Skill Premiums and Japan's Wage Structure in the 1980s

Yuji Genda

Offprint from *Gakushuin Economic Papers*, Vol.31, No.3, October 1994

Gakushuin Economic Papers, Vol. 31, No. 3 October 1994

abstract

In the 1980s the wage structure of Japan was quite stable relatively to the other developed countries. This paper examines changes in skill premiums attributable to tenure and other dimensions. Then three facts are found about Japan's wage structure changes in the 1980s.

First, changes in returns to tenure contributed to moderating wage dispersion between and within groups distinguished by age, education level, and firm size. In the groups which expanded in number for a period of 1978–1990 they tended to lessen the tenure returns largely.

Secondly, changes in the distributions of tenure within groups have increased the age and firm size wage differentials and have decreased the college wage premium. It is notable that the age wage differential among high school graduates in particular has grown through these changes.

Thirdly, changes in returns to characteristics other than tenure have proved to be effective on increasing the education level and firm size wage differentials and on abating the age wage differential. Apart from tenure effects, the product demand shift hypothesis was consistent with the changes in the age and education level wage differentials during the 1980s. Shifts in industry rents enlarged the firm size wage differential.

Address correspondence to:
Yuji Genda
Faculty of Economics
Gakushuin University
1-5-1 Mejiro, Toshimaku
Tokyo, 171, Japan

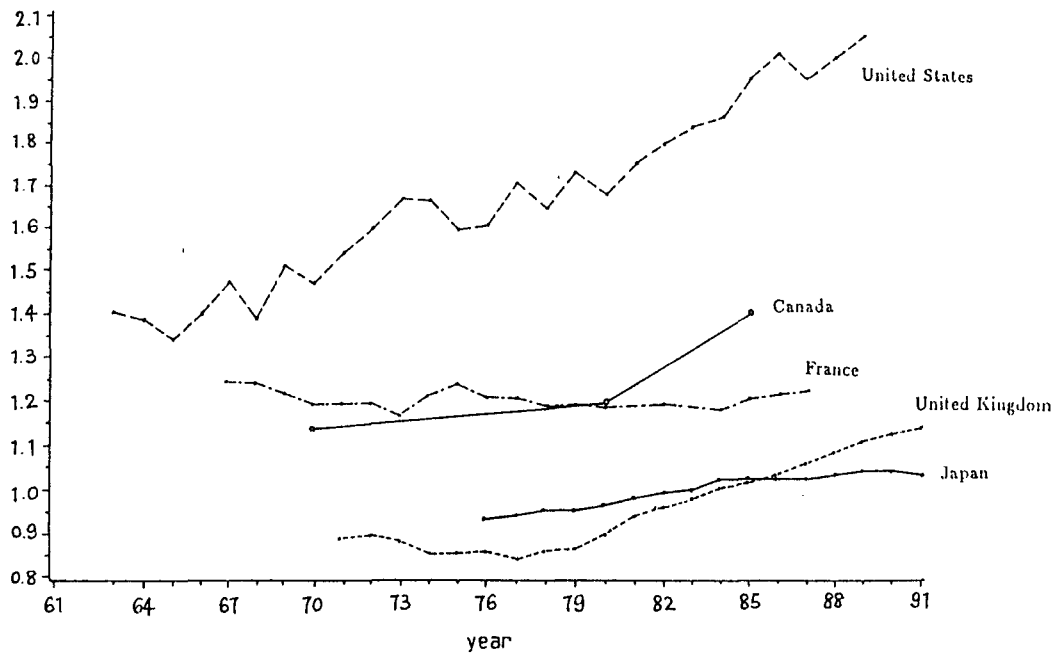
I would like to thank Christopher Ferrall and Tsuneo Ishikawa for helpful comments and suggestions. I have benefited from discussions with Marcus Rebick.

1 Introduction

The substantial growth of overall wage inequality in the United States during the 1980s has been well documented by recent studies.[1] The objective on these studies is mainly to find the reasons for the increases in the education level wage differential and the age wage differential for those with low education. How about Japan's wage structure changes in the 1980s? Davis (1992) examined cross-country patterns of changes in wage inequality and found that wage inequality among males gradually expanded in many advanced economies.

Figure I shows time series patterns of log wage differentials between the 10th percentile and 90th percentile in several advanced economies.

Figure I . Overall Wage Inequality among Men in Advanced Economies
90-10 Log Wage Differential



Source. Davis (1992, Figure 1. A) except for the result for Japan. The result of log monthly contracted wage differentials for Japan is computed from the *Basic Surveys on Wage Structure*.

[1]See, for example, Juhn, Murphy, and Pierce (1993), Katz and Revenga (1989), Blackburn, Bloom, and Freeman (1990), Mincer (1991), Katz and Murphy (1992), Murphy and Welch (1992) and Bound and Johnson (1992).

On Figure I, except the result for Japan, the data were quoted from Davis. The result for Japan is computed using data on log monthly contractual wage differentials among male ordinary employees. Figure I indicates the wage distribution in Japan has been stable in the 1980s in contrast with the United States, Canada, and the United Kingdom. Regarding relative wage changes, Katz and Revenga (1989) found while in the 1980s the college wage premium greatly expanded in the United States, it increased a little in Japan. They added that in Japan wages of male new entrants have risen relatively to more experienced workers for both high school and college graduates in the 1980s.

The present study is aimed at answering to the question why Japan's wage structure did not exhibit such a substantial change as seen in the United States. To this end, this paper examines the effects of skills on wage changes from two dimensions. They are the effect of worker's characteristics identified by education level, age, and firm size and the effect of tenure. Furthermore, the effect of tenure is decomposed into changes in returns and compositions. Juhn, Murphy, and Pierce (1993), Bound and Johnson (1992), and Ferrall (1992) suggested that changes in unmeasured skills or unobservable technical changes might increase wage inequality in the United States in the 1980s. In many studies using the data from *March Current Population Surveys*, labor groups are not distinguished by tenure, and it is included in unobservable skills. This paper uses the annual data on tenure from the *Basic Survey on Wage Structure*.

Empirical findings from this study are as follows:

Changes in returns to tenure contributed to moderating wage dispersion between and within groups distinguished by age, education level, and firm size in the 1980s. As a result, these changes had the effect of decreasing total wage inequality. Changes in the distribution of tenure within groups increased the age and firm size wage differentials and, on the other hand, decreased the college wage premium. Changes in returns to characteristics other than tenure enhanced the college and firm size wage premiums and reduced the age wage differential.

The conclusion is that these changes smoothed Japan's wage structure in the 1980s. And the changes in return to tenure for the 1978-1990 period may be supported by the changes in the numbers of workers. That is, the increase in older and more-educated workers, in comparison with younger and less-educated workers, diminished the age and education level wage differentials through the tenure return changes. This paper also suggests that a rise in the college wage premium and a fall in the age wage differential through changes in returns to characteristics other than tenure are consistent with the product demand shift hypothesis. Product demand shifted toward younger and more-educated workers from 1978 to 1990. Industry rent shifts played a role in increasing the firm size wage differential.

In Section II the data used in this paper and the facts of Japan's wage structure changes are detailed. Changes in wage differentials for groups by education level, age, and firm size and in wage variations within the groups are examined according to decomposed skills in SectionIII. To explain causes of the changes in skill premiums, hypotheses based on the

supply-demand framework used in Katz and Murphy (1992) and the industry rent shift hypothesis are tested in SectionⅣ. Conclusions are summarized in SectionⅤ.

2 Wage Structure Changes

In this section I document the changes in Japan's wage structure. Among several viewpoints of wage structure changes, I consider changes in relative wages by education level, age, and firm size among males. The results in the following are based on wage data from *the Basic Surveys on Wage Structure* (BSWSs). In these data, sample observations are cell means, and these are available for industry taxonomies, firm sizes, and workers' characteristics. Workers' characteristics are classified according to sex, schooling attained, age, and years of service within a firm (from now on tenure). It is noteworthy that this survey has the advantage of providing information of tenure every year. It is not available every year from *the Current Population Surveys* (CPSs). Accordingly, we can examine the effects of tenure on wage changes using this survey while they are involved in unobservable elements when data are based on CPSs.

