentials which are more compressed than productivity differentials. Thus, firms with less variance in wages have more harmonious labour relations, and achieve higher output per worker. In sum, a higher effort can be expected from a decrease in the variance of wages, i.e., more compression.

The similar proposition was made by Frank (1985), who concluded that wages were more compressed relative to the worker's marginal products because a worker is willing to give up income to be at the top of a firm's wage distribution, while a worker has to be compensated to be at the bottom of it. Frank obtained this result, by comparing utility functions. These two results, namely Akerlof and Yellen, and Frank find that a higher degree of compression in wage distribution is desirable to achieve the highest incentive for effort of workers. We understand that this result is important for the development of the present undertaking.

2. Model

The model, which is analyzed in this paper, is largely based on Lazear (1989). This paper differs from the original Lazear model in the following way; while Lazear considered largely the effect of human resource allocation on productivity difference, we are interested in the effect of it on wage differentials in order to perform an empirical investigation.

Note that we take somewhat restrictive assumptions (symmetric α in 2.2) to clarify our empirical approach.

Let μ_i be effort of *i*-th worker, q_i be output, and θ_i be "sabotage". "Sabotage" implies that a worker receives adverse effort from another. Adverse effort implies that another person disturbs work activity of a worker, and thus lowers the productivity of a person. θ_{-i} indicates it. Let output be given as

$$q_i = \mu_i - \theta_{-i} + \varepsilon_i \tag{1}$$

where ε_i is a random term such that $E(\varepsilon) = 0$.

We suppose that there are two types of workers. One is hawks (H), and another is doves (D). The former is uncooperative and aggressive, while the latter is cooperative and non-aggressive. Each output is given by

$$q_D = \mu_D - \theta_H + \varepsilon_D \tag{2}$$

$$q_H = \mu_H - \theta_D + \varepsilon_H \tag{3}$$

Cost must be born to achieve production, which is denoted by $C(\mu_i, \theta_i)$ for *i*-th worker. The worker's problem is to maximize the following,

$$W_1 P(\mu_i, \theta_{-i}; \mu_{-i}, \theta_i) + W_2[1 - P()] - C(\mu_i, \theta_i) \tag{4}$$

where W_1 is the wage payment when a worker wins, conditional on his choice of μ and θ, and W_2 is the wage when a worker loses. Let $P(\mu_i, \theta_{-i}; \mu_{-i}, \theta_i)$ be the probability of winning, which is given as follows,

$$\begin{aligned} P(\mu_i, \theta_{-i}; \mu_{-i}, \theta_i) &= prob(q_i > q_{-i}) \\ &= prob[(\mu_i - \theta_{-i}) - (\mu_{-i} - \theta_i) > \varepsilon_{-i} - \varepsilon_i] \\ &= G[(\mu_i - \theta_{-i}) - (\mu_{-i} - \theta_i)] \end{aligned}$$

where G() is the cdf of the random term $(\varepsilon_{-i} - \varepsilon_i)$, $E(\varepsilon_{-i} - \varepsilon_i) = 0$, and $V(\varepsilon_{-i} - \varepsilon_i) = 2\sigma^2$ (because ε_{-i} and ε_i are i.i.d.).

The first-order conditions can be written by,

$$(W_1 - W_2)P_1 = C_1 \tag{5}$$

$$(W_1 - W_2)P_2 = C_2 \tag{6}$$

where the subscripts for P are the partial derivatives with respect to μ_i and θ_i.

2.1. Competition (or Contest) among Hawks

We consider, first, the case in which hawks are in competition (or in contest). It is necessary to specify the cost function,

$$C^H = \frac{1}{2}(\mu_H^2 + \alpha\theta_H^2) \tag{7}$$

where α is defined as the weight for sabotage in the determination of the cost, and $0 < \alpha < 1$ is assumed. The assumption implies that the cost associated with sabotage activity is lower than the cost associated with production activity when the common effort is made for hawks. The first order conditions are given under the condition that all workers are identical (i.e., $\mu_i = \mu_{-i}$ and $\theta_i = \theta_{-i}$),

$$(W_1 - W_2)g(0) = C_1^H \tag{8}$$

$$(W_1 - W_2)g(0) = C_2^H \tag{9}$$

Let the left-hand side re-write as $\overline{W}\bar{g}$, we obtain the following identities,

$$\overline{W}\bar{g} = \mu_H = \alpha\theta_H \tag{10}$$

Thus the larger the wage spread $\overline{W}$, the more the workers are engaged in sabotage activity. This gives the following identities,

$$q_H = \mu_H - \theta_H = (1 - \frac{1}{\alpha})\bar{W}\bar{g} \quad (11)$$

This suggests that the level of production is negative because of the negativity of $(1 - \frac{1}{\alpha})$ when sabotage is observed. This negative production is not a serious problem because it was obtained only through a simple form of the production function. A more useful implication here is that the negative production appears only when sabotage activity is observed, while no sabotage activity generates the positive production.

