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1. Introduction

To analyse the structure of earnings, many empirical studies take the approach of regressing earnings on sex, education, age, length of service, occupations, unionization, firm-scale and so on. This implies that they estimate the contribution of each variable in a reduced form of structural equations because earnings are at least to be determined by the interaction of labor suppliers and demanders. But, in spite of its importance, the form of structural equations has not been satisfactorily specified, and consequently it is quite possible that they use endogeneous variables as independent in simple regressions. This will lead us to the situation that the estimated effects of each variable are not consistent among studies and in occasions difficult to interpret properly.

In the present paper, we focus on the effect of firm-scale, of which importance has been stressed by many economists as an explanatory variable of the structured labor market in Japan. Seemingly, the earnings which individual workers receive vary widely depending on the size of firm in which they are employed. For instance, Table 1 shows that the average hourly rates of contractual earnings of workers whose ages are in the range of 30 through 54 differ between large-scale firm (1000 or more employees) and medium-scale firms (100-999 employees) by 24.4%, and between large-

scale firms and small-scale firms(10-99 employees) by 34.3%. For this reason many empirical studies have concentrated on the question of how wages or age-wage profiles differ across interscales by relation to schooling, sex and occupation(white-collar or blue-collar).[1]

There is, however, the tendency that the more the controlled variables increase the more the effect of firm-scale becomes unstable and insignificant. For example, Taira(1961, 1975) and Ono(1971) presented evidence in support of the hypothesis that union pressure causes firm size and inter-industry wage differentials. According to Bluementhal(1966), the Analysis of Variance to the 1961 Japanese manufacturing industries reveals that the 10% of manthly contractual earnings is explained by differences in firm-scale while the Analysis of Covariance shows that the effects of industry and firm-scale are well explained by value added per employee and unionization ratio. More explicitly, Ohtsu(1973) obtained the result that the firm-scale index is not significant controlling for age, sex, length of servise, union and value added per employee. Stoikov(1973) also concluded that the size of firm explains the Japanese wage structure in only a very minor way, when controlled by age, schooling, external and internal experinnce, and occupations. In line with this conclusion Tachibanaki(1975, pp.574) noted that "even though the wage earnings adjusted by bonus and working hours are used, size is a weeker factor than sex, experience and age." Differently, by a cross-sectional analysis on the 1967 manufacturing industries Shimada(1981) found that the size of firm is significantly related to hourly earnings with the inclusions of capital-labor ratio, concentration ratio in the product market and unionization ratio. Facing these results,[2] what we can say is that wage differences due to the size of firm are related to many factors - for example, the nenko-wage system,

value added per employee, the degree of imperfect competition in the labor market or in the product market, redundancy in labor supply, the mechanism of capital concentration, labor quality differences, etc., which are deeply interrelated to each other. See Paine(1971) and Ono(1973) on the meaning of firm-scale.

To solve the problem, the present paper will construct a simultaneous equation model having separation as an dependent variable, based on the human capital theory, and fit to the 1976 earnings data concerning workers in the age range of 30 through 54 in the Japanese munufacturing industries. This approach is usefull for our analysis in two ways. One is concerned with the choice of separation as an independent variable. It is a widely accepted view that the nenko-wage is the system to reduce the quits of skilled workers by combining tightly the wage rate with age or length of service and the lifetime employment system makes the firm refrain from laying off the skilled in business recessions,[3] and it is also generally agreed that both systems apply to regular male employees in large-scale firms and some medium firms in the private sector and regular employees in the public sector. Therefore, we could expect that the larger the firm the lower the separation and, hence, the higher the wage rate. Note here that lower separation gives the firm an incentive to invest more in specific training and makes the worker's productivity higher. Such interpretation of the nenko-wage and the lifetime employment implies that they are consistent with economic rationality from the point of view of the human capital theory and represented by the combination of lower separation and higher wage rate. That is, when the negative relation between separation and wage rate is built in a model, the effects of these systems are empirically reflected in its statistical

significance. So far, many labor economists have investigated the importance of the nenko-wage and lifetime employment in the determination of the earnings structure in Japan, focusing on the return differentials between internal and external experience. But, as was criticized by Sano(1976), their discussion is based on the ad hoc interpretations attached to these variables.

Our approach based on a simultaneous equation model is also helpful in analysing the effect of interactions among variables and in explaining how each affects the earnings structure. More specifically, in our framework it is possible to distinguish the effect of a certain variable into two kinds; the direct one through changing the wage policy of the firm and the indirect one through affecting the quit behavior of the worker. This distinction will make it easier to clarify the mechanism of wage determination and also possible to give reasonable interpretations to the effects of the variables such as sex which have been playing an important role in the studies of earnings structure.