2.1 Data

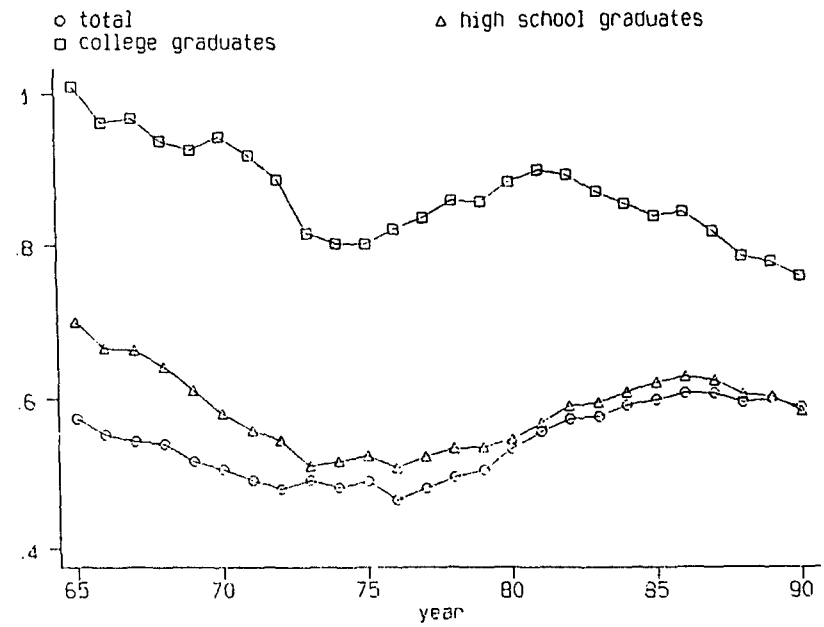
The BSWS data are distinguished by 3 enterprise size categories (firms with 1000 or more employees, 100-999 employees, 10-99 employees), 4 education level categories (junior high school graduates, high school graduates, junior college graduates, college graduates), 12 age categories (less than 18, 18-19, 20-24, 25-29, ..., 55-59, 60-64, 65 or more years old), and 8 tenure categories (0, 1-2, 3-4, 5-9, 10-14, 15-19, 20-29, 30 or more years). When the variables for age and tenure within each cell are used, they are presented by their means. Because the midpoints of the tail categories about age and tenure and unknown, the inquired ages of workers are restricted to be more than 18. I focus on male workers before mandatory retirement, so that female workers and male workers being more than 60 years old are excluded. And years of service within firms for workers whose tenure is more than 30 years are assumed to be represented by 30 years.[2] As a result, the classification dividing the data into 864 distinct labor groups is available in each year.

2.2 Changes in Relative Wages

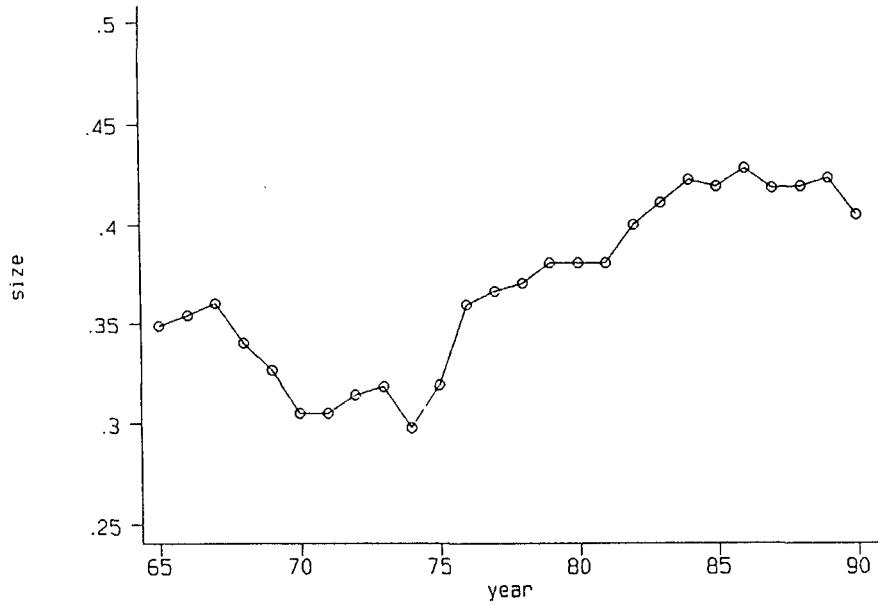
Figure.Ⅱ, Ⅲ, and Ⅳ show log wage differentials distinguished by education level, age, and firm size among male ordinary workers for the 1965-1990 period. The wage measure used in these figures is the sum of total monthly contractual earnings and one-twelfth of annual special earnings for male ordinary workers.

[2]Even if workers whose job tenure is more than 30 years are excluded from the samples, the conclusion of this paper does not change at all.

Figure II. The College Wage Premium



FigureIII. The Age Wage Premium



FigureⅣ. The firm Size Wage Gap

Figure Ⅱ illustrates that the male college/high school relative wage (from now on the college wage premium) decreased from 1965 to 1979. In the early and mid 1980s the college wage premium was almost constant and it increased in the late 1980s. Among 20-29 year old workers, the college wage premium tended to decline from 1965 to 1980 and reversely expanded in the 1980s. On the other hand, among 40-49 year old workers, the premium lessened in the long-run over the entire period.

Figure Ⅲ shows that the 40-49/20-29 year old relative wage (from now on the age wage premium) reduced from 1965 to 1976. After that it increased steadily until leveling off recently. Among high school graduates the age wage premium diminished by the mid 1970s and began to grow after that. Among college graduates the age wage premium abated over the entire period and did almost in a monotone in the 1980s.

Figure Ⅳ suggests that the relative wage of male workers in large firms with 1000 or more employees to those in small firms with 10 to 99 employees (from now on the firm size wage gap) decreased from 1967 to 1974. From 1974 to 1984 the firm size wage gap increased monotonically and from 1985 to 1989 it was almost constant.

2.3 Relative Wage Changes at the Fixed Distribution

These figures suggest changes in the composition of age distributions had effects on the stable college wage premium in the 1980s. And the changes in education level distributions also produced the stability of the age wage premium during the periods. Next, the number of male employees in each cell is held constant, and relative wage changes are documented at the fixed distribution in each year. Then, the BSWSs for 1974, 1978, 1982, 1986, and 1990

are used in the following way. The wage measure is the average scheduled (straight time) monthly wage on full-time male workers which a (864×5) matrix can summarize. The wages in each year are deflated by the fiscal year consumer price index. When I describe wages for aggregated groups, I use a fixed-weight aggregation scheme according to Katz and Murphy (1992). The weights of cells are given by the 864 element vector of average employment shares over the chosen five years. Therefore, these wage changes for aggregated groups are independent of shifts in the labor force compositions distinguished by education level, age, firm size, and tenure. Table I shows the results.

TABLE I
CHANGES IN REAL WAGES FOR FULL-TIME WORKERS, MALE, 18-59 YEARS OLD, 1974-90

	Changes in log average wage (multiplied by 100)					
Group	1974-78	1978-82	1982-86	1986-90	1974-90	1978-90
All	6.3	0.1	2.7	4.2	13.3	7.0
Education:						
High school graduates	6.5	0.1	2.1	4.0	12.8	6.3
College graduates	6.7	-1.1	3.0	4.3	13.0	6.3
Age:						
20-29 years old	2.8	0.4	3.1	6.9	13.3	10.4
30-39 years old	5.3	-0.9	0.7	3.1	8.2	2.9
40-49 years old	9.1	0.9	4.0	3.3	17.2	8.1
50-59 years old	7.6	0.5	3.7	4.6	16.5	8.8
Education and Age:						
High school graduates						
20-29 years old	3.1	0.8	2.3	6.6	12.7	9.7
40-49 years old	10.2	0.4	3.7	2.5	16.8	6.6
College graduates						
20-29 years old	3.0	-0.6	4.5	7.5	14.4	11.4
40-49 years old	10.2	-0.8	3.4	2.6	15.3	5.2
Enterprises:						
with 1000- employees	9.9	0.7	2.9	3.4	16.9	7.0
with 100-999 employees	3.2	-1.6	2.5	3.6	7.7	4.5
with 10-99 employees	5.3	1.4	2.6	5.9	15.2	9.9

the numbers in the table represent log changes in mean monthly scheduled wages (*shotei-nai kyuyo*) using BSWSs for the five years. Mean monthly wages for full-time workers in each of 864 (sex, firm-size, education, age, tenure) cells were computed in each year. Mean wages for groups represent weighted averages of these cell means using a fixed set of weights (the average employment share of the cell for these years). All earnings are deflated by the consumer price index.

It describes changes in the log real monthly wages of the male labor force and of individual groups for the 1974-1990 period and for four subperiods, 1974-1978, 1978-1982, 1982-1986, and 1986-1990. To find changes in wages in the 1980s, the result for the longer subperiod 1978-1990 is also described.

The first row of Table I shows the average real monthly wages among males increased by 13.3 percent for the 1974-1990 period. A fall in the real wage did not occur in any subperiod. This is in contrast with the result in the United States that there was the downward trend in real wage rates from 1973 to 1988 (Bound and Johnson (1992)).

The next two rows show real wage changes by education level. To save space, I show changes in real wages of high school and college graduates. The wages of the two educaion levels grew for the entire period. And the growth in the real wages of the two education levels broke down into steady increases in all subperiods except the 1978-1982 period. Hence, the college wage premium was almost constant for the 1974-1990 and 1978-1990 periods.

