

***Cohort Size Effects on Employment
and Relative Wages: the Case of Japan***

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A B S T R A C T

The Japanese population has undergone considerable change in its age composition in the postwar period. After the postwar baby boom from 1947 to 1949, fertility declined dramatically, and the aging of the population that has already begun is expected to accelerate in the next several decades. This paper analyzes how these changes in age distribution have affected employment patterns and wages in Japan. The first half shows that changing population age distribution has affected the age distribution of the work force and the employment patterns of the various industries. For example, in 1950 in the manufacturing industry 30.6 percent of the male employees and 57.0 percent of the female employees were under age 25, but by 1980 the percentages were 10.2 and 14.7 respectively. The second half shows that the ratio of older to younger workers has a significant negative effect on the relative earnings of these groups. However, the oil shocks and recessions coincided with the passage of the baby boom through the younger age groups of the work force and with the overall aging of the population, so economic factors tended to outweigh demographic factors in the analysis.

I. Introduction

In a virtually closed population such as the Japanese one, transformation of the age structure is induced by changes in fertility and mortality. Following the postwar baby boom (1947-1949), Japan experienced an unprecedented decline in fertility. Over the period 1947-1957, the total fertility rate (TFR) fell by over half from 4.54 to 2.04 children per woman. There was little change until the first oil crisis of 1973, when it began to fall again, and by 1981 TFR was 1.74 (Ishikawa, 1983: 66). In addition, remarkable mortality improvements were recorded from the late 1940s to the mid-1960s. The expectation of life at birth for males increased from 50.06 in 1947 to 63.24 years in 1957 and for females from 53.96 to 67.60 years over the same period. In 1981, life expectancy in Japan was among the highest in the world: 73.79 for males and 79.13 for females (Institute of Population Problems, 1982: 25).

As a result of these dramatic demographic changes, the shift in the age structure of the Japanese population has been increasingly pronounced in recent years. Although the index of aging ($100 \times$ those aged 65+ / those aged 0-14) was only 13.96 in 1950 and 19.06 in 1960, it rose to 29.53 in 1970 and 38.71 in 1980 (Statistics Bureau, various years). Moreover, according to the most recent population projections, the speed of aging is expected to accelerate in the next several decades (Ogawa *et al.*, 1983).

The change in age composition has already started to affect various socioeconomic aspects of Japanese society, particularly public transfer programs such as old-age pension schemes and medical plans. In business circles, there has been a growing awareness of the difficulties likely to arise from the slowing growth of the labor force and from changes in its age composition. Furthermore, these predicted changes in the labor force and in the expenditures on social security programs may lead to an economic slowdown in the long run (Ogawa, 1982).

In this paper we analyze several economic consequences of age structural shifts for employment patterns and relative wages in the Japanese labor market. Section II of the paper is a brief description of the institutional characteristics of Japanese employment and wage structure. In Section III, we present an analysis of the pattern of

the changes in the age composition of the productive-age population and of employed persons in the past three decades. Section IV discusses age composition effects on the pattern of employment at the national level, as well as in various industries. The ensuing section examines the effect of age structure change on relative wages at both national and industry levels. The final section summarizes major findings.

II. Institutional Characteristics of Japanese Employment and Wage Structure

To facilitate the discussion that follows, we should first describe briefly some of the fundamentals of Japanese employment and wage practices. The seniority wage system and lifetime employment are the two major institutional features of the Japanese male labor market. Because Japanese women in the past have usually retired upon marriage or upon giving birth, they have not been a part of these systems, which were originally instituted after World War I to cope with the scarcity and high turnover of skilled workers.^{1/} Under the seniority-based wage system, salary increases with the age of an employee, his duration of service, and his job responsibilities. Salaries include the basic monthly wage, earnings for overtime, cost of living allowances, and various duty and incentive allowances (Martin, 1982a). In 1981, the basic monthly wage corresponded to 90 percent of a male worker's average monthly earnings (Ministry of Labour, 1983b: 104). Besides these monthly earnings, bonuses are usually given twice a year. Although the size of the bonus is closely tied to monthly earnings, it varies considerably from year to year. In 1981, bonuses amounted to three-and-a-half months' wages for the average male worker.