2. The Data and Earnings Function in a reduced form

To begin with, the earnings function in a reduced form was fitted to the logarithm of hourly rate of contracted earnings of workers at the age range of 30 through 54 years in 1976 manufacturing industries. Since 20 of 2-digit industry in manufacturing sector is classified by three categories of firm-scale, large firms having more than 1000 employees, medium firms between 999 and 100 employees, and small firms between 99 and 10 employees, the number of groups is 60. But the large firm category in Leather industry was excluded because the reported number of its total workers is curiously less than 1000 in the Basic Survey of Wage Structure (Japan, Ministry of Labor, 1976). Therefore, the number of our observations is 59. Each of the variable used is briefly described below.

Earnings

From the Basic Survey of Wage Structure the hourly rate of contracted earnings, HWS, which is the dependent variable in our model, is computed as follows,

$$\text{HWS} = \frac{\text{monthly contractural earnings excluding payments to overtime worked}}{\text{monthly scheduled hours}}$$

HWS defined above is a suitable measure of long-run earnings capacity of workers since it is free from earnings variations due to short-run fluctuations in the market conditions of product demand.

Schooling

The recorded schooling in the Basic Survey of Wage Structure is schooling levels completed, junior-high school grade of 9 years,

senior-high school grade of 12 years, junior-college grade of 14 years, and college grade of 16 years. SCH is defined as an weighted average (by employment) of schooling years of each unit. This measure is not so deficient because dropouts are rare in Japan.

Sex

MALE represents the percentage of male employee within a group. We expect it has the positive effect on earnings for two conceivable reasons. One is that male workers are more productive in firms, and the other that they invest in themselves or are invested by firms more than female workers because they are more likely to stay in labor force as primary workers through their lifetime.

Type of Work

The classification of employees as white collar and blue-collar workers is important since the training process and hence the skills and knowledge accumulated differ with type of work. Intuitively, it is often argued that white-collar workers in professional occupations or in hierarchical organizations embody firm-specific skills less than blue-collar workers working in the team production. We use the data of managerial, official, and technological workers as white collar and production workers as blue-collar in the classification of the Basic Survey of Wage Structure. WHITE represents the percentage of white-collar workers within a group.

Length of Service

The data of length of service from the survey measure the length

of time workers have been employed by their present employer. We suppose this variable as a proxy for the investment in on-the-job training in specific employment. To analyse its effect on earnings let us define LS as an average of length of service weighted by employment.

Age Composition

The conventional production function assumes that the marginal productivity of an input depends on its quantity relative to those of other related inputs and the more its quantity the lower is its marginal productiviy. In the context of our study, the larger the number of skilled workers relatively to that of unskilled workers, the lower is their productivity. To take account of this effect we assume that workers whose ages are 30 through 54 years are the skilled, and introduce age composition as an independent variable. Thus, we define AGE representing the proportion of skilled workers within a scale-classified industry.

Value added per employee

It is often stressed that value added per employee, VALUE, associated with firm-scale, capital intensity, concentration ratio and so forth, plays an important role in making the Japanese labor market structured. Since we can not obtain the data on this variable by relation to age from the Census of Manufacturers(Ministry of International Trade and Industry, 1976),[4] VALUE is calculated for the workers whose ages are over 15 years.

Unionism

Recently a new view on the impact of trade unionism has been presented by Freeman(1976, 1980), Brown and Medoff (1978), and Medoff(1979).

They argue that trade unions function to improve not only economic conditions of workers by "union power" but also social relations in the team production, which strongly affect the probability of workers' quitting and the productivity of workers. More specifically, applying the exit-voice model of the social system advocated by Hirschman (1970) to the labor market, Freeman (1976, 1980) discussed that unions reduces quits and permanent separations by providing a "voice" alternative to classical exit behavior when workers are dissatisfied with conditions, and presented empirical evidence showing significantly lower exit for unionist by analysing data on individuals. Further Freeman (1976) and Brown and Medoff (1978) presented and tested the hypothesis that trade unions have a substantial positive effect on output per worker through affecting the firm-specific investments in human capital, social interactions among workers, disputed between workers and supervisors, the moral of workers, and motivation.