The next four rows show real wage changes by age for males. Over the entire period, the average wage gap increased by 3.9 percent between 40-49 and 20-29 year old workers and by 9.0 percent between 40-49 and 30-39 year old workers. However, time patterns of age wage differentials were uneven. From 1978 to 1990, the 20-29 year old workers gained most on other age groups.

The next four rows show real wage movements of different education levels by age. There were not so much differences in the time series of age wage differentials in each education level. Over the entire period 40-49 year old workers gained on 20-29 year old workers. On the other hand, from 1978 to 1990 the younger workers gained on the older workers in each education level. Then college graduates show 6.2 percent decrease in the age wage premium, and high school graduates show 3.1 percent decrease in it. The age wage premium for high school graduates declined in the 1980s at the fixed distribution, while it expanded at the flexible distribution in FigureⅢ.

These parts of Table I also suggest the college wage premium changes by age. During the 1974-1978 period the college wage premium did not change in each age group. From 1978 to 1990, however, its premium declined for the 40-49 year old workers, while it augmented for the 20-29 year old workers. These facts are consistent with time patterns of actual college premiums by age shown in FigureⅡ.

The final three rows show real wage changes by enterprise size. Over the entire period, workers in large firms gained 8.2 percent on those in middle firms and 1.7 percent on those in small firms. During the 1980s, however, workers in small firms gained on workers in large and middle firms, while the firm size wage gap expanded in FigureⅣ. From 1978 to 1990 workers in small firms gained 5.4 and 2.9 percents on those in middle and large firms. The decrease in the firm size wage gap during the 1980s is mainly attributable to rising small firms' average wage for the 1986-1990 period.

In summary, from 1974 to 1978 the age and firm size wage differentials increased and

they decreased reversely for the 1978-1990 period if the employment shares of the labor forces are fixed. The college wage premium was almost constant for the entire period, and it raised for young workers and abated for old workers.

During the 1980s relative wage movements at the fixed distributions in Japan were different from those in the United States in several points. Katz and Murphy (1992) showed that from 1979 to 1987 in the United States college graduates gained 14.1 percent on high school graduates. Among those with 1-5 years of experience, the college wage premium increased by 30.6 percent. Among those with 26-35 years of experience it increased by 4.6 percent. And they documented the experience wage differential for the less-educated male workers rose sharply in the 1980s, and it declined for more-educated males. On the other hand, in Japan the college wage premium did not change at all from 1978 to 1990. Its premium broke into an increase for young workers and a decrease for old workers in the 1980s. And the age wage premiums for both high school and college graduates decreased.

3 Decompositions of Changes in Wages

In this section I investigate movements of two kinds of skill premiums to explain changes in wage differentials. I divide the skill premiums into two dimensions. One is a return to skills for workers' characteristics identified by age, education level, and firm size. The other is a return to an extra year of tenure. Hashimoto and Raisian (1985, 1992) and Mincer and Higuchi (1988) found that earning profiles are steeper in Japan compared with the United States. They suggested its primary reason was the greater gains from tenure in Japan. On the other hand, Clark and Ogawa (1992) found that the value of tenure declined in Japan recently. They also suggested the value of an additional year of general experience then exceeded the gain from a year of job tenure. Although this point is controversial, anyhow wage movements in Japan may reflect changes in these skill premiums.

I show the way of decomposing the two kinds of skills. Male workers are divided into 864 cells ij which consist of 108 workers' categories i (i=1, 2, ..., 108) distinguished by age, education level, and firm size and 8 job tenure categories j (j=1, 2, ..., 8). According to Hashimoto and Raisian and Clark and Ogawa, a simple and useful framework of isolating these two premiums is to denote a wage equation such as

$$Y_{ijt} = \{a_{0t} + a_{1t}gi + a_{2t}g_1^2 + a_{3t}zi + a_{4t}z_ig_i\} + (b_{0t} + b_{1t}g_i + b_{2t}nj + b_{3t}z_i)n_j + \epsilon_{ijt} \quad (1)$$

where Y_{ijt} is the log of the real scheduled monthly wage deflated by consumer price index for a group cell ij at time t, gi is the age, z_i is the vector of schooling dummies, n_j is tenure, and ϵ_{ijt} is the disturbance term.[3] a_{kt}, b_{kt} (k=0, 1, 2) and the vector a_{3t}, a_{4t}, b_{3t} are

[3]The standard Mincer-type earnings function contains experience rather than age. Even if experience substitutes for age in equation (1), the main conclusion of this paper does not change at all.

coefficients. Equation (1) is estimated by firm size. And it is estimated under the assumption that the variance for each group is proportional to the reciprocal of its employees' number and the tenure distribution is exogenous in each date[4]

The log average wage of group i distinguished by age, education level, and firm size is defined as follows:

$$Y_{it} \equiv \sum_{j=1}^{8} Y_{ijt} f_{ijt} \tag{2}$$

where f_{ijt} is the employment share of the j tenure workers among the group i at time t. Y_{it} can be expressed as

$$Y_{it} = \sum_{j=1}^{8} (f_{ijt} - f_{ij}) Y_{ijt} + X_{it}; \quad f_{ij} \equiv \frac{1}{T} \sum_{t=1}^{T} f_{ijt} \quad \& \quad X_{it} \equiv \sum_{j=1}^{8} Y_{ijt} f_{ij}. \tag{3}$$

F_{ij} is the average employment share of the cell ij among the group i over T periods and X_{it} is the log average wage of the group i at time t weighted by the fixed employment shares.

Using (1), the change in X_{it} from time t to time $t+1$ is

$$\Delta X_{it} = \sum_{j=1}^{8} \{\Delta a_{0t} + \Delta a_{1t} g_i + \Delta a_{2t} g_i^2 + \Delta a_{3t} z_i + \Delta a_{4t} z_i g_i + (\Delta b_{0t} + \Delta b_{1t} g_i + \Delta b_{2t} n_j + \Delta b_{3t} z_i) n_j + \Delta \epsilon_{ijt}\} f_{ij}. \tag{4}$$

If $\bar{n}_i \equiv \Sigma_{j=1}^{8} n_j f_{ij}$ and $Var_i(n_j) \equiv \Sigma_{j=1}^{8} (n_j - \bar{n}_i)^2 f_{ij}$, (4) can be represented as

$$\begin{aligned} \Delta X_{it} &= \{\Delta a_{0t} + \Delta a_{1t} g_i + \Delta a_{2t} g_i^2 + \Delta a_{3t} z_i + \Delta a_{4t} z_i g_i\} \\ &\quad + \{(\Delta b_{0t} + \Delta b_{1t} g_i + \Delta b_{2t} \bar{n}_i + \Delta b_{3t} z_i) \bar{n}_i\} \\ &\quad + \{Var_i(n_j) \Delta b_{2t} + \sum_{j=1}^{8} \Delta \epsilon_{ijt} f_{ij}\}. \end{aligned} \tag{5}$$

Therefore changes in log average wages at the fixed distribution shown in Table I can be decomposed according to (5). It will be useful to call the first bracket of the right hand in (5) the change in the return to individual characteristics other than tenure (from now on CRC). And the second bracket is called the change in the return to tenure (from now on CRT).

Using $\triangle X_{it}$, the change in Y_{it} from time t to time $t+1$ becomes

$$\begin{aligned} \Delta Y_{it} &= \sum_{j=1}^{8} \{Y_{ijt} \Delta f_{ijt} + (f_{ijt} - f_{ij}) \Delta Y_{ijt}\} + \Delta X_{it} \\ &= \sum_{j=1}^{8} Y_{ij} \Delta f_{ijt} + \Delta X_{it} \sum_{j=1}^{8} \{(f_{ijt} - f_{ij}) \Delta (Y_{ijt} - Y_{ij}) + (Y_{ijt} - Y_{ij}) \Delta (f_{ijt} - f_{ij})\} \end{aligned} \tag{6}$$

[4]The WLS results by firm size are available on request.

where

$$Y_{ij} \equiv \frac{1}{T}\sum_{t=1}^{T}\{a_{0t} + a_{1t}g_i + a_{2t}g_i^2 + a_{3t}z_i + \Delta a_{4t}z_i g_i + (b_{0t} + b_{1t}g_i + b_{2t}n_j + b_{3t}z_i)n_j\}. \tag{7}$$

Using $\Sigma_{j=1}^{8} f_{ijt} = \Sigma_{j=1}^{8} f_{ij,t-1} = 1$, the first term in (6) is reduced to

$$\sum_{j=1}^{8} Y_{ij}\Delta f_{ijt} = \frac{1}{T}\sum_{j=1}^{8}\sum_{t=1}^{T}(b_{0t} + b_{1t}g_i + b_{2t}n_j + b_{3t}z_i)n_j\Delta f_{ijt}. \tag{8}$$

Therefore this term represents the effect of the change in the tenure distribution among group i on the change in the return to tenure from time t to time $t+1$. It is called the effect of the composition change in tenure (from now on CCT).