Lifetime employment provides job stability to workers, who in turn exhibit a high level of loyalty to their employers. These highly loyal workers are, however, required to retire at an age specified by the company. In 1981, average retirement age was 57.6 years, very low in comparison to other highly industrialized countries and in comparison to Japanese life expectancy (Ogawa and Suits, 1983). Although the age limit has been gradually rising in recent years, it has increased by only 2.1 years since 1965.

One of the main deterrents to the extension of retirement age is related to the practice of the seniority wage system. Under this wage system, the postponement of retirement age implies larger wage bills. In the recent past, however, due to the relative increase in aged workers and the relative decrease in young workers, many businesses have been gradually replacing the seniority-based wage system with an ability-oriented one (Ogawa and Suits, 1983). In 1970, 27.9 percent of the business enterprises with more than 30 employees reported that they had a system in which wages were tied to work requirements. In 1979, however, the percentage of businesses using this wage system increased to 45.1 percent.

Despite these recent changes, to a considerable extent the seniority wage system is still a source of employers' strong preferences for young workers. As shown in Table 1, in 1982 the ratio of job openings to job seekers for the age group below 20 was 1.8, as opposed to 0.6 for all ages combined. Even so, the openings ratio for young workers is not so high as it was during the rapid economic growth of the 1960s, as indicated by the 1970 figure.

Although some business enterprises, mainly larger ones, have established reemployment programs and employment extension programs for older workers (Furuya and Martin, 1981), these programs offer employment opportunities only to selected employees after reaching retirement age. Most older workers tend to be hired by small-scale businesses in such industries as trade and services. During the period 1970-1980, the service industry had a net addition of 315,000 workers aged 60 or older, and the wholesale and retail trade industry gained 311,000, as opposed to an increase of only 104,000 in manufacturing (Statistics Bureau, 1970 and 1980). Generally work can be found only with reduced pay, prestige, and job stability. Thus, the aging of the Japanese labor force, which we will discuss next, presents a particular challenge in view of the country's employment patterns and labor institutions.

III. Aging of the Working-age Population and the Labor Force: A Demographic Analysis

The changes in the postwar period in the age composition of the Japanese working age population, as well as of the labor force, have

Table 1. Ratio of Job Openings to Job Seekers by Age, 1960-1982

Age	Year						
	1960	1965	1970	1975	1980	1981	1982
All	0.7	0.6	1.6	0.7	0.8	0.7	0.6
>20	0.7	1.6	5.1	2.8	2.6	2.4	1.8
20-24	0.7	0.6	1.3	0.7	1.1	1.1	0.7
25-29	0.7	0.6	1.8	0.7	0.9	0.9	0.9
30-34	0.8	0.6	2.1	1.1	0.9	0.8	0.8
35-39	0.6	0.6	1.9	0.9	1.0	1.0	0.9
40-44				0.7	0.9	0.9	0.7
45-49	0.3	0.5	1.3	0.5	0.6	0.6	0.5
50-54				0.3	0.5	0.4	0.3
55-59				0.2	0.3	0.2	0.2
60-64	0.1	0.1	0.3	0.1	0.2	0.1	0.1
65+				0.0	0.1	0.1	0.0

Source: Bureau of Employment Security, Ministry of Labour, Report on Employment Service, various years.

been considerable. In Table 2, we have listed several demographic indices representing changes in the age composition of the Japanese population over the period 1950-1980. These indices show that, first, the proportion of the aged population relative to the productive-age population has been steadily increasing, while that of the young population has been decreasing. These changes have been directly reflected in the change of the index of aging, shown in the fourth line of the table. It should be noted also that the speed of population aging accelerated, particularly after 1960.

