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Risk Behavior and the Determinants of Bonus versus Regular Pay in Japan*

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Compensation schemes for workers have generated much interest in recent years. At the micro level they may affect workers' productivity. Due to the responses of firms, aggregate employment may also be affected by how workers get paid. Japanese bonus payments account for 25 to 33% of workers' total earnings and have attracted attention in the literature as a flexible method of compensation. In this paper we consider a model in which regular pay and bonus payments are treated as two streams of income with different risk characteristics. Workers are assumed to be risk averse while employers are assumed to face different cost conditions depending on how workers are paid. One of the implications of the model is that returns to human capital investments paid out in bonus form contain risk premiums. Another is that the ratio of bonus to regular pay should rise as the qualifications of the worker increase. These implications are consistent with the empirical findings presented in the paper. *J. Japan. Int. Econ.*, June 1991, 5(2), pp. 140–159. Faculty of Business, University of Alberta, Edmonton, Alberta, Canada T6G 2R6. © 1991 Academic Press, Inc.

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Compensation schemes for workers have generated much interest in recent years. At the micro level, how workers get paid for their labor may affect their incentives to work, their productivity and firms' industrial relations, and worker and firm decisions concerning investment in firm-

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specific human capital. At the macro level it has been argued that aggregate employment may depend, at least in the short run, on how workers are paid (Freeman and Weizman, 1987; Weizman, 1984, 1985). The bonus payment approach used by Japanese firms has attracted attention in the literature as a flexible method of compensation. Bonus payments in Japan often amount to four to six months worth of regular monthly contract earnings and hence account for 25 to 33% of total annual earnings.[1] Some U.S. companies are now adopting, or considering adopting, compensation systems involving substantial bonus payments.[2] Saporito (1987, p. 28) outlines the basic motivation for the change from a managerial perspective:

> Many companies resort to the hatchet method of cost control because they view labor costs are invariable, or have labor contracts that make them so. This is a pitfall that Worthington Industries, a Columbus, Ohio steel-processing company, has avoided. . . . If business dips, . . . the company's labor costs plunge right along with it. Wages for production workers who are nonunion, the majority at Worthington, are composed of a base salary plus a cash bonus equal to a fixed percentage of the operating profits. The bonus typically represents 40% to 50% of the worker's wages. No profit, no pay above base salary.

In Japan, where managers are constrained by "three sacred treasures" of industrial relations—lifetime employment, the nenko (length-of-service reward) wage system, and enterprise unionism—from using a hatchet approach to controlling labor costs, bonus compensation schemes may well be an essential ingredient in business survival.[3] Yet, despite the ubiquitousness of these compensation schemes in Japan, there are systematic differences according to company size and type of worker in the degree of reliance on bonus payments. As Hashimoto (1979) notes, the reasons for these differences are not well understood. Hashimoto develops a model in which the reliance on bonuses in a compensation scheme is determined so as to minimize the dissipation of employer and employee returns on investments in on-the-job training resulting from job quits and

[1] The size of the average bonus paid semiannually in Japan is often determined by negotiations between the firm management and labor unions. See, for example, Ono (1980) and Marsh and Mannari (1976, p. 124).

[2] Although bonus payments are typically limited to workers in the management level in the United States, nonmanagement workers in the United States also experience some wage flexibility. See Raisian (1983). See also Gordon (1982) for a comparison of macro fluctuations and Triplett (1983) for the role of fringe benefits in U.S. compensation schemes.

[3] These three stereotyped treasures, combined with labor market conditions, could work for or against company objectives. It should be pointed out that there is disagreement among scholars concerning the extent to which these three treasures characterize the Japanese industrial relations system. Hashimoto and Raisian (1985) provide evidence favoring this characterization of the Japanese system. Shimada (1983, 1985) and Koike (1983), for example, provide differing views. It is generally agreed, however, that many Japanese workers are paid based on bonus-type arrangements, which is the topic of the paper.

layoffs. His model predicts that an increased profitability of investment leads to an increased bonus–earnings ratio. This prediction is consistent with empirical evidence that the bonus–earnings ratio is higher for workers with more education, who have more years of tenure with the present employer, and who work for larger firms, since these are all factors believed to enhance the profitability of on-the-job training in Japan. Despite this consistency of Hashimoto's model with empirical evidence, however, it seems somewhat odd to explain variations in the bonus–earnings ratio in Japan as a function of costs related to quits and layoffs. Hashimoto himself asserts that in Japan "most regular workers behave as if they were employed on a lifetime contract." Job separation rates in modern Japan have been low for most industries and job types, including even those workers who receive little on-the-job training and do not enjoy any sort of formal lifetime employment status.