As a result, the log wage change of group i at time t can be written as

$$\Delta Y_{it} = CRC_{it} + CRT_{it} + CCT_{it} + \Delta\theta_{ijt} \tag{9}$$

where

$$\Delta\theta_{ijt} \equiv Var_i(n_j)\Delta b_{2t} + \sum_{j=1}^{8}[\Delta\{(f_{ijt} - f_{ij})(Y_{ijt} - Y_{ij})\} + \Delta\epsilon_{ijt}f_{ij}]. \tag{10}$$

$\Delta\theta_{ijt}$ implies the effects which cannot be explained by CRC, CRT, and CCT. This term was quite small compared with the above three effects, so that it is excluded from explanations of changes in wage differentials.[5]

Table Ⅱ, Ⅲ, and Ⅳ show CRC, CRT, and CCT respectively for the total mean of 864 cells and for broader groups using the BSWS data (1974, 1978, 1982, 1986, and 1990).

[5]Juhn, Mupphy and Pierce (1993) interpreted the increase in wage inequality during the 1980s in the United States was due to the rise in the skill premiums. They divide the rise in skill premium into observable dimensions (i.e., education level, experience and occupation) and unobservable dimensions (the residual). They suggested the effects of unobservables have played the important part of the increase in wage inequality since the late 1960s in the U.S.. In their analysis tenure was involved in unobservables, while the effect of tenure is considered by itself in the current study.

TABLE II

CHANGES IN RETURNS TO CHARACTERISTICS (CRC)
OF FULL−TIME WORKERS, MALE, 18−59 YEARS OLD, 1974−90

	Changes in estimated returns (multiplied by 100)					
Group	1974-78	1978-82	1982-86	1986-90	1974-90	1978-90
All	5.1	2.0	3.9	8.2	19.2	14.1
Education:						
High school graduates	4.0	1.8	3.7	7.4	16.9	12.9
College graduates	4.3	0.2	4.2	9.8	18.6	14.3
Age:						
20-29 years old	3.0	1.5	4.1	8.6	17.2	14.1
30-39 years old	5.8	2.2	3.6	7.9	19.6	13.7
40-49 years old	6.7	2.3	3.8	7.9	20.7	14.0
50-59 years old	5.7	2.1	4.8	8.5	21.0	15.3
Education and Age:						
High school graduates						
20-29 years old	2.8	2.0	3.5	8.0	16.3	13.5
40-49 years old	5.3	1.7	3.9	6.8	17.6	12.4
College graduates						
20-29 years old	2.8	-0.0	5.5	9.5	17.8	14.9
40-49 years old	5.6	0.6	2.8	10.4	19.4	13.9
Enterprises:						
with 1000- employees	3.5	3.2	4.8	7.7	19.2	15.7
with 100-999 employees	4.4	0.8	3.0	8.8	17.0	12.6
with 10-99 employees	7.5	2.0	3.9	8.0	21.3	13.9

the numbers in the table represent log changes in mean monthly estimated wages which are independent of years of service on current job. Mean wages independent of employment tenure in each cell are computed from the estimation of the first four terms of equation (1). Estimated mean wages for broader groups in each year represent weighted averages of theses cell means using a fixed set of weights (the average employment share of the cell for the estimated years).

TABLE Ⅲ

CHANGES IN RETURNS TO TENURE (CRT)
FOR FULL−TIME WORKERS, MALE, 18−59 YEARS OLD, 1974−90

	Changes in estimated returns (multiplied by 100)					
Group	1974-78	1978-82	1982-86	1986-90	1974-90	1978-90
All	0.3	-1.1	-1.3	-3.0	-5.0	-5.4
Education:						
High school graduates	1.2	-0.9	-1.6	-2.5	-3.9	-5.1
College graduates	1.2	-1.1	-1.1	-4.4	-5.3	-6.5
Age:						
20-29 years old	-0.4	-1.0	-1.2	-1.8	-4.3	-3.9
30-39 years old	-0.0	-2.3	-2.1	-3.7	-8.1	-8.1
40-49 years old	1.2	-0.7	-1.2	-3.7	-4.3	-5.6
50-59 years old	0.8	0.6	-0.2	-2.6	-1.3	-2.2
Education and Age:						
High school graduates						
20-29 years old	-0.1	-1.0	-1.4	-1.8	-4.4	-4.2
40-49 years old	2.9	-0.8	-1.9	-3.2	-2.9	-5.8
College graduates						
20-29 years old	-0.1	-0.6	-0.8	-1.8	-3.3	-3.2
40-49 years old	3.6	-1.4	-1.0	-7.3	-6.1	-9.7
Enterprises:						
with 1000- employees	5.3	-2.1	-2.2	-3.3	-2.3	-7.6
with 100-999 employees	-1.4	-2.1	-0.6	-4.5	-8.6	-7.2
with 10-99 employees	-3.0	1.1	-1.2	-1.0	-4.1	-1.1

a. the numbers in the table represent log changes in mean monthly estimated wages which are returns to the length of service on current job. Mean wages as returns to tenure in each cell are computed from the estimation of the second bracket in equation (1). Estimated mean wages for broader groups in each year represent weighted averages of theses cell means using a fixed set of weights (the average employment share of the cell for the estimated years).

TABLE Ⅳ

CHANGES IN COMPOSITIONAL EFFECTS OF TENURE (CCT)
ON EARNINGS FOR FULL−TIME WORKERS, MALE, 18−59 YEARS OLD, 1974−90

	Changes in estimated returns (multiplied by 100)					
Group	1974-78	1978-82	1982-86	1986-90	1974-90	1978-90
All	0.4	1.1	1.7	0.8	4.1	3.6
Education:						
High school graduates	1.3	1.6	2.2	1.1	6.2	4.9
College graduates	-0.5	1.0	1.2	0.7	2.3	2.9
Age:						
20-29 years old	0.4	-0.9	-0.2	-0.1	-0.8	-1.2
30-39 years old	0.5	-0.5	0.9	-0.7	0.2	-0.3
40-49 years old	-1.4	2.3	1.9	0.4	3.3	4.6
50-59 years old	-1.4	1.8	2.7	2.2	5.2	6.7
Education and Age:						
High school graduates						
20-29 years old	0.8	-0.9	-0.3	-0.1	-0.5	-1.3
40-49 years old	-1.4	1.7	1.9	-0.2	2.0	3.4
College graduates						
20-29 years old	0.1	-0.3	0.3	0.1	0.1	0.0
40-49 years old	-1.3	1.8	0.0	-1.0	-0.5	0.8
Enterprises:						
with 1000- employees	1.1	2.3	2.4	0.9	6.7	5.6
with 100-999 employees	1.1	1.6	1.2	0.7	4.6	3.5
with 10-99 employees	1.2	0.8	1.2	0.8	4.0	2.8

the numbers in the table represent log changes in mean monthly wages which comes from changes in the distribution of job tenure under fixed returns to tenure. Fixed retruns to tenure in each of 864 cells were calculated as the average estimations of the second bracket in equation (1) for estimated years. Estimated mean wages for broader groups in each year represent the sum of the products of the fixed return and the employment share over these cells.

Each of them is computed as a change in a weighted average of each return for the corresponding broader groups. In Table Ⅱ and Ⅲ, common to calculations of average wages in Table Ⅰ, the average employment share of cells over the estimated five years is used as a fixed set of weights to compute the average returns in each date. About CCT in Table Ⅳ, it is calculated with the fixed returns to tenure using the average WLS coefficients over the five years.

3.1 The Overall Case

The first raw of Table Ⅱ shows that the average return to characteristics other than tenure among total males increased by 19.2 percent over the entire period. It is larger about 6 percent than the growth of the average wage in Table Ⅰ. Table Ⅲ suggests that this difference is probably because the average return to tenure among males decreased from 1978 to 1990. It is consistent with the finding of Clark and Ogawa (1992) that the value of tenure declined for the 1971−1986 period. Table Ⅲ also shows that the decline in returns to tenure continued from 1986 to 1990 and became more substantial during this period. Table Ⅳ indicates that the shift of tenure compositions contributed to a rise in the average wage at the flexible distribution in the 1980s.

3.2 The Education Level Wage Differential

How about the education level wage differential? The college wage premium is focused on again. About CRC, it increased over the entire period. Except the period of 1978−1982 college graduates gained on high school graduates through CRC. While the college wage permium at the fixed distribution shown in Table I was stable in the 1980s, CRC contributed to expanding it. On the other hand, the college premium declined from 1978 to 1990 through CRT, because the average college graduates lost the gain from tenure more than the average high school graduates did. As CRC and CRT offset each other, the college wage premium at the fixed distribution became constant for the 1978−1990 period. And CCT decreased its premium over the entire period.