Second, the substantial shrinkage of the young population contributed to lowering total dependency (third line) up to 1970. During the period 1970-1980, however, the increase in the relative size of

Table 2. Selected Demographic Indices for Japan, 1950-1980

(Unit: %)

	1950	1960	1970	1980
$\frac{65+}{15-64}$ *	8.27	8.92	10.24	13.49
$\frac{0-14}{15-64}$ **	59.26	46.78	34.69	34.89
$\frac{(0-14) + (65+)}{15-64}$ ***	67.54	55.69	44.93	48.35
$\frac{65+}{0-14}$ ****	13.96	19.06	29.53	38.71
$\frac{15-24}{15-64}$	32.81	29.38	27.56	20.42
$\frac{55-64}{15-64}$	10.18	10.95	11.39	12.77
$\frac{55-64}{15-24}$	31.01	37.29	41.32	62.55

Source: Statistics Bureau, Prime Minister's Office, Population Census of Japan, various years.

- * Index of aged dependency
- ** Index of young dependency
- *** Index of total dependency
- **** Index of aging

the aged population started to play a dominant role in the determination of the level of total dependency. These changes in the relative proportion of the two age groups, old and young, have shifted the emphasis from the quantitative question of "how many dependents" to the qualitative one of "what kind of dependents" the working population has to support.

Third, the composition of the productive-age population has been gradually affected, primarily due to the relative decrease in the

size of young cohorts, as represented by changes in the last three indices in Table 2, which are composed of various groups in the productive-age population.

As mentioned earlier, these age changes have been generated by both fertility reduction and mortality improvement. To disentangle the effect of mortality and fertility upon age structure, we have carried out three different population projections as follows: (a) projection of the 1950 census population up to the year 1980 by applying the fertility rates as observed, but keeping mortality constant at the level of 1950, (b) projection of the same initial population up to the year 1980 by applying the declining rates of mortality, holding fertility constant at the 1950 level, and (c) projection of the 1950 census population up to the year 1980 with fertility and mortality constant at their 1950 levels.

Table 3 compares the results of these population projections. Several demographic indices are shown, but let us focus on the index of aging, the second one, for the purpose of discussion. This index had a value of 13.96 in 1950, as shown in Table 2. It would have increased to 30.67 in 1980 under projection (a), to 19.69 under (b), and to 16.24 under (c). The total change in the index from 1950 to 1980 can be decomposed as follows:

$$\begin{aligned} \text{total change} &= \text{fertility component} + \text{mortality component} \\ &+ \text{age structure component} + \text{residual} \end{aligned}$$

$$\begin{aligned} 1980 - 1950 &= (1980^a - 1950) + (1980^b - 1950) + (1980^c - 1950) \\ &+ \text{residual} \end{aligned}$$

Substituting the values of the components from Tables 2 and 3, we find that the total change is 24.75 percentage points. The fertility component is 16.71 percentage points or almost three times the mortality component of 5.73 percentage points.

A similar analysis of the aging of the productive-age population can be made. Let us take the ratio of those aged 55-64 to those aged 15-24. The total change amounts to 31.54, the fertility component 28.14, and the mortality component 4.88. As is the case with the aging of the total population, the aging of the productive-age population, therefore, has been induced mainly by fertility reduction.

Table 3. Selected Demographic Indices for Projected Populations
Based on 1950

(Unit: %)

	Index				
	$\frac{(0-14)+(65+)}{15-64}$	$\frac{65+}{0-14}$	$\frac{15-24}{15-64}$	$\frac{55-64}{15-64}$	$\frac{55-64}{15-24}$
<u>Projection (a)</u>					
Constant mortality and actual fertility					
1960	55.29	18.08	30.05	10.71	35.62
1970	42.52	26.73	28.50	11.01	38.63
1980	44.59	30.67	20.34	12.03	59.15
<u>Projection (b)</u>					
Actual mortality and constant fertility					
1960	67.35	15.05	28.08	10.78	38.39
1970	66.69	16.94	30.20	10.97	36.31
1980	68.00	19.69	29.85	10.71	35.89
<u>Projection (c)</u>					
Constant mortality and constant fertility					
1960	66.96	14.48	30.05	10.71	35.62
1970	65.21	15.44	30.66	10.68	34.83
1980	63.78	16.24	29.74	10.24	34.44

These comparative analyses indicate that although improved mortality affected the aging of both total and productive-age populations, fertility decline was the principal cause of the age compositional shifts observed during the period 1950-1980. Such findings are in agreement with population theory and with other empirical studies (Coale, 1957).