The next problem is the firm's behavior, namely the maximization of workers' expected rent subject to a zero-profit constraint by choosing W_1 and W_2 (because competition for labour bids up the purse to the point where expected total receipts equal costs),

$$max\{W_1 + W_2 - 2C(\mu_H, \theta_H)\} \quad (12)$$

where the following constraint must be satisfied,

$$W_1 + W_2 = E(q_H + q_H) \quad (13)$$

The solution can be written under the condition that firm's production is given by a linear combination of two types of workers,

$$W_1 - W_2 = 1/4\bar{g}^2(1 + \frac{1}{\alpha}) \quad (14)$$

It is useful to compare this result with the case of the original Lazear and Rosen framework which was obtained under the condition of no sabotage activity,

$$W_1 - W_2 = 1/4\bar{g}^2 \quad (15)$$

The comparison implies that it is necessary to reduce the wage gap between winners and losers under the condition that only hawks are in one contest.

2.2. Competition (or Contest) between Hawks and Doves

This section considers the case in which both hawks and doves are in the common work-place. In other words, both hawks and doves compete. We assign the cost function for hawks and doves, respectively,

$$C^H = \frac{1}{2}(\mu_H^2 + \alpha\theta_H^2) \quad (16)$$

$$C^D = \frac{1}{2}(\alpha\mu_D^2 + \theta_D^2) \quad (17)$$

The meaning of α is equivalent to (7). It is noted that the difference between hawks and doves appears because the cost associated with sabotage activity for hawks is lower than the cost for doves. We can assume this difference since it is natural for hawks that their mental agony must be lower than doves' agony, when both sides commit to sabotage activity in order to seek a higher possibility of promotion. In other words, doves would suffer mentally to a greater extent than hawks.

The first-order conditions for both sides can be written as follows,

$$(W_1 - W_2)g(\mu_D - \mu_H + \theta_D - \theta_H) = C_1^D \tag{18}$$

$$(W_1 - W_2)g(\mu_D - \mu_H + \theta_D - \theta_H) = C_2^D \tag{19}$$

$$(W_1 - W_2)g(\mu_H - \mu_D + \theta_H - \theta_D) = C_1^H \tag{20}$$

$$(W_1 - W_2)g(\mu_H - \mu_D + \theta_H - \theta_D) = C_2^H \tag{21}$$

The left-side equations in (18), (19), (20), (21) are equal in view of the fact that $g(x) = g(-x)$ is satisfied under $x \fallingdotseq 0$. We rewrite them by $\hat{W}\bar{g}$. The solution is given by the following,

$$\alpha\mu_D = \theta_D = \mu_H = \alpha\theta_H = \hat{W}\bar{g} \tag{22}$$

This reduces to the following,

$$q_D = q_H = 0 \tag{23}$$

This implies that the level of production by both hawks and doves is zero, implying that no production is achieved when both hawks and doves work together.

2.3. Comparison with the Original Lazear and Rosen Model

The original Lazear and Rosen model did not take into consideration any sabotage activity. We write the cost function as follows,

$$C = \frac{1}{2}\mu^2 \tag{24}$$

The level of production for symmetric workers i and j is given by

$$q_i = q_j = \tilde{W}\bar{g} \tag{25}$$

By combining this with the previous equation (23), we obtain the following,

$$q_i = q_j > q_H = q_D = 0 \tag{26}$$

The result indicates that hawks' sabotage activity destroys the whole production system, when both hawks and doves work together, or are at the common workplaces. One effective policy, which can avoid such a disastrous outcome derived from co-working of both hawks and doves, is to decrease the wage gap $\overline{W}$ (or $\hat{W}$) under the competitive system for promotion in the firm in order to reduce a strong effect due to sabotage activity by hawks. This is nothing but the wage compression. The theoretical exercise under our model framework was able to show that some compressed wage distribution is desirable for the following two cases; (1) hawks work together, and (2) hawks and doves work together. "Together" means here that both groups seek promotion in the competitive world.