To analyse the effect of unionism on earnings in Japanese manufacturing industries we define UNION as the ratio of union membership to the total employment of skilled workers over 15 years. Tha data source of union membership is the Basic Survey of Labor Unions (Japan, Ministry of Labor, 1976) and that of total employment is the Basic Survey of Wage Structure.

Firm-scale

The size of a firm is associated with many factors such as capital-labor ratio, value added per employee and institutional rules. Since one of the major purposes in the present paper is to explore its meaning, we will discuss it more later. In this section we define firm-scale dummy

variables, D_1 with a value of 1 for the groups of skilled workers employed by large firms and 0 for the other groups, and D_2 with a value of 1 for the groups employed by medium firms and 0 for the other groups. In addition, E_1 is defined as a scale dummy with a value of 1 for both the large and the medium firm groups and 0 for the small firm groups.

Table 1 presents the results of regressing the logarithm of hourly contracted earnings against schooling level achieved, its square, male ratio, the percentage of white-collar workers, the percentage of workers whose ages are in the range of 30 through 54, length of service, the proportion of employees organized, and two firm-scale dummies. The results have some interesting implications: First, the three variables — schooling level, its square and male ratio — have the expected signs, and influence earnings strongly and consistently regardless of the inclusions of the other variables. For example, estimated equation (1) shows that 89% in the variance of hourly earnings is explained by the variances in these three variables. Further, note that the coefficients of these variables are significant at the 1% level of confidence in all the equations through (1) to (12).

Second, by the comparison between equation (3) and (4) or between (3) and (6) we find that without the regressor of length of service white-collar occupations have a positive effect on earnings significantly, but, when length of service is included, their effects become insignificant at the 5% level of confidence. The inclusion of length of service also makes the effect of firm-scale ambiguous and lessons the coefficient of

union ratio, reducing its significance. Compare equation (2) with (4), and (5) with (6). These results should be attributed to the existence of the high correlations of length of service with white-collar occupations, firm-scale and unions. According to Table 2, its correlation coefficient is 0.731 with WHITE, 0.786 with D_1 and 0.877 with UNION. In this situation we can not identify the contributions of these variables by the simple regression of a reduced form.

Third, the comparison between (2) and (5), or between (4) and (12), suggests that with the inclusion of union variable the effect of firm-scale on the determination of earnings of skilled workers has the unexpected sign and is not significant under conventional criteria. This is in line with the results of the other empirical studies mentioned in the previous section. We will discuss their relation more in the next section.

Forth, it is interesting to note that the effect of value added per employee is not statistically significant per se, but with the inclusion of union ratio. See equation (5), (8) and (9). This may be interpretted as implying that an increase in the value added can brings about an increase in the wage rate only by the help of some pressures such as unions on the wage policy of the firm. Equation (11) shows that significantly the product of VALUE and UNION, VU, has a positive effect on earnings.

3. The Model

According to the human capital theory a worker's remuneration is a positive function of his human capital created by the investments in both formal schooling and on-the-job training. Since formal schooling approximates to general training, the worker bears most of its cost. On the other hand, since on-the-job training creates not only general but also firm-specific human capital in him, the firm bears a part of its costs and takes part in the decision on the amount of human investment. Thus, under the existence of specific skills the problem of how to suppress quitting of skilled employees becomes a major concern and regulating the determinants of turnover an important policy for the firm because it wishes to recoup the fincanced costs of human investment. Oi (1962), Becker (1964), Rosen (1968), Parsons (1972), Salop(1973) and Ohashi(1983) explore the implications of the existence of training and hiring costs and inferred that, as training and hiring costs increase, higher wages will be paid in an attempt to reduce quits, and layoffs will be less prevalent because minor and temporary fluctuations in product demand is less likely to drive productivity below wages by the margin of training costs amortized over the expected duration of employment.

As for the effect of specific human capital on the quit behavior of workers, we can reasonably conjecture as follows: Since specific skills are of no value in other firms, the worker whose skills are in a large extent firm-specific will suffer from a sharp decrease in his wage when quitting the firm. That is, the larger the percentage of specific skills he has acquired, the bigger the wage gap between the present and alternative exployment and the less is the worker likely to quits.

This can establish the hypothesis that the more the worker acquires specific-skills the more the firm invests in him and the higher is his wage rate.

Thus we can realize that the amount of human investment and the separation of workers are closely interrelated, and hence, in analysing how and what factors they are determined, simultaneous equation models are required.