Although labor force participation also has an effect on the age composition of the labor force, as will be discussed in detail in the next section, the above changes in the age composition of the working-age population are closely linked to those in the distribution of workers. Table 4 shows the distribution of employed persons by age over the period 1950-1980. Because of both demographic change and increased school attendance, the youngest age group (15-19) shrank enormously in terms of its number and share over the period under review. It declined from 14.0 percent in 1950 to only 2.7 percent in 1980. The number of employed persons aged 20-24 decreased from 1950 to 1960, but increased in 1970 because of the postwar baby boom and then declined to 9.9 percent in 1980. Thus, at the beginning of the thirty-year period young workers accounted for over 30 percent of the work force, but at the end only 13 percent.

The main corps of the workers at ages 25-59 recorded steady growth in both numbers and percentage. Another age group that increased in numbers was the 60 and over group. Despite a decline in participation especially in the 1960s, as agriculture became less important in Japan's economy, this group of workers continued to in-

Table 4. Age Distribution of Japanese Employed Persons, 1950-1980

(Unit: 1,000 persons; % in parentheses)

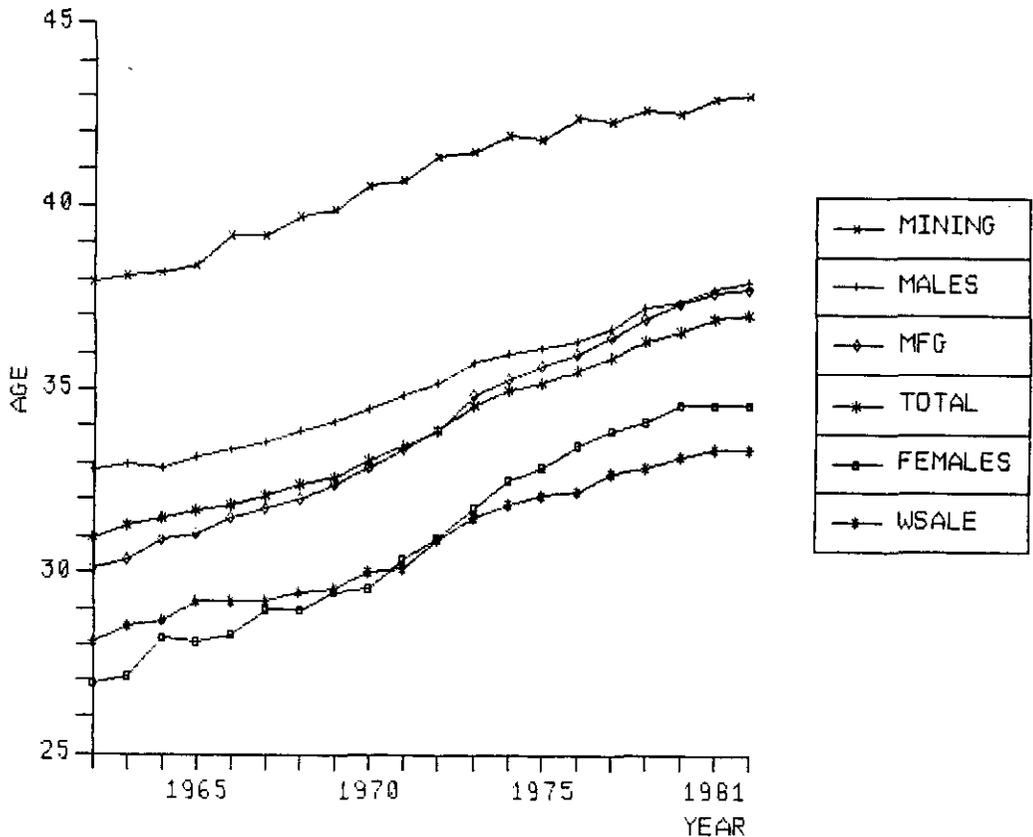
Age	1950	1960	1970	1980
Total	35,574(100.0)	43,690(100.0)	52,236(100.0)	55,811(100.0)
15-19	4,998 (14.0)	4,608 (10.5)	3,184 (6.1)	1,513 (2.7)
20-24	5,801 (16.3)	6,434 (14.7)	8,036 (15.4)	5,503 (9.9)
25-39	11,452 (32.2)	16,026 (36.7)	18,751 (35.9)	21,121 (37.8)
40-59	10,525 (29.6)	12,493 (29.6)	17,400 (33.3)	22,282 (39.9)
60+	2,798 (7.9)	3,680 (8.4)	4,864 (9.3)	5,392 (9.7)