It is true that profit-sharing bonus payments and other nenko practices begin in the 1890s in a period of industrialization when labor turnover and absenteeism rates were high. Taira (1970) argues that these practices were first introduced as a response to labor relations problems. Nevertheless, Taira and others agree that these practices became prevalent only following World War II, and Hashimoto (1979, p. 1088, Table 1) documents the increasing importance of bonus payments in the low labor turnover years of 1959 through 1975. It seems unlikely that Hashimoto's model can explain this latter development. Nor can it directly explain variations in the bonus–earnings ratio for new workers who have had no on-the-job training. Hashimoto also notes that his model cannot be used to explain variations in the bonus–earnings ratio for women "because females have rarely been found in the lifetime employment system" (p. 1100). Finally, it is important to recognize that Hashimoto's model does not capture any of the bonus-related benefits to the firm that can result from a more positive covariance of labor costs with sales revenues. This aspect of the bonus system is what seems to be attracting the interest of American managers.

In this paper we present a new theoretical explanation for the empirical patterns noted by Hashimoto, as well as for observed variations in the bonus–earnings ratio for working women. In the first section of the paper we develop a mean-variance version of an expected utility maximization model which implies that workers will demand risk premiums when more variable bonus payments are substituted for regular wage payments. In the second section we argue that firms maximizing expected profits will set the expected bonus–earnings ratios of workers of different types so as to balance the risk premium costs associated with bonus payments against lower adjustment costs due to a higher covariance of the wage bill with sales revenues. As presented in this paper, our model ignores the possibility of job separations and the accompanying firm and worker costs that play a central role in Hashimoto's model. In future research, however, it may prove possible to blend key features of our model and that of Hashimoto.

In the third and final section of the paper, empirical results are presented and discussed. Our model implies a specification for the bonus payments equation which nests the specification used in Hashimoto's 1979 study. The empirical importance of this innovation is explored, and our results are compared with Hashimoto's. Our empirical results are consistent with the theoretical implication that returns from investments in education, on-the-job training, and experience reflect risk premiums when they are paid in bonus form. Results for female workers that are consistent with the implications of our model are also shown.

1. Bonus-Related Risk Premiums

In practice, the amounts paid out to workers in bonuses are usually tied in some way to firm performance. Thus bonus payments provide an incentive for workers to do their best to help the firm succeed. When sales dip, the bonus system also provides a mechanism whereby the wage bill of a firm can be reduced without layoffs. Without some mechanism for reducing the wage bill when sales revenues fall, a firm hiring workers in a social context or under contracts effectively precluding layoffs could expand its work force only to the size that could be afforded under the most unfavorable forecasts of future business conditions. These are some of the reasons why firms (that is, the owners/managers of firms) would be expected to be interested in compensation plans that include a bonus payment component.

However, from the workers' point of view bonus payments are a more risky form of renumeration. The values of the coefficient of variation (standard deviation divided by mean) both for yearly changes and for the levels for regular pay and for bonus payments (in real terms) over the period of 1967–1984 are shown in Table I for Japanese firms with 30 or more regular employees in eight specified industries and also in all industries. The coefficients of variation for the bonus payments are consistently larger than the corresponding values for regular pay. We would expect workers to bargain for risk premiums as compensation for any increased earnings variability associated with bonus payments. This point can be demonstrated in the context of the following simplified model.

Suppose that the regular earnings of a worker can be treated as being risk free.[4] We let w denote the salary that a worker of a given quality could

[4] It is possible to generalize our model to the case where w is also a random variable, but this is not done here for the sake of simplicity.

TABLE I
COEFFICIENTS OF VARIATION FOR REGULAR AND BONUS PAYMENTS

Industry	Yearly changes		Level	
	Regular	Bonus	Regular	Bonus
All[a]	0.78	1.32	0.18	0.22
Mining	0.78	2.57	0.20	0.26
Construction	0.68	1.14	0.19	0.25
Manufacturing	0.74	1.62	0.19	0.22
Utilities	1.05	2.67	0.18	0.23
Transport and communication	0.61	0.71	0.22	0.24
Wholesale and retail	1.78	1.94	0.12	0.17
Finance and insurance	0.98	1.38	0.18	0.20
Real estate	0.97	1.53	0.16	0.16

Source. The figures shown in this table are calculated using cash earnings series for 1967–1984 published by the Bank of Japan (1977, Table 155; 1984, Table 163). The bonus amounts are calculated as the difference between the total and contractual cash earnings. (Contractual cash earnings include contractually determined regular pay as well as overtime permiums.) The bonus amounts calculated in this way include small amounts of other sorts of special cash earnings. The data on which the figures shown in this table are based are for establishments owned privately or by national or local governments that have 30 or more regular employees. Prior to computing the coefficients of variation, all of the figures were deflated using the Japanese consumer price index with a base year of 1975.

[a] Includes the eight industries listed separately in this table.

command if paid entirely in this risk-free form. We also let b denote a random variable representing bonus payments with expected value $E(b)$. Suppose the worker actually receives earnings, e, which are some combination of regular salary and bonus payments. Then the earnings of the worker can be represented as

$$e = (1 - \alpha)w + \alpha b \tag{1}$$

and the worker's expected earnings are given by

$$E(e) = (1 - \alpha)w + \alpha E(b), \tag{2}$$

with variance

$$V(e) = V(\alpha b) = \alpha^2 V(b) \tag{3}$$

for $0 \leq \alpha \leq 1$.