Wage Equation

Before specifying wage equations, we define a variable, SEPA, which represents the proportion of workers in a data unit who separated firms for some reason —— firing, company disolution, bankruptcy, a slump in business, search for a better job, ill health and etc. The data source is the Employment Trend Survey (Ministry of Labor, 1976). This variable is expected to have a negative effect on earnings because the more the worker is likely to separate the less the firm invests in him.

We now specify wage equations which may be expressed generally as,

$$(1) \qquad \underset{}{HWS} = f(\underset{-}{SEPA}, \underset{+}{SCH}, \underset{+}{MALE}, \underset{+}{WHITE}, \underset{-}{AGE}, \underset{+}{VALUE}, \underset{+}{UNION}, \underset{+}{D_1}, \underset{+}{D_2}),$$

where the sign under each variable shows its expected effect. Note here that length of service used in the previous earnings functions is replaced by SEPA. This is because they have the same theoretical meaning in our framework in the sense that both are associated with the amount of human investment which have been done on the job.[5] Concerning the variables in the right-hand side, a distinction should be drawn between productive and

institutional factors. The former, which we reasonably interpret as reflecting market forces with economic rationality, are SEPA, SCH, MALE, WHITE and AGE. The latter are VALUE, UNION and firm-scale dummies, D_1 and D_2.

Separation Equation

Table 2 shows the proportion of workers who separated firms to the total number of separation by relation to reason in 1976 manufacturing industries. Here we notice the following facts: (1) Quits (separation by private reason) are the most prevalent and share 73.2% in the total. (2) Separations by quit or layoff (separation by employment contract expired or managerial reason) share 90.2%. These results imply that since quits and layoffs are influenced by the degree of firm-specificity of the skills created in workers, as have been discussed above, we must take account of differences in skill specificity across industries, occupations and interscales on analysing separation.

As is well known, it is difficult to measure specific training directly for empirical work. Therefore, some proxies must be used. According to Mincer (1962), controlling for years of education, the wage level can be a proxy for the amount of specific training invested in a worker. This is because for a given level of educational attainment his wage is positively associated with the quantum of on-the-job training. Note here that formal schooling is assumed to be general training.

Another proxy for specific training was implicitly suggested by Donaldson and Eaton (1976) and Nickell (1976). Their fundamental reasoning is the following: In a two-period model, if the labor supply

constraint is that over the two periods the expected present value of earnings of workers with general skills must equal the expected present value of earnings of workers with specific skills, and the employers hiring employees in whom they intend to create specific skills have an incentive to pay the lowest wage possible in period one and the highest in period two in order to lower the quit probability of the specifically skilled workers. This implies that the wage level of an unskilled worker represents the amount of specific skills such that, the more he will acquire specific skills, the more his wage profile steeply rises and the lower is his wage in training period. Now let us define HWU as the hourly contractual earnings of workers at the age range of 20 through 24.

In deciding on quitting, a worker takes account of not only the current level of wage but also its future. If he is pessimistic on the future of the firm because of a slump in business or its unstableness, he is likely to quit. To introduce this effect into the equation, we use a variable, INVQ, defined as the proportion of involuntary quits (separations by employment contract expired or managerial reason) to the total number of separations.[6]

Based on the above discussion, the separation equation can be specified generally as

$$(2) \qquad SEPA = g(\underset{-}{HWS}, \underset{+}{HWU}, \underset{+}{WHITE}, \underset{+}{INVQ}, \underset{-}{MALE}, \underset{+}{SCH}, \underset{-}{UNION}, \underset{-}{D_1}, \underset{-}{D_2}).$$

In the next section equation (1) and (2) will be specified in linear stochastic forms and estimated by the technique of two-stage least-square (2SLS).

4. The Empirical Results

The estimated equations which appear to be fitted fairly well by the technique of 2SLS are reported in Table 5, and we use this model as a basis for comparisons with others. The wage and separation equations specified alternatively are also presented in Table 6 and 7, respectively.

The first issue addressed is the effects of firm-scale which may be regarded as representing many related variables — for instance, institutional rules such as the nenko system, high promotion possibility, social prestige, stableness in employment and many opportunities for transfer. Wage equation (1W) in Table 6 shows that the direct effects of the firm-scale dummies on earnings not only are statistically insignificant but also have the unexpected signs while, in equation (2W) where UNION is excluded, they are significant. But note that in equation (2W) SEPA is not statistically significant at the 5% level of confidence. These results are due to the strong correlation among UNION, SEPA and the firm-scale dummies, in particular, between UNION and the firm-scale dummies. See Table 2. Since from the theoretical point of view UNION and SEPA make economically clear sense more than the scale dummies, we excluded the latter from equation (BW) in the Basic Model.