How can changes in the college wage premium by age be explained by these three effects? Among younger workers each of CRC, CRT, and CCT enlarged the premium during the 1980s. Accordingly, the college wage premiums at both of the flexible and fixed distributions expanded among them. Among older workers the education level wage differentials at the flexible and fixed distributions decreased during the 1980s although CRC increased the college wage premium. Table Ⅲ and Ⅳ indicates that it is probably because the prices and quantities of tenure moved in favor of older high school graduates relatively to older college graduates. For the 1978−1990 period the tenure return declined by 9.7 percent for older college graduates and by 5.8 percent for older high school graduates. And whereas the compositional effect of tenure increased the earnings for high school graduates by 3.4 percent during the 1980s, it did only by 0.8 percet for college graduates.

3.3 The Age Wage Differential

The age wage differential between 20−29 and 40−49 year old workers declined through CRT during the 1980s. The age wage premium was almost constant through CRC during the 1978−1990 period. Therefore, the relative wage at the fixed distribution was smaller in 1990 than in 1978. On the other hand, CCT expanded the differential by 5.8 percent then. Since the compositional changes were more than to make up for the declines in returns, the actual age wage premium shown in Figure Ⅲ was higher in the 1980s than in the 1970s.

Dividing males by education level generated similar contrasts in the two effects of tenure on the age wage premium. CCT increased the age wage premium, while CRC and CRT decreased it in the 1980s for the two education levels. However, there was a difference in actual wage changes from 1978 to 1990 by education level in Figure Ⅲ; the actual age wage differential expanded for high school graduates, and it declined for college graduates. There are two reasons for this. One is that older workers lost the age wage premium through CRT for college graduates more than for high school graduates. The other is that the distribution of tenure moved in favor of older high school graduates. Therefore, the decline in the age wage premium through CRT was smaller and the rise in it through CCT was larger for high school graduates than for college graduates.

3.4 The Firm Size Wage Differential

Table Ⅱ and Ⅲ show that the firm size wage gap through CRC was increasing in the 1980s and its gap through CRT was largely decreasing. As Table Ⅰ suggests, the gap at the fixed distribution shrank from 1978 to 1990. This is because the decline in the gap by CRT was larger than the increase in it by CRC. The rising firm size gap shown in Figure Ⅳ may be attributable to CCT. That is, the proportion of workers gaining large returns to tenure increased in large firms compared with small firms for the 1978−1990 period.

3.5 Summary

Table Ⅴ summarizes changes in the wage differentials and skill premiums by education level, age, and firm size.

TABLE V

CHANGES IN LOG WAGE DIFFERENTIALS FROM 1978 TO 1990

MALE WORKERS (MULTIPLIED BY 100)

	observed average wages	average wages with fixed weights	effects of returns to characteristics	effects of returns to tenure	compositional effects of tenure
The College Wage Premium :					
Total	22.1 → 23.0	22.5 → 22.5	26.8 → 28.2	-6.1 → -7.5	-5.9 → -7.9
20-29 years old	7.0 → 12.0	9.2 → 10.9	14.6 → 16.1	-4.6 → -3.5	-4.8 → -3.5
40-49 years old	35.5 → 30.9	34.3 → 32.9	39.7 → 41.1	-5.7 → -9.6	-5.8 → -8.4
The Age Wage Premium:					
Total	48.3 → 58.0	55.1 → 52.8	33.3 → 33.2	19.9 → 18.2	16.1 → 21.9
High School graduates	53.7 → 57.7	58.7 → 55.6	34.5 → 33.5	23.9 → 22.3	20.1 → 24.9
College graduates	82.2 → 76.6	83.8 → 77.6	59.6 → 58.5	22.8 → 16.3	19.2 → 20.0
The Firm Size Wage Premium:					
Large/Small Firms	20.1 → 23.2	22.4 → 19.4	3.1 → 4.9	18.0 → 11.4	12.0 →14.9

Numbers in this table show changes in log earnings gaps from 1978 to 1990. The log wage differentials are computed at the distributions in each date and the average distributions over the chosen five years respectively. The basic results of Table V are as follows: [6]

(I) CRC encouraged the rises in the college and firm size wage premiums, while it did a little reduction in the age wage premium.

(II) CRT contributed to the decreases in the college wage premium among older workers, the age wage premium and the firm size wage gap.

(III) CCT played the part in increasing the age wage premium for high school graduates and the firm size wage gap, while the college wage premium among older workers decreased with it.

3.6 Variation within Groups

I have given explanations about wage differentials across broader groups. Next I explain the dispersion in real wages, CRC, and CRT within these groups simply using a coefficient of variation. The measures of overall wage inequality are calculated at the flexible and fixed distributions respectively. The result at the flexible distribution is computed using the employment shares in each year as the weights of 864 cells. The result at the fixed distribution is computed using the average employment shares over the five years as the weights. Hence, changes in earnings inequality at the fixed distributions do not reflect compositional changes in the labor force. The coefficients of returns to characteristics and tenure are computed at the fixed distribution.

Table VI shows the results.

[6]Throughout this paper, examinations are limited to the changes in wage structures among male workers. When the analysis is extended to the wage differential by sex, the decline in the gender wage differential at the fixed distribution can be seen in the 1980s. This came from the fact that CRC and CRT moved in favor of female workers. On the other hand, CCT raised the gender wage gap.

TABLE Ⅵ

COEFFICIENTS OF VARIATION, MALE, 1974−1978,

Group	1974	1978	1982	1986	1990
actual wages(flexible weights):					
Total	0.297	0.309	0.313	0.321	0.324
actual wages(fixed weights):					
Total	0.302	0.331	0.323	0.323	0.309
High School Graduates	0.272	0.305	0.300	0.289	0.287
College Graduates	0.338	0.375	0.379	0.373	0.358
20-29 years old	0.130	0.144	0.130	0.120	0.116
40-49 years old	0.240	0.268	0.251	0.248	0.237
Large Firms	0.312	0.348	0.347	0.344	0.337
Middle Firms	0.299	0.322	0.308	0.312	0.293
Small Firms	0.256	0.254	0.240	0.237	0.224
returns to charcteristics:					
Total	0.228	0.233	0.226	0.224	0.231
High School Graduates	0.151	0.162	0.160	0.161	0.156
College Graduates	0.246	0.261	0.257	0.247	0.252
20-29 years old	0.108	0.113	0.110	0.114	0.118
40-49 years old	0.211	0.205	0.191	0.188	0.201
Large Firms	0.230	0.227	0.235	0.222	0.245
Middle Firms	0.237	0.267	0.252	0.261	0.259
Small Firms	0.203	0.192	0.178	0.174	0.168
returns to tenure:					
Total	0.142	0.174	0.171	0.169	0.162
High School Graduates	0.154	0.191	0.186	0.179	0.172
College Graduates	0.113	0.157	0.144	0.149	0.121
20-29 years old	0.058	0.062	0.056	0.048	0.042
40-49 years old	0.129	0.173	0.164	0.158	0.151
Large Firms	0.144	0.185	0.185	0.178	0.171
Middle Firms	0.141	0.147	0.146	0.162	0.149
Small Firms	0.119	0.097	0.111	0.112	0.116

Overall wage inequality at the flexible distribution monotonically increased from 1974 to 1990. In contrast, total wage inequality under the fixed distribution gradually decreased for the 1978−1990 period. This contrast implies that compositional changes in labor forces had the effect on expanding overall wage inequality in the 1980s.

Looking at the wage dispersion for broader groups at the fixed weights, coefficients in each group became small from 1978 to 1990. A decrease in wage variations in the 1980s after an increase in the 1970s is common to time patterns of variations of returns to tenure within groups. Regarding returns to individual characteristics, there cannot be observed

changes in a monotone. And changes in variations of returns to individual characteristics are smaller than those of tenure returns. Hence, the decrease in variations of tenure returns within groups mainly contributed to the decline in wage inequality at the fixed distribution in the 1980s. The effect of returns to tenure played the key role in decreasing Japan's wage dispersion within groups as well as across the groups in the 1980s.

Looking at groups divided by firm size, wage variations in each firm size reduced in the 1980s. For workers in large firms, this is because variations in returns to tenure lessened. Within workers in small firms, however, a variation in tenure returns increased after 1978, while variation in returns to characteristics was monotonically decreasing over the entire period.

4 Causes of Changes in Wage Differentials

In this section, I explain the causes of changes in relative wages, CRC, and CRT between groups using a supply and demand framework. Its framework has been much used to examine the wage structure changes in the United States (Katz and Murphy (1992), Murphy and Welch (1992), and Bound and Johnson (1992)). In this framework different groups identified by education level, age, tenure, and firm size are assumed to be distinct labor inputs which are imperfect substitutes in production. In addition, to examine the effect of the noncompetitive factor on changes in wage differentials, I compute industry rent shift measures.