Note that the characteristization we have adopted for regular versus bonus earnings does not preclude long-run covariation of regular earnings with firm sales performance. It is only assumed that workers know with certainty what their regular earnings will be for each unit time period from the start of that period. This is in accord with widespread employment and wage contract practices, except that these contracts frequently allow for possible fluctuations in overtime (and sometimes even regular time) hours of work. In future research, the model could be generalized to allow for this by breaking earnings into fixed versus variable components and including in the variable portion not only bonus payments but also overtime and any other components of earnings that are not given at the start of each unit time period. This generalized model could be used for qualitative analyses. Empirical research based on this sort of a generalized model would require micro rather than grouped data of the sort used in this study, with sufficiently detailed earnings information and knowledge of employment contract arrangements to permit separation of the fixed versus the variable components of earnings for each worker.

Consider the special case of expected utility maximization where the worker has a mean-variance utility function of the form

$$U = E(e) - gV(e), \tag{4}$$

with g denoting some nonnegative parameter representing the degree to which the worker is risk adverse.[5] Given this utility function, the worker will be indifferent as to the choice of the value of α as long as[6]

$$E(b) = w + \alpha gV(b). \tag{5}$$

That is, the worker is indifferent between being paid w with certainty or e given by (1) as long as (5) holds. If employers fully compensate workers for risk associated with any substitution of bonuses for regular pay, then the expected earnings of the worker will be given by

$$\begin{aligned} E(e) &= (1 - \alpha)w + \alpha[w + \alpha gV(b)] \\ &= w + \alpha^2 gV(b), \end{aligned} \tag{6}$$

where the term $\alpha^2 gV(b)$ can be thought of as the risk premium associated with the given firm-specific values of α and $V(b)$.

[5] Here we are assuming that the standard assumptions are satisfied (quadratic utility functions and/or normal random variables) in order for the mean-variance approach to be a legitimate substitute for the expected utility approach. (See Tobin (1958, 1969) for a justification of this approach.) The mean-variance approach is widely used in finance and other areas.

[6] This is seen by substituting (2) and (3) into (4) and setting the terms involving α equal to zero.

2. Regular Wage versus Bonus Payments

Workers who are fully compensated for additional bonus-related earnings variability should be indifferent as to the mix between bonus and regular wage payments. On the other hand, the firm will want to choose a bonus–regular pay mix which balances the cost savings associated with increased reliance on a bonus compensation system against increases in the expected wage bill due to the need to pay bonus-related risk premiums. This point can be demonstrated by extending our simplified model.

Suppose a worker of a specified type working in a given firm generates an annual level of sales denoted by S with expected value $E(S)$ and variance $V(S)$. Let F denote the nonlabor costs associated with this production that are known and fixed from the start of the year. The less the wage bill for workers of a particular type fluctuates with fluctuations in S (due, for example, to changing price conditions in product markets), the more careful the firm must be to restrict hiring of regular workers of this type in order to avoid problems of financial stringency if the realized value of S turns out to be low. In periods of unexpectedly poor product demand the firm may have to borrow and incur financing costs in order to meet its payroll commitments. On the other hand, in order to minimize lost sales in periods of peak product demand the firm may have to pay financing and storage costs for inventory stocks built up in times of weaker product demand, or it may have to pay high overtime rates to its regular workers or hire temporary workers during peak periods. We observe that, for a given type of regular worker, these adjustment costs will be higher the closer the covariance between S and e, the earnings of such a worker, is to zero.

Suppose we implement these concepts concerning adjustment costs as follows. The expected adjustment costs associated with the production activities of a worker of a specified type are assumed to be given by

$$\begin{aligned} C &= fV(S - e) \\ &= fV(S) + f[V(e) - 2\,\mathrm{Cov}(S, e)], \end{aligned} \tag{7}$$

where the cost parameter f (≥ 0) is presumably larger in value the larger the amount of specific training the firm invests in workers of this type. As is shown, the positive correlation between firm sales revenue and the bonus component of earnings implies that $\mathrm{Cov}(S, e) > 0$ except when there are no bonus payments. In the latter case, when $\alpha = 0$, from the definitions used in this model for regular versus bonus pay, it follows that, conditional on the information available at the start of the current time period, $\mathrm{Cov}(S, e) = 0$ and $V(e) = 0$ in the second line of (7). Hence the expected adjustment costs C associated with the production of a worker of a designated type will be highest when the worker is paid entirely in the form of regular wages. We denote this maximum possible value of C by

$$C^{M} = fV(S). \tag{8}$$

Without any loss of generality we can represent the quantities w, b, and $E(b)$ that are determined by the labor market and the common utility function for all workers of a given type as fractions of the firm-specific, expected or actual, worker-generated sales net of the maximum adjustment and fixed nonlabor costs. Thus we have

$$w = \omega[E(S) - F - C^{M}], \tag{9}$$

$$b = \beta[S - F - C^{M}], \tag{10}$$

$$E(b) = \beta[E(S) - F - C^{M}]. \tag{11}$$

This specification of w, b, and $E(b)$ has substantive meaning, as well as providing the means for mechanically linking the outcomes of worker and firm decision making. In approximate conformity with actual practice, contracts setting regular wage payments and the formulas for tying bonus payments to firm performance are assumed to be entered into prior to the start of the current unit time period. At the start of the current period the firm is thus assumed to know $E(S)$ and $V(S)$, but not S, and to be in a position to enter into contracts specifying w and $E(b)$, but not b. For both the purpose of making contractual arrangements with workers and for firm planning and decision-making purposes, w and $E(b)$ are specified as functions of the *expected* sales net of the designated nonlabor costs, while the bonuses actually paid out will be the agreed on function of *actual* net sales.