On the other hand, as can be seen from equation (BS) in Table 5 or (3S) in Table 7, the firm-scale dummies are negative to separation although the effect of D_1, the scale dummy of large firms, is less clear. This implies that an enlargement in firm-scale leads to an increase in the earnings of skilled workers by reducing separation possibility and hence stimulating the investment in specific training. However, this effect should not be stressed too much because we have, at

the same time, a few embarrassing results: First, the coefficient of D_1 is smaller than that of D_2 in equation (BS) and (3S). That is, the workers in the medium firms are more unlikely to separate than those in the large firms. Second, the effects of scale dummies become statistically insignificant with excluding UNION, whose coefficient is unexpectedly positive otherwise. See Table 7. Third, the standard error of the regression is the smallest in the equations estimated without UNION or D_1 and D_2.

The results concerning the scale effect on separations are not consistent among the empirical studies which have been done on separation and quit in Japan as well as in the United States.[7] Mizuno (1978) reported that firm-scale is not significant to the separations of male workers but female while Ono (1981) obtained the opposite results. In addition, they differ with the sign of the scale effect. That is, the effect of firm-scale on separation is positive to female in the former work, but negative to male in the latter.[8]

It should be stressed here that the above results does imply the irrelevancy of firm-scale dummies to earnings, but not firm-scale per se. As have been discussed before, under the existence of firm-specific skills the scale effect is also reflected in both the negative relation between separations and wages and its statistical significance since the nenko-wage and the lifetime employment which function to reduce separations and to make the firm invest more in specific training apply prevalently to large-scale and medium-scale firms.[9] From the point of view of this, the results in Table 5, 6 and 7 reject the null hypothesis that firm-scale has no relation to earnings and separations.

Here in this stage still remains the problem of why the nenko-wage and the lifetime employment system are prevailingly adopted by large and medium firms. We can solve this problem by assuming that the bigger the size of the firm the more is the specificity of the skills which the workers acquire through on-the-job training and hence the stronger is the incentive of the firm to reduce separations. Concerning monopolistic and large-scale firms Koike (1966) conjectured the following causes to hold the above assumption: First, monopolist firms make use of their own machinery whose similars are not difficult to find in others. Second, the mass production makes it possible to design the job and the training system specific to the firm. Thus we can conclude that the firm-scale associated with skill-specificity plays an important role in the determination of the earnings structure although the scale dummies used in the present paper as proxies for the other factors such as social prestige have only small effects.

We now turn to the effects of unions. According to the wage equations in Table 5 and 6, the null hypotheses that union coefficient is not significantly different from zero is rejected at the 1% level of confidence. In other words, unions are significantly related to the hourly wages of skilled workers. This result can be interpreted as showing that union power is strong enough to lift up wages against the pressure of market forces or unions raise the productivity of workers by improving social relations in the team production. Unfortunately, however, we can not identify each contribution.

The union effect on separations is somewhat puzzling because it is positive against our expectation and in a case statistically significant

under conventional criterion. See equation (BS) in Table 5 and the equations in Table 7. Clearly this union effect works to decrease the hourly wages of skilled workers, reducing human investments. Our basic model in Table 5, however, suggests that it is less important and dominated by the direct ones as can be shown below. Substituting equation (BS) into (BW) and rearranging give us the following equation,

$$\begin{aligned}(3)\quad HWS = &- 14.625 + 2.751\ SCH - 0.124\ SCH^2 + 0.558\ MALE + 0.170\ WHITE \\ &+ 0.517\ AGE - 0.910\ HWU - 0.213\ INVQ + 0.011\ VALUE \\ &+ 0.240\ UNION + 0.043\ D_1 + 0.050\ D_2\end{aligned}$$

where the coefficient of UNION is positive. Incidentally it is also interesting to note that the coefficient of UNION and those of firm-scale dummies are all positive in the simultaneous estimation while they were different from each other in the estimations by the technique of ordinary least squares. See equation (5) and (12) in Table 5.

Similarly, by solving the basic model, we can get the separation equation in a reduced form,

$$\begin{aligned}(4)\quad SEPA = &\ 18.935 - 2.748\ SCH + 0.161\ SCH^2 - 0.722\ MALE + 0.521\ WHITE \\ &- 0.699\ AGE + 2.693\ HWU + 0.629\ INVQ - 0.014\ VALUE \\ &- 0.67\ UNION - 0.048\ D_1 - 0.147\ D_2.\end{aligned}$$

Thus we know unions and firm-scale are negatively related to separations in the final effects.