4.1 Changes in Supply Factors

A first factor to explain wage structure changes is supply changes in the labor force. Suppose that the Japanese labor market is approximately competitive. If a group which is not a perfect substitute for other groups is excess supplied, a relative wage of its group will go down. Katz and Revenga (1989) indicated that only a small increase in the college wage premium in Japan might come from the changes in relative supplies. That is, the stable college wage premium came from the fact that the growth rate of college male graduates did not slow in Japan in the 1980s.

I examine the plausibility of relative supply shifts to explain changes in relative wages and these changes through CRC and CRT. Table Ⅶ summarizes the demographic changes in employment and the changes in employment by firm size.

TABLE Ⅶ

DEMOGRAFIC CHANGES IN BROADER GROUPS AND CHANGES IN EMPLOYMENT BY FIRM SIZE, MALE, 18-59 YEARS OLD, 1974-90

	Changes in log employment (multiplied by 100)					
Group	1974-78	1978-82	1982-86	1986-90	1974-90	1978-90
All	-14.1	11.6	3.7	7.4	8.6	22.7
Education:						
High school graduates	-10.6	13.2	9.7	12.7	25.0	35.6
College graduates	-2.9	25.1	11.9	15.2	49.4	52.3
Age(men):						
20-29 years old	-25.0	-8.2	-2.4	10.0	-25.6	-0.6
30-39 years old	-9.7	18.4	0.6	-10.0	-0.7	9.0
40-49 years old	-7.4	15.9	6.2	19.0	33.8	41.1
50-59 years old	-4.0	27.6	18.1	18.1	59.8	63.8
Education and Age(men):						
High school graduates						
20-29 years old	-25.2	-10.4	-0.2	11.1	-24.7	0.5
40-49 years old	8.5	30.8	17.0	28.6	84.9	76.4
College graduates						
20-29 years old	-5.6	14.1	1.9	7.7	18.2	23.8
40-49 years old	1.0	29.6	18.2	33.4	82.2	81.2
Enterprises:						
with 1000- employees	-35.9	7.3	5.3	7.9	-15.4	20.5
with 100-999 employees	2.7	8.1	3.0	10.8	24.7	28.8
with 10-99 employees	1.3	12.4	2.8	3.4	19.9	18.6

The numbers in Table Ⅶ represent log changes in each group's employment.[7] While the supply of college graduates and older workers much increased for the 1974-1990 period, the college wage permium was almost constant and the age wage premium enlarged in Table Ⅰ. In the 1980s, however, many between-group relative wage changes were likely to be consistent with shifts of the labor force. A decline in the age wage differential was accompanied by a fall in the relative employment share of young workers. Among older workers the proportion of college graduates increased and the college wage premium declined. A fall in the firm size wage gap might come from the relative decrease in the employment share of small firms. And among the two skill premium changes in the 1980s, supply changes seem to be more consistent with CRT than CRC. Table Ⅴ shows the falls in

[7]In this paper labor inputs are computed not as working hours but as employment. This is because there is inconsistency in Japan's statistics on working hours between several data sources even after controlling for differences in definitions. See Ganda (1993) for detail.

the age wage premium, the college wage premium among senior workers, and the firm size wage gap at the fixed distribution were mainly attributable to CRT.

To provide a more strict analysis, I use a formal approach to examine the supply shift hypothesis. I employ the stable demand measure used in Katz and Murphy.[8] If the aggregate production function is concave, the Jacobian matrix of the labor demand function should be negative semidefinite. And if demand shifts reflecting technological progress, product demand, and other nonlabor inputs do not have effects on labor inputs, the following condition should be satisfied:

$$(W_t - W_\tau)'(X_t - X_\tau) \leq 0. \tag{11}$$

X_t is a (864×1) vector of the number of workers distinguished by education level, age, firm size, and tenure in year t. W_t *is* a (864×1) vector of wages for these inputs in yeat t. This inequality means that changes in factor supplies and changes in wages should negatively covary. If it is satisfied, the actual wage changes fro year τ to year t are consistent with supply shifts with stable labor demand.

If wages are decomposed to the two skill premiums, supply factors may have effects on the returns to them respectively. Therefore, the following two inequalities are also examined:

$$(RC_t - RC_\tau)'(X_t - X_\tau) \leq 0 \tag{12}$$

and

$$(RT_t - RT_\tau)'(X_t - X_\tau) \leq 0. \tag{13}$$

RCt is a (864×1) vector of the return to workers' characteristics apart from tenure for these inputs in yeat t. RTt is a (864×1) vector of the return to tenure in year t.

The top part of Table Ⅷ shows the inner products of changes in relative wages with changes in relative supplies.

[8]See for detail katz and Murphy (1992, pp.46－48).

TABLE Ⅶ
INNER PRODUCTS OF CHANGES IN RELATIVE WAGES WITH CHANGES IN RELATIVE QUANTITIES

	1974	1978	1982	1986
Actual Changes:				
1978	-0.00354			
1982	-0.00633	-0.00514		
1986	-0.00422	-0.00700	0.00025	
1990	-0.00583	-0.01095	0.00002	-0.00031
CRC:				
1978	0.00376			
1982	0.00272	0.00000		
1986	0.00161	0.00003	0.00040	
1990	-0.00015	-0.00079	0.00133	0.00060
CRT:				
1978	-0.00626			
1982	-0.00673	-0.00390		
1986	-0.00198	-0.00443	-0.00014	
1990	-0.00373	-0.00706	-0.00108	-0.00017

They are computed between each pair of the chosen five years. According to Katz and Murphy, relative wages for each of 864 distinct labor groups are defined to be actual wages deflated by the average wage at the fixed employment share in each year. And a relative supply measure is the relative employment of a group to the total employment in efficiency units. The total employment in efficiency units is defined to be $\Omega' X_t$, where Ω is a (864×1) vector of average relative wages over the entire sample.

From the top part of Table Ⅶ the data on wage changes are consistent with the stable demand hypothesis in many cases. Eight of the ten results are negative. In particular the absolute value is the largest for the 1978-1990 period among these comparisons. On the other hand, three comparisons between pairs of 1982, 1986, and 1990 are positive or almost zero. Therefore, for the short-run interval for the 1982-1990 period the pure supply shift theory is likely to be rejected.

The middle and bottom parts of Table Ⅶ show the inner products of the relative CRC and CRT with changes in relative supplies according to (12) and (13). The relative CRC is the change in the return to workers' characteristics for distinct labor group deflated by the average return to characteristics. The average return to them is computed using the average employment shares over the five years as weights. Relative supplies in efficiency units of the return to characteristics are computed using the average relative returns to them over the five years as weights of each employment. Relative CRT and relative supplies in efficiency units of the return to tenure are computed similarly.

The middle part of Table Ⅶ suggests that the data are inconsistent with the stable demand hypothesis as to returns to characteristics other than tenure. Only two of the ten comparisons are negative and almost zero. The comparison between 1974 and 1978 is strongly positive. Relative returns to characteristics seem to be independent of supply shifts or under the influence of other factors such as demand shifts. In contrast, the bottom part of Table Ⅶ indicates that CRT is consistent with the stable demand hypothesis. All of the ten comparisons show the negative inner products. CRT from 1978 to 1990 can be explained most among pairs of the selected five years by this hypothesis. For the 1978–1990 period the labor force moved toward the more-educated and older workers. Then the employment share of small firms was decreasing relatively to those of large and middle firms. The groups expanding in number for the period tended to lessen their tenure returns largely. In consequence, these changes in the relative numbers of workers diminished the college and age wage premiums, and the firms size wage gap through tenure return changes. Table Ⅶ totally indicates that many negative inner products between relative wages and relative supplies mainly came from CRT generated by the changes in cohort size. In other words, the cohort size changes clearly had effects on the relative wage changes through CRT.

What are the plausible explanations of the effect of the changes in the numbers of workers on CRT? Several interpretations are possible according to theories of returns to tenure. First, according to the theory of specific human capital, the returns to tenure are assumed to be returns to firm specific training collected by employees. The rapid growing size of entering cohorts may imply the decline in efficiency of training on the job. For example, this is because of the relative shortage of trainers to trainees. And in the tight labor market employers may reduce the marginal level of requirements of workers' trainability at the entry port to secure the sufficient work force. In these cases the retruns to specific skill investment may decrease with increasing numbers of employees in cohorts. Then the rate of returns to tenure may lessen for them. Table Ⅲ shows that from 1978 to 1990 a fall in the return to tenure is notable for the more experienced workers. Most of the 40–49 year old workers in the late 1970s were hired as the cohorts entering in the 1950s when the labor market was not so tight. On the other hand, many 40–49 year old workers in the late 1980s were graduated when labor demand expanded. Therefore, if the growing size of entering cohorts has the negative influence in training specific skills, the size of groups affects returns to tenure.