Using (9)–(11), earnings for a worker of a given type can be represented as

$$e = (1 - \alpha)\omega[E(S) - F - C^{M}] + \alpha\beta[S - F - C^{M}], \tag{12}$$

where $0 < \omega \leq 1$ and $0 \leq \beta \leq 1$. We also have $V(b) = \beta^2 V(S)$,

$$V(e) = (\alpha\beta)^2 V(S), \tag{13}$$

and

$$\mathrm{Cov}(S, e) = \alpha\beta V(S). \tag{14}$$

From (12) it can be seen that $(\alpha\beta)$ is the proportion of worker-generated sales, net of associated nonlabor costs, that is actually paid out as bonuses. We sometimes refer to the proportion $(\alpha\beta)$ as the *bonus payout ratio*. Now, by substituting (8), (13), and (14) into (7), we can express the expected adjustment costs associated with the production activities of each worker of the given type as

$$C = C^M + f[(\alpha\beta)^2 - 2\alpha\beta]V(S), \tag{15}$$

where $[(\alpha\beta)^2 - 2\alpha\beta] \leq 0$ since $(\alpha\beta)^2 \leq (\alpha\beta)$. This proves the earlier assertion that C^M is the maximum possible value for C. From this expression we see also that C is a decreasing function of α.

If the worker is fully compensated for the risk associated with any substitution of bonus payments for regular pay, then by (5) and (11) the value of β must be such that

$$\begin{aligned} E(b) &= \beta[E(S) - F - C^M] \\ &= w + \alpha g V(b) \\ &= \omega[E(S) - F - C^M] + \alpha g \beta^2 V(S). \end{aligned} \tag{16}$$

From (9) and (16) we have

$$\begin{aligned} E(b) - w &= (\beta - \omega)[E(S) - F - C^M] \\ &= \alpha g V(b). \end{aligned} \tag{17}$$

Thus as long as g is positive, and hence there is a positive risk premium associated with bonus payments, we have $\beta \geq \omega$. From (1), (9), and (11) we see also that the expected wage bill for a worker can be represented as

$$E(e) = (1 - \alpha)\omega[E(S) - F - C^M] + \alpha\beta[E(S) - F - C^M]. \tag{18}$$

By (6) and (15), the expected profit resulting from the production of a worker of the designated type is

$$\begin{aligned} E(P) &= E(S) - F - C - E(e) \\ &= E(S) - F - C^M - f[(\alpha\beta)^2 - 2\alpha\beta]V(S) - w - \alpha^2 g V(b) \\ &= E(S) - F - C^M - w + [2f\alpha\beta - (f + g)(\alpha\beta)^2]V(S). \end{aligned} \tag{19}$$

In the final restatement of $E(P)$ in (19), the bonus payout ratio $(\alpha\beta)$ enters only through the terms in the expression in square brackets in the last line. This expression will be positive, and hence will make a positive contribution to the expected profit, as long as the bonus payout ratio is greater than zero and less than $[2f/(f + g)]$. Thus mixed regular wage–bonus compensation packages involving bonus payout ratios in this range should be preferred by the firm to a straight regular wage compensation package. The profit advantage to the firm from a compensation package involving bonus payments will be greater the greater the variability of the sales generated by the designated type of worker. By differentiating the final expression for expected profit with respect to $(\alpha\beta)$, the bonus payout ratio, and setting this partial derivative equal to zero, we see also that the expected profit is maximized[7] when

$$\begin{aligned} \alpha\beta &= f/(f + g) \\ &= 1/[1 + (g/f)]. \end{aligned} \tag{20}$$

Thus three factors jointly determine the expected earnings of a worker of a given quality employed by a specific firm. The labor market sets the value of w, which is the minimum value of the expected earnings for this worker. The utility function for the given type of worker determines the rate at which the expected earnings of the worker must rise if bonus payments are to be substituted for some portion of w. That is, the utility function determines the risk premium the firm must pay to get a worker of the given quality to accept a compensation package involving some specified level of risk instead of the risk-free value w set by the labor market. Given the value of w and the rate at which a worker is willing to give up regular pay for expected bonus payments, the maximization problem of the firm then determines the actual mix between regular and expected bonus payments for a given type of worker. Note that this multistage process is qualitatively different from the portfolio problem of determining the desired mix between a risk-free asset and a risky asset subject to a budget constraint that is not affected by this mix.[8]

[7] $E(P)$ given by (19) is concave in $(\alpha\beta)$.