Source: Statistics Bureau, Prime Minister's Office, Population Census of Japan, various years.

crease. In contrast to a 70 percent shrinkage of the age group 15-19, this oldest age group expanded by 93 percent during the period 1950-1980.

These age-structural shifts of the work force have caused a continuous rise in the mean age of workers. For instance, the average worker outside agriculture was 31.0 years in 1962, 33.5 in 1971, and 37.0 in 1981 (Ministry of Labour, Basic Survey of Wage Structure, various years). It is also interesting to observe that there are clear differences in the pattern of increase of the mean age among the various industries. Figure 1 presents changes in the mean age by sex

FIGURE 1.
CHANGES IN THE MEAN AGE OF THE WORK FORCE
BY SEX AND FOR SELECTED INDUSTRIES, 1962-1981



and for selected industries over the period 1962-1981. Among nine nonagricultural industries, the mining industry has continually shown the highest mean age--43.0 in 1981--and the wholesale and retail trade industry, the lowest one--33.4 in 1981. The manufacturing industry has undergone the greatest increase in the mean age of its work force from 30.1 in 1962 to 37.7 years old in 1981. Although the mean age of the female work force has been lower than that of males in every industry for the past two decades, it has risen more rapidly. In 1962, male workers were on average 5.9 years older than females, but by 1981 the difference was only 3.3 years. The mean age of females in the manufacturing industry, for example, rose by 10.1 years from 26.7 in 1962 to 36.8 in 1981.

Clearly, changes in labor force participation, as well as in age composition, have had an effect on the age distribution of the work force. In the next section, we will attempt to sort out the role of each factor.

IV. Age Structural Effects on Employment Patterns

A. Definition and Methodology

One of the most widely-used census measures of the dimensions of the labor force in proportion to the total population is the crude activity rate (CAR), i.e., the labor force per 100 total population. It should be stressed that CAR is greatly influenced by the age composition of the population. However, CAR is not an appropriate statistical measure for our analytical purposes, primarily because we want to demonstrate the effect of changes in age composition on employment not only at the aggregate level but also at the industrial level. For those who are in the labor force, but not employed, it is difficult to specify which industry they should be associated with. Although the Japanese unemployment rate doubled in the 1970s, it remains quite low by international standards--2.2 percent in 1981.^{2/} In this section, therefore, we will employ a measure slightly different from CAR, but analogous to it.

This measure, which we will call the crude employment rate (CER), represents the number of employed persons (EMP) as a percent of the population age 15 and over (P15+). CER is calculated as follows:

$$\text{CER} = \text{EMP}/\text{p15+} \quad (1)$$

This formula can be expanded as below:

$$\text{CER} = \sum_{i=1}^n \sum_{j=1}^k \frac{\text{POP}_i}{\text{P15+}} \times \frac{\text{EMP}_{ij}}{\text{POP}_i} \quad (2)$$

where POP_i is the population size for the i^{th} age group, EMP_{ij} is the number of employed persons in the i^{th} age group and the j^{th} industry, n is the number of age groups, and k is the number of industries. For simplicity's sake, we rewrite equation (2) as:

$$\text{CER} = \sum_{i=1}^n \sum_{j=1}^k A_i \times V_{ij} \quad (3)$$

where $A_i = \text{POP}_i/\text{P15+}$, and $V_{ij} = \text{EMP}_{ij}/\text{POP}_i$. By following a decomposition technique developed by Kitagawa (Kitagawa, 1955; Cho and Retherford, 1973; Retherford and Ogawa, 1978), equation (3) can be used to decompose the change in CER over a given time period as:

$$\Delta \text{CER} = \sum_{i=1}^n \sum_{j=1}^k \bar{A}_i \times \Delta V_{ij} + \sum_{i=1}^n \sum_{j=1}^k \Delta A_i \times \bar{V}_{ij} \quad (4)$$

where \bar{A}_i and \bar{V}_{ij} are averages over the period. The two terms on the right show the contribution from changes in industrial employment rates and from changes in age structure. One of the features of this decomposition technique is that there are no residual terms. Another is the assumption that the two factors do not affect each other.^{3/}

B. Change in the Crude Employment Rate at the Aggregate Level

Before applying this decomposition method to the industry-specific census data on employment, let us examine changes in the CER for the nation as a whole over the period 1950-1980. As shown in Table 5, the CER decreased by 1.6 percentage points from 1950 to 1980. There was an increase in the first intercensal period, a slight decrease in the second, and a substantial decrease in the third. Similar patterns of change can be observed for males and females, but the

Table 5. Crude Employment Rate by Sex, 1950-1980

(Unit: %)

	Year			
	1950	1960	1970	1980
Both Sexes	64.0	66.9	66.2	62.4
Males	81.4	84.4	83.1	79.8
Females	47.8	50.5	50.3	46.0

Source: Statistics Bureau, Prime Minister's Office, Population Census of Japan, various years.

CER for males was substantially higher than that for females throughout the time period under review.

In Table 6, the changes in CER for each sex have been broken down into the two components for various time periods. In general, the employment rate effect is much larger. As regards both sexes together, age compositional shifts contributed to an increase in CER over the period 1950-1980, while changes in employment rates contributed to a decrease. Because the latter is larger than the former, the net total effect is negative over the thirty-year period.

For males the age composition effect is always positive, whereas for females it is negative overall and for the first and third decades. The reason for this difference is that there is greater variation of employment by age for females as they first "retire" upon marriage and childbearing and then return to the labor force in their forties and fifties. Thus, the age composition effect for females is more sensitive to changes in the proportion of the population ages 20-24, where one of the peaks in female employment occurs. Because the employment rate is high and unchanging in the middle ages for males, the male age composition effects are larger.

The employment rate effect is positive in the 1950s (more so for females than males), but in the 1960s for each sex there is a negative employment rate effect, which is magnified in the 1970s. As mentioned

Table 6. Decomposition of the Changes in the Crude Employment Rate by Sex, 1950-1980

(Unit: %)

	Time Period			
	1950-1980	1950-1960	1960-1970	1970-1980
<u>Both Sexes</u>				
Age Composition Effect	2.01	0.65	0.52	0.26
Employment Rate Effect	-3.64	2.20	-1.16	-4.10
Total Effect *	-1.63	2.85	-0.65	-3.84
<u>Males</u>				
Age Composition Effect	5.16	1.83	1.08	1.78
Employment Rate Effect	-6.84	1.10	-2.34	-5.13
Total Effect *	-1.68	2.93	-1.26	-3.35
<u>Females</u>				
Age Composition Effect	-0.43	-0.22	0.12	-1.02
Employment Rate Effect	-1.39	2.95	-0.32	-3.34
Total Effect *	-1.82	2.73	-0.19	-4.36

* Total effects can be derived from Table 5.

earlier, one of the major sources of the fall in employment rates is the rising educational enrollment rates for the younger age groups. During the period 1960-1980, the probability of junior high school graduates entering senior high schools increased by 36.5 percentage points from 57.7 to 94.2 percent (Ministry of Education, 1981); the probability rose from 59.6 to 93.1 percent for males and from 55.9 to 95.4 percent for females. The continuation rate for universities or other institutions of higher learning also showed a remarkable increase over the corresponding period, namely, from 10.3 to 37.9 percent for both sexes, from 14.9 to 42.3 percent for males, and from 5.5 to 33.3 percent for females.