Table 5, 6 and 7 show that white-collar occupations significantly and consistently have positive effects on both hourly wages and separations. The results may be interpreted as follows: Since white-collar occupations

are generally associated with administrative, technological and official works, a high quality of labor is required to perform them successfully. This leads to the result that the firms attempt to employ qualified workers for white collar occupations by raising wages and become more selective in the determination of promotion of internal workers to administrative and managerial jobs. In turn, since administrative and official jobs are embedded into hierarchical organizations, it is often seen, especially in Japanese large companies and national government offices, that white-collar workers swollen out of competition for a higher position are forced or persuaded to transfer to other related forms such as affiliated or cooperating companies. In this situation, it is fortunate that highly talented workers are adaptable to cercumstances and the knowledge which white-collar workers acquire are relatively general. Thus the direct effects of white-collar occupations on both earnings and separations are positive. Further, as is clear from equation (3) and (4), its final effects on both variables are also positive.

It is interesting to note that male ratio is positive to earnings but its effect on separation is not statistically significnat.[10] See equation (BW) in Table 5 and (3S) in Table 7. They say that wage differentials between male and female are attributable to the difference in the type of labor force. That is, since women are more likely to quit the labor force for various non-economic reasons such as family affairs, firms are reluctant to invest in them. But this is not the case when wages, type of work and market conditions are controlled. In other words, the high probability of women separating, if any, is probably due to their lower wages, higher proportion of non-manual workers or unfavourable market

conditions. Thus we can conclude that wage differentials between male and female are caused by lower productivity of women in the production and training, and/or by discrimination against them in the determination of wages or in the process of hiring and promotion.

Finally, we turn to the effects of formal schooling. Equation (BW) in Table 5 and (4S) in Table 7 show that formal schooling significantly has a positive effect on earnings while it does not on separation. The interpretation of its positive effect on earnings is straightforward. That is, formal schooling raises worker's productivity by creating general skills in them. In turn, formal schooling makes it easier for workers to turn over among firms by reducing the wage loss accompanied, and the other that firms give specific training to workers with a higher level of formal education, which is supposed to make the training more efficient, highly educated workers embody a large amount of specific skills. Thus, if the above two effects offset each other, we can not obtain the significance of formal schooling on separation.

Table 1 — Mean Values of the Variables by Relation to Firm-scale, Concerning 30-54 Workers in the Japanese Manufacturing Industries, 1976

variables	firm-scale			unit
	large firms	medium firms	small firms	
HWS	1.055(100)	0.808(76.6)	0.651(61.7)	thousand of yen
SEPA	0.063(100)	0.110 (175)	0.156 (248)	ratio
SCH	10.6 (100)	10.1 (95.3)	10.0 (94.3)	year
MALE	0.87 (100)	0.77 (88.5)	0.62 (71.3)	ratio
WHITE	0.46 (100)	0.36 (78.3)	0.25 (54.3)	ratio
LS	15.5 (100)	11.0 (71.0)	8.6 (55.5)	year
UNION	0.88 (100)	0.48 (54.5)	0.08 (9.1)	ratio

Note — HWS = the hourly rate of contractual earnings; SEPA = separation ratio; SCH = the average years of schooling; MALE = male ratio; WHITE = white-collar ratio; LS = the average years of length of service; UNION = union ratio.
The detailed definition of each variable will be given in Section 2.

Table 2 - Correlation Coefficient Matrix
among the Related Variables

	WHITE	LS	VALUE	UNION	SEPA	D_1	E_1
WHITE	1.000	0.731	0.645	0.682	-0.549	0.731	0.581
LS		1.000	0.569	0.877	-0.631	0.786	0.639
VALUE			1.000	0.394	-0.442	0.344	0.338
UNION				1.000	-0.526	0.820	0.826
SEPA					1.000	-0.468	-0.466
D_1						1.000	0.494
E_1							1.000

Table 3 — OLS Regressions on Logarithm of Hourly Wages of Skilled Workers in Japanese Manufacturing Industries, 1976