[8] By assuming that each worker's expected utility level is fixed at $EU(w)$ derived from consuming regular pay w, we are abstracting from life-cycle effects such as the smoothing out of consumption and liquidity constraints facing workers over time. For example, our model does not explain a possible equilibrium which may exist between workers who maximize lifetime expected utility and firms where older workers receive larger portions of their earnings in the form of bonus payments than younger workers because older workers are less subject to liquidity constraints. Our model implies, nevertheless, that older workers receive larger portions of their earnings in the form of bonus payments provided that they are more qualified than younger workers. In this sense the optimal bonus payout formula (20) can explain the variation in bonus payments resulting from workers' life-cycle behavior if such behavior can be restated in terms of the demand side adjustment cost parameter (f).

In controlling for g, we see from (20) that the optimal bonus payout ratio will be higher for types of workers in whom the firm invests more specific training (that is, workers with larger values of the firm-specific cost parameter f).[9] This training-related effect will be intensified in practice if the workers in whom the firm invests more also tend to be less risk adverse (and hence have smaller values of g). As the value of f increases, the amount by which α must be increased for (20) to be satisfied, however, will be moderated by accompanying increases in β due to increases in the size of the bonus-related risk premium as α increases (see (16)).

From (1), (9), and (10) it can be seen that the ratio of expected bonus payments ($\alpha E(b)$) to regular pay ($(1-\alpha)w$) is given by

$$\frac{\alpha\beta[E(S) - F - C^{M}]}{(1-\alpha)\omega[E(S) - F - C^{M}]} = \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{\beta}{\omega}\right) = \left(\frac{1}{(1/\alpha) - 1}\right)\left(\frac{\beta}{\omega}\right). \tag{21}$$

As already indicated, we would expect the value of α to be higher for better-qualified workers in whom the firm has invested larger amounts of specific training. Moreover from (16) and (9) it can be seen that increases in ω should be accompanied by greater increases in β.[10] Thus the expected bonus–regular pay ratio should be higher for more highly qualified workers. For the same reasons, the expected bonus–expected earnings ratio, given by

$$\frac{\alpha\beta[E(S) - F - C^{M}]}{(1-\alpha)\omega[E(S) - F - C^{M}] + \alpha\beta[E(S) - F - C^{M}]} = \frac{\alpha\beta}{(1-\alpha)\omega + \alpha\beta} = \frac{1}{((1-\alpha)/\alpha)(\omega/\beta) + 1}, \tag{22}$$

should also be higher for more highly qualified workers.

[9] Expression (20) could be viewed as an optimal risk sharing formula between a worker whose risk aversion is characterized by g and a risk neutral firm which nevertheless behaves as if it were risk averse because of the adjustment costs characterized by the parameter f. The key assumption in our model which ensures an interior optimum for the bonus payout ratio ($\alpha\beta$) is the specification in Eq. (7) that the adjustment costs for a given firm and type of worker are negatively related to the correlation between sales revenues and the wage bill for this worker type.

[10] Of course, we would expect w to be higher for more qualified workers (in terms of both education and on-the-job training). But workers with higher values of w will not necessarily have higher values of ω (in (9)) since the expected sales ($E(S)$) generated by more qualified workers may also be higher.

3. Empirical Results

Japanese firms have typically made larger training investments in workers with higher initial levels of education. At any given initial educational level it is commonly argued that large firms invest more specific training in their workers than smaller firms. Japanese firms have also tended to make more substantial training investments in male workers than in female workers even after controlling for the initial education level. (See, for example, Galeson and Odaka (1976), Anderson and Hill (1983), and Hill (1983, 1984).) On the basis of the arguments presented in the previous sections, therefore, we would expect the bonus–earnings ratio to be an increasing function of educational level and firm size and to be systematically higher for male employees than for female employees with the same level of education and working for the same size of firm.[11] These are exactly the patterns we observe in Table II for both 1974 and 1984. (The grouped data used in computing the figures shown in Table II, and also in Tables III and IV, are described in the Appendix.)

From the worker's perspective, both regular wage and bonus payments represent returns on years of education, tenure, and other job-related attributes. Coefficient estimates for a standard log-linear *equation for the regular wage payments* are shown for 1974 in Table III in column 2 for all workers, column 6 for male workers, and column 11 for female workers, and for 1984 in Table IV in column 2 for all workers, column 6 for male workers, and column 10 for female workers.

The theoretical arguments also suggest that the log of the bonus payments should be represented as a function of the log of the regular wage payments and other variables included explicitly to account for risk premium effects. Coefficient estimates for this augmented bonus equation are shown in columns 5, 9, and 14 of Table III and in columns 5, 9, and 13 of Table IV. We refer to this as an *augmented bonus equation* because it has not been customary to include a regular wage variable in an equation for bonus payments. We refer to the bonus equation without the regular wage variable as the *original bonus equation*. Coefficient estimates for the original bonus equation are shown in columns 3, 7, and 12 of Table III and in columns 3, 7, and 11 of Tables IV.