The second interpretation is that the effect of cohort size on earnings distinguished by careers functioned in Japan in the 1980s. This effect is explained by Welch (1979). Welch's career-phase model assumed that careers consist of a series of distinct phases, and activities at various phases are not perfect substitutes for activities at other phases; workers can do jobs which are beyond learners' control. The increase in tenure may imply transition into a new career phase, and the returns to tenure may be the payments for careers. Then large cohorts will have depressant effects on returns to tenure if the aggregate production function is quasi-concave. And this effect reduces with the worker-learner substitution elasticity.

Accordingly, this model predicts that the cohort size effect increases with the education levels and it comes early in the career. The cohort size elasticity of the return to tenure written as $-\partial ln$ (Return to Tenure)$/\partial ln$ (Cohort Size) in each education level can be computed using results in Table Ⅲ and Table Ⅶ. For the 1978-1990 period the relative elasticity of 20-29 year old to total high school graduates is 0.028 and that of 40-49 year old high school graduates is 0.020. And the relative elasticity of 20-29 year old to total college graduates is 0.133 and that of 40-49 year old college graduates is 0.107 during the 1978-1990 period. These results may be consistent with the predictions of the career-phase model.

Third, according to the theory of agency in durable employement relations, returns to tenure mean deferred compensations which encourage workers' efforts or reduce turnovers. In this system, employees pay entrance fees or post bonds to employers at the early stages, and the fees and bonds are paid back as tenure returns after working for several periods. The fees and bonds collected by employers may decline during the periods when labor demand is expanding. This is because if employers continue to collect the large amount of them in the tight labor market, they cannot secure the desired work force. Hence, the cohort size is negatively correlated with its return to tenure. Ishikawa and Genda (1989) found evidence that the entry fee mechanism worked for the period of the early 1960s to the early 1970s, the so-called the rapid growth era. That is, the large cohort hired during the rapid growth era paid small fees at the entry port, and they were paid back to the cohorts as the returns to tenure in the 1980s.[9]

If the above three interpretations are plausible, workers in large cohorts could expect the future decline in their tenure returns in advance when they got jobs. The other explanation is, however, that the unanticipated decrease in the returns occurred to those workers because of the unexpected decline in the growth of firms. Suppose that the slowdown of the growth of the firms after the oil shock could not be anticipated before the mid-1970s. Then the long-term employment relationship contracted during the rapid growth era were forced to change. It would be less necessary for employers to reduce turnovers by setting high rates of returns to tenure than before. In particular, these returns for large cohorts might lessen largely.

It is an open issue which hypothesis has the most exploratory power to the cohort size effect on CRT.

4.2 Changes in Demand Factors

Second, I evaluate the explanation of the product demand shift hypothesis on relative labor demands. Suppose that compositions of distinct labor groups identified by education level, age, and firm size are different between sectors. Then between-group wage differentials will change in favor of those employed in sectors where product demand

[9]Beaudry and DiNardo (1991) found the link between wages and the past labor market conditions in the United States. And they suggested the implicit contract model with costless mobility well describes the fact using individual data from CPSs and the Panel Study of Income Dynamics (PSID).

expands. Several product demand shift measures were developed from the analyses of relative wage changes in the United States (Freeman (1975, 1980), Katz and Murphy (1992), Murphy and Welch (1992), and Bound and Johnson (1992)). In this paper I use an index of the fixed coefficient manpower requirements model analyzed by Freeman. This index for a group measures the average growth rate of total employment by industry weighted by employment share of the group in a base year.[10] Specifically the relative product demand shift index for group i denoted as ΔD_i is given by

$$\Delta D_i = \sum_s \frac{E_{si}}{E_s}\left(\frac{\Delta E_s}{E_s} - \frac{\Delta(\Sigma_s E_s)}{\Sigma_s E_s}\right) \tag{14}$$

where E_s is total employment of ordinary male workers in sector s, E_i is total employment of group i, and E_{si} is group i's employment in sector s in a base year.

There are two problems in testing the product demand shift hypothesis. One is about classifications of sectors. To compute ΔD_i, the economy is assumed to be divided by 9 one-digit industries and 3 firm sizes' categories. Within an industry, the effect of product demand shifts on labor demand may be different in firm size. It may be because the content of job characteristics, the capital-labor ratio and technological innovations are different by firm size. Then firm size categories should be involved in sector classifications as well as industry categories. On the hand, classifications of firm sizes rather imply differences in workers' ability. That is, those who belong to the different-sized firms *ceteris paribus* may have the different quality of skills. Accordingly, the demand shift measures are computed in two cases: between 27 industry and firm size sector demand shifts for groups by education level and age, and between 9 industry sector demand shifts for groups by education level, age, and firm size.

And the other problem is the possibility of measurement errors. So far I have used the data from BSWSs to examine the wage change structures. However, these data are hardly used to examine the changes in employment because the purpose of them is to capture the wage determinants. Therefore, I use two alternative sources to compute E_s in (14): BSWSs and *Labor Force Surveys* (LFSs). LFSs are the popular data source to capture the employment level in Japan.

Table Ⅸ shows relative demand shift measures for the 1978-1990 period.

[10]Katz and Murphy clarified the theoretical interpretation of the demand shift measures. They denote that this demand shift index understates the relative labor demand shifts favoring groups with increases in relative prices since relative wages are not stable.

TABLE Ⅸ

BETWEEN-SECTOR DEMAND SHIFTS MEASURES, 1978-1990
AND BETWEEN-INDUSTRY RENT SHIFT MEASURES, 1978-1988
MULTIPLIED BY 100

	Demand Shifts				Rent Shifts
	Between industry		Between industry and firm size		Between Industry
Group	BSWS	LFS	BSWS	LFS	BSWS
Education:					
High school graduates	-0.7	-0.9	-3.0	-5.0	0.09
College graduates	3.4	3.7	3.7	4.1	-0.35
Age(men):					
20-29 years old	0.6	0.6	-0.5	-1.7	-0.15
30-39 years old	-1.4	-1.4	-2.1	-4.2	0.06
40-49 years old	-2.9	-3.4	-4.2	-7.5	0.18
50-59 years old	-1.9	-3.5	-4.7	-8.8	0.10
Education and Age(men):					
High school graduates					
20-29 years old	0.0	-0.1	-2.3	-3.6	-0.06
40-49 years old	-1.7	-1.9	-3.6	-6.4	0.24
College graduates					
20-29 years old	3.5	4.2	3.6	4.2	-0.33
40-49 years old	2.8	3.0	3.2	3.6	-0.31
Enterprises:					
with 1000- employees	-5.6	-5.3	—	—	0.59
with 100-999 employees	0.9	0.6	—	—	-0.23
with 10-99 employees	1.7	0.8	—	—	-0.40

The reported numbers in this table are of the form $log(1+\Delta Di)\times 100$ or $\log(1+\Delta IRi)\times 100$. The numbers in parenthses are relative demand shifts measure from 1974 to 1978.

From 1978 to 1990 the relative demand estimates using BSWSs are consistent with the estimates using LFSs for both the between industry and between industry and firm size measures.[11] Table Ⅸ indicates that labor demand shifted in favor of college graduates and younger workers from 1978 to 1990. If we assume that workers in differentsized firms have different skills, between industry demand shifts toward workers who tend to be employed in small firms. The industries mainly consisting of small firms such as wholesale and retail trade industries, and service industries expanded their employment during the 1980s. And more-educated and young workers are intensively employed in these industries. On the other hand, the industries mainly consisting of large firms such as manufacturing industries, and communication, transportation, and utility industries reduced their employment for the period. In these industries less-educated and old workers and employed intensively. And the age and firm size wage differentials at the fixed distribution decreased over this period. Therefore, the fixed-factor price demand shifts toward young workers and employees in small firms would have been greater than the increases in Table Ⅸ.

The basic message of Table Ⅸ is that the product demand shift hypothesis is useful in explaining the differences in CRC by education level and age in the 1980s; the demand shifts by education level and age may be consistent with a rise in the college wage premium and a fall in the age wage premium through CRC from 1978 to 1990. Among four groups classified by education level and age in Table Ⅸ, young college graduates were under the most favorable demand conditions. Old college graduates under the second favorable conditions, and the old high school graduates under the least favorable ones. This order is the same as that of CRC.

Comparing the results for the relative demand shifts in the United States in the 1980s, the between-sector demand was increasing in education levels in both countries (Katz and Murphy (1992)). And it shifted in favor of less-educated males among younger groups (Bound and Johnson (1992)). In this sense the directions of the 1980s between-sector demand shifts in Japan appear to be the same as in the United States. However, similarly to the results for the U.S., measured demand shifts are quite smaller than supply changes. And it is noteworthy that the relative demand shifts cannot explain the change in the firm size wage gap through CRC. Although between industry demand shifts toward workers in small firms, the firm size wage gap involved in relative returns to characteristics other than tenure was increasing.