Independent variables	Equations					
	(1)	(2)	(3)	(4)	(5)	(6)
constant	-23.442	-18.714	-15.022	-13.043	-16.774	-13.16
	(4.85)	(4.45)	(3.53)	(3.47)	(4.65)	(3.61)
SCH	4.056	3.215	2.564	2.143	2.878	2.205
	(4.40)	(4.02)	(3.21)	(3.03)	(4.20)	(3.21)
SCH^2	-0.181	-0.144	-0.117	-0.094	-0.129	-0.099
	(4.12)	(3.80)	(3.15)	(2.85)	(3.99)	(3.06)
MALE	0.923	0.802	0.637	0.582	0.679	0.594
	(13.54)	(12.74)	(7.64)	(8.73)	(11.17)	(9.12)
WHITE			0.534	0.136		0.196
			(3.20)	(0.91)		(1.50)
AGE			0.259			
			(1.67)			
LS				0.024		0.013
				(4.20)		(2.27)
VALUE					0.006	0.003
					(2.50)	(1.14)
UNION					0.321	0.133
					(4.20)	(2.73)
VU						
D_1		0.148	0.167	0.033	-0.082	
		(4.75)	(5.11)	(0.90)	(1.31)	
D_2		0.083	0.078	0.043	-0.038	
		(3.62)	(3.16)	(2.07)	(1.10)	
$\bar{R}^2$	0.900	0.928	0.938	0.952	0.948	0.954

Note.— t values are given in parentheses. $\bar{R}^2$ stands for the coefficient of determination adjusted for the degree of freedom.

Table 3 (continued)

Independent variables	Equations					
	(7)	(8)	(9)	(10)	(11)	(12)
constant	-14.874 (4.04)	-16.619 (4.62)	-22.923 (4.73)	-17.686 (4.73)	-17.629 (4.84)	-13.972 (3.73)
SCH	2.468 (3.52)	2.853 (4.18)	3.971 (4.31)	3.031 (4.26)	3.039 (4.40)	2.335 (3.31)
SCH^2	-0.108 (3.27)	-0.128 (3.97)	-0.177 (4.05)	-0.135 (4.02)	-0.137 (4.17)	-0.104 (3.14)
MALE	0.596 (8.90)	0.686 (11.42)	0.891 (12.17)	0.744 (12.81)	0.712 (12.13)	0.567 (7.59)
WHITE						0.184 (1.04)
AGE						0.089 (0.60)
LS	0.028 (7.20)					0.014 (1.94)
VALUE		0.006 (2.50)	0.004 (1.17)			0.003 (0.94)
UNION		0.231 (7.15)		0.221 (6.57)	0.192 (5.35)	0.190 (2.13)
VU					0.007 (2.02)	
D_1						-0.050 (0.81)
D_2						-0.010 (0.30)
$\bar{R}^2$	0.948		0.900	0.943	0.946	0.953

Table 4 — The Percentage of Separations by Reason in Manufacturing industries, 1976

employment contract expired	7.7%
managerial problem	9.3%
mandatory retirement	3.1%
discharge	3.1%
quit	73.2%
ill health, death, others	3.5%
Total	100 %

Note. — the data source is the Employment Trend Survey (Ministry of Labor, Japan, 1976).

Table 5 — 2 SLS Estimates of Basic Simultaneous Model, 1976

(BW) $$\underset{}{HWS} = \underset{(2.65)}{-8.230} - \underset{(2.12)}{0.338}\,SEPA + \underset{(2.63)}{1.547}\,SCH - \underset{(2.54)}{0.070}\,SCH^2 + \underset{(4.84)}{0.314}\,MALE + \underset{(2.71)}{0.346}\,WHITE$$
$$+\underset{(2.54)}{0.291}\,AGE + \underset{(2.54)}{0.006}\,VALUE + \underset{(7.26)}{0.217}\,UNION \qquad SER = 0.0470$$

(BS) $$\underset{}{SEPA} = \underset{(0.07)}{0.011} - \underset{(2.98)}{1.294}\,HWS + \underset{(1.95)}{1.516}\,HWU + \underset{(2.85)}{0.741}\,WHITE + \underset{(3.12)}{0.354}\,INVQ + \underset{(2.65)}{0.243}\,UNION$$
$$-\underset{(1.23)}{0.072}\,D_1 - \underset{(2.40)}{0.083}\,D_2 \qquad SER = 0.0551$$

Note.—— t values are given in parentheses. SER represents the standard error of the regression. The average value of HWS is 0.834 in thousand of yen and that of SEPA is 0.111 in ratio.