Two aspects of the estimation results for the augmented bonus equation deserve special mention. First of all, the coefficient estimates for the tenure, education, and other variables are essentially equal to the original

[11] It is interesting to note that the behavior of the ratio between nonwage benefits and total compensation is similar to the behavior of the expected bonus–expected earnings ratio. For example, the nonwage benefits–total compensation ratio rises as firm size rises, and it is higher for male workers than for female workers (Nakamura and Nakamura, 1989).

TABLE II

BONUS PAYMENTS AS FRACTIONS OF TOTAL EARNINGS OF SALARIES FOR WORKERS[a]

Size of employer[b]	1974									1984								
		Male education level[c]				Female education level					Male education level				Female education level			
	All	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	All	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Manufacturing																		
10–99	0.20	0.23	0.24	0.25	0.25	0.20	0.20	0.21	0.17	0.18	0.21	0.22	0.21	0.23	0.19	0.19	0.18	0.22
100–999	0.27	0.29	0.31	0.33	0.33	0.26	0.25	0.22	0.28	0.27	0.30	0.31	0.30	0.32	0.28	0.27	0.26	0.28
1000+	0.29	0.31	0.33	0.40	0.38	0.32	0.28	0.22	0.25	0.33	0.35	0.37	0.37	0.41	0.39	0.33	0.30	0.32
Service																		
10–99	0.24	0.21	0.24	0.31	0.29	0.18	0.23	0.26	0.30	0.24	0.21	0.25	0.24	0.27	0.21	0.23	0.24	0.26
100–999	0.31	0.28	0.31	0.35	0.34	0.21	0.28	0.31	0.32	0.30	0.26	0.30	0.33	0.34	0.20	0.26	0.28	0.31
1000+	0.35	0.35	0.34	0.36	0.36	0.32	0.33	0.33	0.34	0.35	0.31	0.33	0.34	0.39	0.26	0.32	0.31	0.32

[a] These figures are calculated using numbers from Ministry of Labour (1974, 1984). See the Data Appendix for details.
[b] The size of the employer is measured by the number of regular workers working at the establishment.
[c] These are (1) lower secondary school, (2) upper secondary school, (3) junior college, and (4) college or university.

bonus equation coefficient estimates minus the regular wage equation coefficient estimates. Thus the omission of the log of the regular wage payments from the bonus equation, as in Hashimoto's 1979 study, does not appear to result in seriously biased estimates of the *total* effects of the tenure, education, and other included explanatory variables. Second of all, the estimated coefficients of the log of the regular wage payments in the augmented bonus equation are insignificantly different from 1 in all cases for both 1974 and 1984. Because of this, it is also appropriate to estimate an equation for the log of the ratio of bonus to regular wage payments. Coefficients estimates for this log ratio equation are shown in columns 4, 8, and 13 of Table III and columns 4, 8, and 12 of Table IV. Our empirical findings concerning the importance of the treatment of regular earnings in an equation for bonus payments could not have been established on theoretical or other a priori grounds.

In line with our findings concerning the empirical significance of including a regular wage variable in the bonus equation, note the striking similarity between Hashimoto's coefficient estimates, shown in column 10 of Table III, and the corresponding 1974 estimates for our augmented bonus equation, shown in column 9 of Table III. The data Hashimoto used for 1970 are classified more finely than the published data we used for 1974. Also, due to the limitations of the published data (including the data used by Hashimoto), it is not possible to control for a host of potentially important factors that have changed over time. The similarity of our column 9 results to Hashimoto's, and also of our 1974 and 1984 results, is reassuring evidence that the reported responses are not simply proxy reflections of unobservable factors.

From Tables III and IV we see that the rates of return on years of education and tenure with the present employer are consistently higher for bonus payments than for regular wage payments. The penalty effects for working in a smaller-sized firm (and hence the extra rewards from working in a larger-sized firm) are also larger for bonus than for regular wage payments. On the basis of the theoretical arguments presented in the previous sections, the amounts by which the bonus equation coefficient estimates exceed the regular wage equation coefficient estimates might be interpreted as estimates of risk premium effects.

Hashimoto (1979, p. 1100) presents estimation results only for male workers because his theoretical model is not applicable to most female workers. Note, however, that our estimation results for female workers for both 1974 and 1984 display essentially the same patterns as our results for male workers. The theoretical arguments developed in the first sections of this paper are as applicable to female workers as they are to male workers and imply that we should observe similar patterns of coefficient estimates for both sex groups. It is true, however, that the coefficient estimates for the tenure and education variables are generally somewhat

TABLE III
DETERMINANTS OF REGULAR AND BONUS PAYMENTS: 1974[a]