[11]From 1974 to 1978, however, the BSWSs estimates are inconsistent with the LFSs estimates for both measures. While the between-sector demand shifted toward high school graduates and older workers in the BSWS estimates, it shifted toward college graduates and younger workers in the LFS estimates. Hence, to reduce the impact of measurement errors in computing relative demand shifts, the sample period is now limited to the 1978-1990 period.

4.3 Changes in Industry Rents

So far, the effects of supply and demand shifts on relative wages have been examined. Then it is assumed that the competitive labor market is the good approximation to the actual labor market. If this assumption is plausible and working conditions are not so much different across industries, the identical wage should be offered to the same characteristic workers.

However, it is known that even if observable employees' characteristics are held constant, there are variations in wages across industries.[12] There are two candidates to explain this fact. One is the industry rent hypothesis that inter-industry wage differentials for workers with the same observable characteristics represent noncompetitive industry rents. These rents may reflect the differences in the power and coverage of unions, implicit sharing of monopoly profits, and several kinds of the efficiency wage premiums. Another candidate is the compensating differential hypothesis that such industry rents reflect inter-industry differences in working conditions. Whichever hypothesis is plausible, relative wage changes in the 1980s might reflect changes in industry rents received by certain groups. To test for this explanation, it is necessary to see the effects of inter-industry rent shifts on relative wages. Tachibanaki and Ohta (1991) found large variatios in industry rents after controlling for various qualifications in employees in 1978 and 1988 in Japan using individual BSWS data. I use the industry rent estimates they calculated and compute the industry rent shift measure form 1978 to 1988 for group i denoted IR_i as follows:

$$\Delta IR_i = \sum_s \frac{E_{si}}{E_i} \Delta R_s \tag{15}$$

Where R_s is the rent in one-digit industry s estimated by Tachibanaki and Ohta.

The last column of Table Ⅸ shows the results of between industry rent shift measure. Measured industry rent shifts are much smaller than the supply and demand shifts. The changes in industry rents did not appear to be crucial in generating changes in wage differentials in the 1980s. However, it is notable that the relative industry rents shifted reversely to product demand. That is, between industry rent shifted toward old workers, high school graduates, and employees in large firms. Therefore, the relative demand shifts were partially offset by the industry rent shifts, so that the correlation between CRC and demand shifts might be weakened. And workers in large firms gained the rents on workers in small firms. Table Ⅰ shows a fall in the firm size wage gap from 1978 to 1990. If the industry rent shifts had not occurred, it would have decreased further more.

[12]See Dickens and Katz (1987), Murphy and Topel (1987), Krueger and Summers (1988) in the U.S. and Tachibanaki and Ohta (1991) in Japan.

5 Conclusion

The main findings of this study is that the changes in terms of prices and quantities of tenure played the important roles in wage structure changes of Japan in the 1980s. That is, changes in returns to tenure contributed to the decline in wage differentials by education level, age, and firm size. They decreased overall wage inequality in the end. And the changes in returns to tenure from 1978 to 1990 were ascribable to changes in cohort size. Compositional changes in tenure enlarged the age and firm size wage differentials and they contracted the college wage premium among senior male workers. Product demand shifted toward younger workers and college graduates from 1978 to 1990. It generated the increase in the college wage premium and the decrease in the age wage differential as a result of changes in returns to workers' characteristics other than tenure. Industry Rents shifted against product demand and moved to increase the firm size wage differential, while they had a small effect.

This paper has raised two subjects for further studies in the future. The first subject is that the exact sources of product demand and industry rent shifts are still unknown. About product demand shifts, candidates of their sources are technological changes or lie in the changes in openness to international trade. Higuchi (1989) found that some of the recent declines in the relative wages of traded goods industries can be accounted for by the deterioration of their profits in comparison with other industries reflecting the keen competition in the international and domestic product market. As regards industry rent shifts, differences in the decline in unionization and/or the change in working conditions between groups are possible. Second, the changes in the tenure distribution are presumed to be exogenous. The relative return to tenure for high school graduates increased with the relative number of college graduates. And product demand shifted against high school graduates and toward college graduates. Owing to both effects, high schcool graduates were more likely to stay in firms rather than college graduates. A general equilibrium framework in deciding tenure may be needed to find the reason for movements of tenure distributions.

References

[1] Beaudry, Paul and John DiNardo "The Effect of Implicit Contracts on the Movement of Wages over the Business Cycle: Evidence from Micro Data", *Journal of Political Economy*, 1991, 99, pp.665-688.

[2] Blackburn, McKinley, David Bloom, and Richard B.Freeman "The Declining Position of Less-Skilled American Males," in *A Future of Lousy Jobs*? Gary Burtless, ed. (Washington, DC: The Brookings Institution, 1990), pp.31-67.

[3] Bound, John and George Johnson, "Changes in The Structure of Wages in the 1980's: An Evaluation of Alternative Explanations", *American Economic Review*, 1992, 82, 371-392.

[4] Clark, Robert L., and Naohiro Ogawa, "Employment Tenure and Earnings Profiles in Japan and The United States: Comment", *American Economic Review*, 1992, 82, 336-345.

[5] Davis, Steven J., "Cross-Country Patterns of Changes in Relative Wages", NBER Working Paper No.4085, June 1992.

[6] Dickens, William T., and Lawrence F.Katz, "Inter-Industry Wage Differences and Industry Characteristics", in *Unemployment and the Structure of Labor Markets*, Kevin Lang and Jonathan Leonard, eds (New York: Basil Blackwell, 1987) pp.48-89.

[7] Ferrall, Christopher., "Empirical Analysis of Occupational Hierarchies", mimeo, Queen's University, March 1992.

[8] Freeman, Richard B., "The Effect of Demographic Factors on the Age-Earnings Profile in the United States", *Journal of Human Resources*, XIV (Summer 1979), 289-318.

[9] ——, "An Empirical Analysis of the Fixed Coefficient 'Manpower Requirements' Model, 1960-1970," *Journal of Human Resources*, XV (1980), 176-99.

[10] Genda Yuji, "Cross-Industry Differences in Working Hours and Wages (*In Japanese*)" JCER *Economic Journal*, Japan Center for Ecomonic Resarch, 1993, 24.

[11] Hashimoto Masanori, and John Raisian, "Employment Tenure and Earnings Profiles in Japan and the United States", *American Economic Review*, September 1985, 75, 721-35.

[12] ——, and ——, "Employment Tenure and Earnings Profiles in Japan and the United States: Reply", *American Economic Review*, 1992, 82, 346-354.

[13] Higuchi, Yoshio, "Japan's Changing Wage Structure: The Impact of Internal and International Competion", *Journal of the Japanese and International* Economies, III (December 1989), 480-499.

[14] Ishikawa, Tsuneo, and Yuji Genda, "Does Seniority Wage Nullify Rationing in the Labor Market? A Study of Japanese Experience, 1964-1982", mimeo, Tokyo University, 1989.

[15] Juhn, Chinhui, Kevin M.Murphy, and Brooks Pierce, "Wage Inequality and the Rise in the Returns to Skill", *Journal of Political Economy 1993*. 101, 410-442.

[16] Katz, Lawrence F., and Ana L.Revenga, "Changes in the Structure of Wages: The United States vs Japan", *Journal* of the *Japanese and International Economies*, Ⅲ (December 1989), 522-53.

[17] Katz, Lawrence, F., and Kevin M.Murphy, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors", *Quarterly Journal of Economics*,CⅦ (1992), 35-78.

[18] Krueger Alan B., and Lawrence H.Summers, "Efficiency Wages and Inter-Industry Wage Structure," *Econometrica*, 1988, Vol.56, No.2, pp.259-293.

[19] Mincer, Jacob, "Human Capital, Technology, and the Wage Structure: What Do Time Series Show?" NBER Working Paper No.3581, January 1991.

[20] Mincer, Jacob, and Yoshio Higuchi, "Wage Structures and Labor Turnover in the United States and Japan", *Journal of the Japanese and International Economies*, Ⅱ (1988), 97-133.

[21] Murphy, Kevin M., and Robert H.Topel, "Unemployment, Risk, and Earnings: Testing for Equalizing Wage Differences in the Labor Market", in *Unemployment and the Structure of Labor Markets*, Kevin Lang and Jonathan Leonard, eds (New York: Basil Blackwell, 1987), pp.103-140.

[22] Murphy, Kevin M., and Finins Welch, "The Structure of Wages", *Quarterly Journal of Economics*, CⅦ (1992), 285-326.

[23] Tachibanaki, T., and Soichi. Ohta, "Wage Differentials by Industry and Labour Market in Japan", Discussion Paper No.332, Kyoto University, August 1991.

[24] Welch, Finis, "Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust", *Jounal of Political Economy*, LXXXⅦ (October 1979), S65-S98.