Another source of the negative employment rate effect is the decline in labor force participation of males age 60 and over. This decline has involved both push and pull factors, such as the decline in agriculture and the improvement in old-age pension benefits, which could have induced older workers to retire earlier. In 1961, the universal pension system was established, and in 1973 there was a dramatic increase in the per capita benefits paid out (Ogawa, 1975). These institutional changes are reflected most likely in the large negative employment rate effect (-4.10 percentage points) over the period 1970-1980.

C. Industry-Specific Change in the Crude Employment Rate

Up to this point, we have analyzed the decomposition of changes in CER at the aggregate national level. Let us now discuss the pattern of changes in industry-specific CERs. As shown in Table 7, the computational work has been carried out for the following 12 industries: (i) agriculture, (ii) forestry and logging, (iii) fisheries and aquaculture, (iv) mining, (v) construction, (vi) manufacturing, (vii) wholesale and retail trade, (viii) finance, insurance and real estate, (ix) transportation, communication and other public utilities, (x) services, (xi) government, and (xii) unclassifiable. Although both the real estate and public utilities industries have been tabulated as separate categories in recent censuses, we will confine our analysis to the above 12-industry classification scheme, because of the data constraint imposed by the 1950 Population Census.

With regard to the total effect, primary industries such as agri-

Table 7. Decomposition of the Changes in the Industry-Specific Crude Employment Rate for Both Sexes, 1950-1980

(Unit: %)

Industry	Period	Age Composition Effect	Employment Rate Effect	Total Effect
Agriculture	1950-1960	0.57	-9.37	-8.80
	1960-1970	0.45	-8.84	-8.39
	1970-1980	0.86	-6.57	-5.70
Forestry and Logging	1950-1960	0.01	-0.04	-0.03
	1960-1970	0.01	-0.44	-0.43
	1970-1980	0.02	-0.10	-0.08
Fisheries and Aquaculture	1950-1960	0.01	-0.21	-0.20
	1960-1970	0.01	-0.37	-0.36
	1970-1980	0.03	-0.19	-0.16
Mining	1950-1960	0.03	-0.25	-0.22
	1960-1970	0.01	-0.55	-0.54
	1970-1980	0.01	-0.16	-0.15
Construction	1950-1960	0.05	1.61	1.66
	1960-1970	0.02	0.82	0.84
	1970-1980	0.02	1.01	1.04
Manufacturing	1950-1960	-0.27	4.64	4.37
	1960-1970	-0.16	2.97	2.82
	1970-1980	-0.19	-2.35	-2.54
Wholesale and Retail Trade	1950-1960	0.08	3.54	3.62
	1960-1970	0.08	2.17	2.24
	1970-1980	-0.25	1.73	1.48
Finance, Insurance and Real Estate	1950-1960	0.01	0.56	0.57
	1960-1970	0.01	0.52	0.53
	1970-1980	-0.08	0.57	0.49
Transportation, Communication and Other Public Util.	1950-1960	0.08	0.40	0.48
	1960-1970	0.02	0.69	0.71
	1970-1980	-0.01	-0.12	-0.13
Services	1950-1960	0.05	2.18	2.23
	1960-1970	0.06	1.70	1.76
	1970-1980	-0.14	1.96	1.82
Government	1950-1960	0.06	-0.73	-0.67
	1960-1970	0.02	0.12	0.14
	1970-1980	-0.02	0.10	0.08
Unclassifiable	1950-1960	0.01	-0.13	-0.13
	1960-1970	0.00	0.03	0.03
	1970-1980	0.00	0.02	0.02