	All				Male				Hashimoto (1979)	Female			
	ln(*R*)	ln(*B*)	ln(*B*/*R*)	ln(*B*)*	ln(*R*)	ln(*B*)	ln(*B*/*R*)	ln(*B*)*	Male ln(*B*/*R*) (1970 data)	ln(*R*)	ln(*B*)	ln(*B*/*R*)	ln(*B*)*
Constant	3.93	2.30	−1.58	−1.48	4.10	2.69	−1.45	−0.954	0.001	3.84	2.21	−1.50	−1.18
	(38.1)	(12.2)	(9.95)	(3.05)	(21.3)	(7.90)	(4.89)	(1.37)	(1.51)	(47.4)	(9.04)	(6.50)	(0.875)
ln(*R*)	—	—	—	.962	—	—	—	.890	—	—	—	—	.883
				(8.25)				(5.78)					(2.54)
Experience	0.006	0.034	0.028	0.028	0.005	0.031	0.026	0.026	0.027	0.024	0.076	0.049	0.054
	(1.68)	(5.17)	(5.11)	(4.98)	(1.01)	(3.34)	(3.28)	(3.24)	(12.0)	(7.03)	(7.38)	(5.07)	(4.23)
Education[b]													
Low	—	—	—	—	—	—	—	—	—	—	—	—	—
Middle	0.123	0.340	0.216	0.222	0.136	0.332	0.209	0.210	0.213	0.206	0.387	0.172	0.204
	(4.15)	(6.31)	(4.75)	(4.62)	(3.19)	(4.39)	(3.18)	(3.06)	(11.6)	(7.34)	(4.55)	(2.14)	(1.88)
High	0.282	0.520	0.224	0.249	0.257	0.481	0.216	0.252	0.210	0.332	0.537	0.175	0.244
	(8.43)	(8.54)	(4.37)	(4.06)	(5.55)	(5.85)	(3.02)	(3.08)	(5.2)	(10.8)	(5.81)	(2.00)	(1.68)
University	0.343	0.692	0.359	0.362	0.360	0.681	0.351	0.360	0.352	0.453	0.746	0.265	0.345
	(11.1)	(12.3)	(7.58)	(5.81)	(8.36)	(8.90)	(5.27)	(4.15)	(14.5)	(12.9)	(7.04)	(2.64)	(1.84)

Firm size[c]													
Large	—	—	—	—	—	—	—	—	—	—	—	—	—
Medium	−0.040	−0.135	−0.081	−0.097	−0.007	−0.112	−0.081	−0.106	−0.101	−0.069	−0.139	−0.071	−0.078
	(1.83)	(3.42)	(2.44)	(2.86)	(0.207)	(1.94)	(1.63)	(2.12)	(4.61)	(4.76)	(3.17)	(1.70)	(1.60)
Small	−0.119	−0.373	−0.256	−0.258	−0.070	−0.327	−0.255	−0.265	−0.358	−0.183	−0.411	−0.235	−0.249
	(4.65)	(7.97)	(6.49)	(6.11)	(1.72)	(4.55)	(4.07)	(4.18)	(15.0)	(11.3)	(8.43)	(5.11)	(3.14)
Age	0.010	0.011	−0.000	0.002	0.015	0.012	−0.002	−0.001	−0.006	0.008	0.006	−0.006	−0.001
	(3.22)	(2.02)	(0.123)	(0.370)	(2.90)	(1.32)	(0.257)	(0.152)	(5.78)	(3.59)	(0.832)	(0.898)	(0.209)
Male	0.388	0.416	0.045	0.042	—	—	—	—	—	—	—	—	—
	(17.8)	(10.5)	(1.34)	(0.753)									
R^2	0.888	0.876	0.722	0.910	0.631	0.776	0.686	0.832	0.979	0.920	0.867	0.705	0.878
Number of observations (cells)		186				108			647			78	

[a] The data are taken from Ministry of Labor (1974, pp. 130–151). The industries included are mining, construction, manufacturing, wholesale and retail trade, finance and insurance, real estate, transport and communication, utilities, and services. The estimation method used is weighted least squares with weights being given by cell sizes. The t statistics given in parentheses are based on heteroskedasticity-adjusted standard errors of White (1980).

[b] The education dummies are defined by lower secondary school (Low), upper secondary school (Middle), junior college (High), and college or university (University).

[c] The firm size dummies are defined by 1000 employees and more (Large), 100–999 employees (Medium), and 10–99 employees (Small).

TABLE IV
DETERMINANTS OF REGULAR AND BONUS PAYMENTS: 1984[a]