3. Empirical Results

The theoretical part showed that wage compression would be desirable under the two cases; (1) hawks work together, and (2) hawks and doves work together. It would be interesting to investigate whether or not the above result is supported by data.

We use the Japanese survey data for white-collar employees in large enterprises. The data consist of ordinary workers (not promoted employees), promoted employees including section heads, department heads, and directors in the manufacturing industries. The number of observations is 1,861. We have totally five different industries, namely (1) electricity, (2) electric power, (3) car maker, (4) chemistry, and (5) commerce (department store). We do not provide the name of the firm in each industry to keep anonymity.

The empirical exercise is conducted in the following way. First, we attempt to classify all employees into two parts; (1) hawks and (2) doves. The method of the classification is to apply the linear discriminant analysis based on personal characteristics and information on work attitude and others.

Second, after estimating the linear discriminant function, we discuss the implication of each explanatory variable for classification into hawks or doves, which was used for the estimation.

The following six explanatory variables were adopted for the estimation. Each variable is measured on the basis of each employee's judgments regarding the following theme.

(1) Cooperative behavior is important to achieve higher satisfaction, when many employees work together.
(2) The merit of promotion to higher positions is to be able to engage in a bigger job which requires higher responsibility.
(3) It is disturbing to manage subordinates for promoted employees.
(4) It is necessary to show higher performance in business activity to justify wider wage differentials.
(5) I anticipate that I should be promoted to a considerably higher position at the current firm.
(6) It is desirable to determine promotion perspective and wage differential at early career stages of employees.

Each employee responded to the above six questions (or themes), where five choices from a definite positive judgment to a definitive negative judgment were prepared.

Table 1 shows the result of the linear discriminant analysis. It is found that the positive values were estimated for the questions (or themes) (2), (3), (4), (5), and (6), while the negative value was estimated for (1). It is possible to propose based on Table 1 that the positive values correspond to hawkish behaviours and attitudes.

It would be interesting to investigate the following question, "Who is likely to be hawkish or dovish?" Table 2 shows the estimated regression result for this question. The regression equation adopts the degree of hawkishness as a dependent variable, and adopts age, wage, enterprise dummies and a sex dummy as independent variables. The degree of hawkishness is equal to the estimated score derived from the linear discriminant analysis. We estimated this regression equation by ordinary least squares method.

The estimated result suggests the following. If a person becomes older, he (or

Table 1 Empirical result for the linear discriminant analysis

Variables	Coefficients
Cooperative behaviour is important	–0.341
A bigger job is assigned for promoted employees	0.215
Disturbing to manage subordinates	0.109
Higher business performance is necessary to justify wider wage differentials	0.382
Anticipating that I shall be promoted	0.680
Desirable to determine promotion and wage differentials at earlier careers	0.346
Constant	–4.398

Table 2 Who is likely to be hawkish?

	Estimated coefficients	t-values
Constant	1.10	5.84
Age	–0.07	–11.04
Wage	0.12	10.38
Electricity	–0.20	–2.39
Electric power	–0.53	–6.34
Car maker	–0.46	–4.90
Chemistry	0.11	1.29
Male dummy	0.72	7.48
R-squared	0.16	

she) is likely to be less hawkish because the estimated coefficient is negative and statistically significant. It is possible to guess that employees can recognize their capabilities or promotion perspectives, when they are older. Thus, they became less hawkish. In other words, younger employees are more hawkish than older workers in general because the majority of younger employees are willing to be competitive.

One interesting result is that males are more hawkish than females because the coefficient is positive and statistically significant. It should be an interesting subject to inquire whether this result for the male-female difference is unique only in Japan, or is universe in the world. Unfortunately, this inquiry goes beyond the scope of this paper.

The effect of wage on hawkishness is positive. The higher the wage is, the more hawkish a person is. This may support evidence such that a hawkish person won in the competition.

The estimated results on industry dummy variables are consistent with the general understanding of the difference in industries. The lowest is the electric power industry. The degree of hawkishness increases in the following order: car maker, electricity, commerce and chemistry.

Table 3 shows the estimated result of the rate of hawks over total employees and the coefficient of variations in wages in the firm. In other words, it shows whether the sample firm consists of mainly hawks or doves, and at the same time the degree of wage dispersions.