Table 6 - 2SLS Estimates of Wage Equations
(the left-hand endogeneous variable = HWS)

quation umber	estimated coefficients on:											SER
	.constant	SEPA	SCH	SCH^2	MALE	WHITE	AGE	VALUE	UNION	INVQ	D_1	D_2	
(1W)	-7.677 (2.48)	-0.408 (2.48)	1.455 (2.51)	-0.066 (2.44)	0.303 (4.74)	0.366 (2.70)	0.228 (1.91)	0.006 (2.79)	0.274 (4.30)		-0.053 (0.98)	-0.055 (1.82)	0.0461
2W)	-7.579 (2.14)	-0.281 (1.51)	1.434 (2.16)	-0.066 (2.12)	0.353 (4.90)	0.521 (3.48)	0.278 (2.08)	0.005 (1.86)			0.154 (5.35)	0.047 (2.23)	0.0529
3W)	-8.154 (2.45)	-0.582 (1.48)	1.529 (2.45)	-0.069 (2.34)	0.271 (2.93)	0.336 (2.47)	0.225 (1.46)	0.005 (1.78)	0.198 (4.66)	0.171 (0.69)			0.0499

Note.- the proper variables from equation (BS) were used as instrumental variables in each estimation.

Table 7 -- 2SLS Estimates of Separation Equations, 1976
(the left-hand endogeneous variable = SEPA)

equation number	estimated coefficient on:											SER
	constant	HWS	HWU	WHITE	INVQ	UNION	MALE	SCH	D_1	D_2	E_1	
(1S)	0.176 (1.50)	-0.648 (2.36)	0.507 (0.97)	0.400 (2.28)	0.399 (4.18)				0.033 (0.95)	-0.009 (0.52)		0.0471
(2S)	0.175 (1.57)	-0.688 (2.68)	0.540 (1.12)	0.378 (2.38)	0.386 (4.04)	0.072 (1.62)						0.0472
(3S)		-1.301 (4.11)	1.541 (5.91)	0.742 (3.84)	0.351 (2.96)	0.241 (2.66)	0.005 (0.05)		-0.072 (1.23)	-0.083 (2.39)		0.0553
(4S)	-0.223 (0.72)	-1.071 (2.98)	1.108 (1.70)	0.536 (2.15)	0.397 (3.67)	0.230 (2.87)		0.033 (0.98)	-0.089 (1.61)	-0.079 (2.53)		0.0502
(5S)		-1.307 (6.27)	1.549 (7.01)	0.747 (4.85)	0.352 (3.27)	0.263 (3.67)					-0.090 (2.99)	0.0545

Note.- the proper variables from equation (BW) were used as instrumental variables in each estimation.

FOOTNOTE

1. For example, see Mizuno(1960), Nakamura(1980) and Shimada(1981).

2. See Tan(1982) for a more thorough survey.

3. Odaka(1967), Taira(1970) and Koike(1966, 1977) interpretted the lifetime employment and high wage policies in large firms as institutional responses to suppress the separation of valuable workers. But their standpoints differ in the following way. Odaka and Taira insisted that these institutions were developed in the period of shortages in skilled labor, that is, in the early phases of industrialization, and Odaka recently pointed out in his work(1976) collaborated with Galenson the symptoms which show that they are about to collapse in highly industrialzed Japan particularly after the Oil Shock in 1973 and 1974. On the other hand, koike argued that the parmanent employment and the way of wage determination like nenko can been seen, more or less, among the developed countries in the stage of the monopolistic capitalism. This paper is in line with Koike.

4. Since the data on the large firm in three industries, Apparels, Furniture and Lumber, was not reported in the Census, we approximated it by the data on the firms having 500-999 employees.

5. Chapman and Tan(1980) utilized the simultaneous equation model which assumes length of service on the current job as an endogeneous variable in order to test the hypothesis that "the greater is the worker-financed stock of training, the lower is the initial industry wage and the more rapid is subsequent wage growth." The model presented in this paper is essentially the same as that of Pencavel(1972) and Ohashi(1973).

6. Unfortunately, however, this is a rough proxy for workers' expectation because we can not obtain its data by relation to firm-scale and age.

7. See Stoikov and Raimon(1968), Burton and Parker(1969), and Telser(1978), for example.

8. Nishikawa(1971) obtained the result that wages are significantly negative to separation only for the data of large and medium firms(more than 30 employees).

9. According to Tan(1982, pp.51), "It is apparent that many of the predictions of the firm-specific training model--employment stability, wage contracts and bonuses, profit sharing and a higher valuation of internal experience--resemble the nenko and permanent employment practices of large Japanese firms. Nevertheless, the specific training model is not easily distingushed from institutional explanations of inter-firm wage differentials."

10. Ono(1981) reported that male ratio has a negative effect on separation significantly in the estimation by the method of ordinary least squares.

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