	All				Male				Female			
	ln(R)	ln(B)	ln(B/R)	ln(B)*	ln(R)	ln(B)	ln(B/R)	ln(B)*	ln(R)	ln(B)	ln(B/R)	ln(B)*
Constant	4.46	2.93	−1.44	−1.81	4.71	2.67	−1.69	−1.97	3.87	2.20	−1.45	−1.63
	(33.7)	(12.0)	(7.61)	(2.41)	(18.5)	(6.49)	(5.42)	(1.93)	(21.9)	(5.27)	(4.00)	(1.18)
ln(R)	—	—	—	1.06	—	—	—	0.984	—	—	—	0.990
				(6.55)				(4.80)				(2.88)
Experience	0.021	0.045	0.020	0.022	0.026	0.043	0.013	0.017	0.040	0.113	0.069	0.074
	(5.16)	(5.93)	(3.43)	(3.14)	(4.74)	(4.88)	(1.94)	(1.98)	(3.51)	(4.23)	(2.98)	(2.63)
Education[b]												
Low	—	—	—	—	—	—	—	—	—	—	—	—
Middle	0.173	0.369	0.160	0.186	0.170	0.450	0.209	0.282	0.387	0.656	0.175	0.272
	(4.08)	(4.73)	(2.64)	(2.65)	(2.86)	(4.70)	(2.87)	(3.36)	(5.99)	(4.29)	(1.31)	(1.40)
High	0.288	0.563	0.248	0.257	0.244	0.559	0.272	0.318	0.597	1.01	0.306	0.420
	(5.19)	(5.51)	(3.12)	(2.68)	(3.14)	(4.45)	(2.85)	(2.83)	(7.22)	(5.17)	(1.80)	(1.54)
University	0.389	0.722	0.316	0.310	0.393	0.818	0.362	0.431	0.708	1.14	0.338	0.442
	(8.23)	(8.32)	(4.67)	(3.26)	(5.84)	(7.53)	(4.38)	(3.63)	(8.70)	(5.94)	(2.01)	(1.47)

Firm size[c]												
Large	—	—	—	—	—	—	—	—	—	—	—	—
Medium	−0.099	−0.270	−0.190	−0.165	−0.083	−0.256	−0.185	−0.175	−0.086	−0.225	−0.186	−0.140
	(4.36)	(6.87)	(6.20)	(4.58)	(0.270)	(5.20)	(4.92)	(4.08)	(3.39)	(3.77)	(3.58)	(2.25)
Small	−0.128	−0.520	−0.406	−0.384	−0.065	−0.481	−0.448	−0.417	−0.195	−0.545	−0.347	−0.352
	(4.93)	(10.9)	(10.9)	(8.67)	(1.56)	(7.20)	(8.81)	(7.56)	(7.35)	(8.67)	(6.33)	(3.97)
Age	0.009	0.011	0.001	0.001	0.009	0.026	−0.010	−0.017	0.018	0.012	−0.009	−0.006
	(2.91)	(1.89)	(0.138)	(0.247)	(1.59)	(2.85)	(1.52)	(2.28)	(4.65)	(1.28)	(1.18)	(0.584)
Male	0.316	0.359	0.065	0.023	—	—	—	—	—	—	—	—
	(10.9)	(6.73)	(1.56)	(0.344)								
R^2	0.940	0.933	0.850	0.955	0.818	0.922	0.897	0.951	0.797	0.817	0.716	0.849
Number of observations (cells)	96				48				48			

[a] The data are taken from Ministry of Labor (1984, pp. 100–105). The industries included are manufacturing, wholesale and retail trade, finance and insurance, and services. The estimation method used is weighted least squares with weights being given by cell sizes. The t statistics given in parentheses are based on heteroskedasticity-adjusted standard errors of White (1980).

[b] The education dummies are defined by lower secondary school (Low), upper secondary school (Middle), junior college (High), and college or university (University).

[c] The firm size dummies are defined by 1000 employees and more (Large), 100–999 employees (Medium), and 10–99 employees (Small).

larger in magnitude for women than for men. This may reflect the greater importance of sorting effects for women. That is, women who are more career-oriented may invest much more effort in seeking out jobs offering better opportunities for on-the-job training and earnings growth and may also tend to accumulate more years of formal education and job tenure. The extent of these sorting effects may be greater for women than it is for men since it is socially acceptable for women to take little or no interest in career development.[12]

Data Appendix

The figures in Table II as well as the empirical results reported in Tables III and IV are based on grouped data published by the Ministry of Labor (1974, Table 66; 1984, Table 77). Each data cell is defined by the year (1974 or 1984), the size of the (private or government) establishment, the industry, the type of worker (production worker versus salaried employee), and the sex and educational attainment of the worker. The information available for each cell is the average age, average duration of service, average monthly contractual earnings, and average annual special earnings for each cell. Most of the special earnings are bonus payments. Also included as special earnings are allowances for marriage and (generally small) payments for other infrequent or unexpected events. We use data for male salaried workers and for female salaried workers for all of the industries for which figures are reported for all four educational levels. (Data for production workers are available only for two broader educational groupings.) Cell sizes were used as weights in the regressions for which results are reported in Tables III and IV.

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[12] An important issue which is not dealt with in this paper is the effect of bonus payments on work incentives. The data used allow us to identify regular pay (contractual earnings including overtime wages) and bonus pay (special earnings). But it is not possible to control for, for example, workers' unobservable effort levels in their work places which may be reflected in bonus payments. It could be the case that the risk premiums contained in the returns to human capital investments and paid out in bonus form might also reflect additional work effort by workers. This problem is confounded by the fact that the workers who put extra effort into their work may be rewarded by promotions which will increase their regular pay as well as by higher levels of bonus payments.

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