Table 3 gives several interesting empirical results. First, the rate of hawks in the firm differs considerably from industry to industry. The highest rate is the chemistry

Table 3 The rate of hawkish employees and the coefficients of variations in wages

		Age			
		30–39	35–44	40–49	30–49
Electricity	Rate of hawkish employees	0.58	0.52	0.43	0.51
	Coefficient of variation in wages	0.24	0.18	0.16	0.39
Electric power	Rate of hawkish employees	0.44	0.37	0.33	0.47
	Coefficient of variation in wages	0.23	0.18	0.20	0.38
Car maker	Rate of hawkish employees	0.46	0.52	0.53	0.46
	Coefficient of variation in wages	0.18	0.20	0.22	0.32
Chemistry	Rate of hawkish employees	0.70	0.66	0.66	0.68
	Coefficient of variation in wages	0.15	0.15	0.23	0.32
Commerce	Rate of hawkish employees	0.65	0.67	0.73	0.70
	Coefficient of variation in wages	0.18	0.17	0.23	0.44
	Correlation coefficient	–0.51	–0.57	0.71	0.29

industry (i.e., 0.66), while the lowest one (i.e., many doves) is the electric power industry (i.e., 0.35). This result is consistent with our general understanding about industries in Japan. The industry dummy variables in Table 2 presented the same result in the different way.

Second, it is not possible to see a common movement in the degree of wage compression from younger ages (i.e., 30–39 years old) to older ages (i.e., 40–49 years old). The degree decreases in a monotone manner in the electricity as employees become older, while it increases in the car industry. The other industries show a common nature.

Third, the correlation coefficients between the rate of hawks over total employees and the coefficients of variations in wage for each age class are calculated as follows; −0.51 for 30–39 years old, −0.57 for 35–44 years old, 0.71 for 40–49 years old and 0.29 for all ages, respectively. The result indicates the fact that wage compression is observed for younger generations. It is possible to conclude that Japanese large firms keep small wage differentials (i.e., wage compression) for younger employees in order to reduce the number of significant sabotage activities among younger employees. Otherwise, sabotage may destroy harmonious circumstance and better industrial relations of the Japanese large firms.

4. Concluding Remarks

The paper investigated the optimal allocation of human resources both theoretically and empirically. The theoretical part showed that some wage compression was desirable for the following two cases; (1) hawks (i.e., uncooperative and aggressive workers) work together, or are in the common work-place, and (2) hawks and doves (i.e., cooperative and less aggressive workers) work together, or are in the common work-place and seek promotion in the competitive world.

The empirical part examined for Japan. Five industries were chosen for the empirical part. After estimating the linear discriminant function, we attempted to classify all workers into (1) hawks and (2) doves. Based on the estimated result of the linear discriminant analysis we investigated, then, the following question, "Who is likely to be hawkish?" We found that men were more hawkish than women, younger employees were more hawkish than older ones and a person with higher wage were more hawkish than otherwise.

Finally, we investigated the relationship between the degree of wage compression and age. We found that large Japanese firms had wage compression for younger generations in order to minimize the degree of adverse effort caused by the behavior of hawks.

References

Akerlof, G. A. and J. L. Yellen (1990) "The fairwage-effort hypothesis and unemployment", *Quarterly Journal of Economics* 104: 255–283.

Frank, R. H. (1985) *Choosing the right pond*. Oxford University Press. New York.

Gibbons, R. and M. Waldman (1999) “Careers in organizations: theory and evidence” in O. Ashenfelter and D. Cards (eds.) *Handbook of Labor Economics*, vol. 3, North-Holland, Amsterdam, pp. 2373–2437.

Lazear, E. P. (1989) “Pay equality and industrial politics”, *Journal of Political Economy* 97: 561–580.

Lazear, E. P. and S. Rosen (1981) “Rank-order tournaments as optimum labor contracts”, *Journal of Political Economy* 89: 841–864.

Malcomson, J. M. (1999) “Individual employment contracts”, in O. Ashenfelter and D. Cards (eds.) *Handbook of Labor Economics*, vol. 3, North-Holland, Amsterdam, pp. 2291–2372.

Prendergast, C. (1993) “The role of promotion in inducing specific human capital acquisition”, *Quarterly Journal of Economics* 105: 255–283.

Tachibanaki, T. (ed.) (1998) *Who runs Japanese business?* Edward Elgar. London.

Tachibanaki, T. and T. Maruyama (2001) “Promotion, incentives, and wages”, in S. Ogura, T. Tachibanaki and D. Wise (eds.) *Aging issues in the United States and Japan*. University of Chicago Press, Chicago, pp. 335–360.

Waldman, M. (1984) “Job assignments, signalling, and efficiency”, *Rand Journal of Economics* 2: 255–267.