culture, forestry and logging, fisheries and aquaculture, and mining recorded declines in CER throughout the period 1950-1980. In particular, the agricultural industry underwent the largest decreases in employment with declines of over eight percentage points in each of the first two decades and of almost six percentage points in the last decade. The government industry also showed a decline in the period 1950-1960. In contrast and not surprisingly, the manufacturing industry had the largest positive effects in the first two decades. However, in the most recent decade there was a relatively large negative total effect (-2.54 percentage points) in manufacturing. All other industries except for transportation showed positive total effects throughout the thirty-year period. Of these other industries, the wholesale and retail trade industry and the service industry showed the greatest gains in employment. However, the magnitude of the total effect generally diminished over time for the industries with growing employment.

As in the aggregate analysis, the employment rate effects outweigh the age composition effects on an industry-by-industry basis. The largest age effects are in the agriculture industry, which given its employment pattern benefited from the aging of the population. However, these positive effects were swamped by the negative employment rate effects. In contrast, industries that have based their growth in part on a young labor force have been negatively affected by aging. In the most recent decade the following six industries had negative age composition effects: the wholesale and retail trade industry (-0.25), the manufacturing industry (-0.19), the service industry (-0.14), the finance, insurance and real estate industry (-0.08), the government industry (-0.02) and the transportation industry (-0.01). These results indicate that there are some industries that, given their pattern of employing different age groups, have already been affected negatively by changes in the age distribution.

The industry-specific employment rate component is affected by a complex set of socioeconomic factors, such as sectoral economic growth, changes in industrial structure, technological change, the development of sectoral welfare programs, and retirement and wage policies adopted in each industry. Despite such complexity, it is still possible to attempt to interpret the results of the industry-specific employment rate effects based upon some observable patterns

and regularities.

As shown in Table 7, the four primary industries had negative employment rate effects throughout the period 1950-1980. Specifically, the agricultural industry underwent enormous reductions of -9.37, -8.84, and -6.57 percentage points. These changes are related to the shift in industrial structure toward modern, heavy industries and toward services. Manufacturing, wholesale and retail trade, and services recorded pronounced increases in the 1950s and 1960s. In the 1970s, however, the value of the employment rate effect for the manufacturing industry became negative. Positive employment rate effects were maintained in trade and services. In addition, the finance, insurance and real estate industry and the construction industry had positive employment rate effects. The manufacturing industry was hurt worse than services or trade by the oil shocks and the recessions in the 1970s, but its share of gross domestic product grew over the decade. Thus, the differential employment rate effects are also due to differences in labor productivity in the various industries.

The changes in industry-specific CERs have been further decomposed on the basis of the following five age groups: 15-19, 20-24, 25-39, 40-59, and 60+. (Although it might be more interesting to analyze them on the basis of more detailed age groups, it is not feasible due to the limited age grouping of the 1950 Population Census.) Tables 8 and 9 show age composition effects for males and females respectively for the three decades, and Tables 10 and 11 show the employment rate effects.

Despite the overall aging of the population, the passage of the Japanese baby boom cohort through the age distribution is clear in Tables 8 and 9. For 1950-1960, age effects for the 15-19 and 20-24 groups of each sex are negative for all industries. For 1960-1970, the effects in the 20-24 column are all positive as those born from 1947 to 1949 passed into this group. For 1970-1980, the baby boom cohort is mixed with the relatively smaller groups surrounding it in the 25-39 category, so the age effect is negative for all three of the youngest age groups: 15-19, 20-24, and 25-39.

As mentioned earlier, the aging of the labor force has had a more positive effect for males than females, because the female rate of employment is highest at ages 20-24. One special case in which this is not true is highlighted in the male 40-59 group for the period

Table 8. Age Composition Effect on Industry-Specific Crude Employment Rates, Males, 1950-1980

(Unit: %)

Industry	Age Groups					
	All Ages	15-19	20-24	25-39	40-59	60+
<u>1950-1960</u>						
All	1.832	-2.397	-1.080	5.167	-0.720	0.862
Agriculture	0.511	-0.692	-0.233	1.158	-0.230	0.507
Forestry	0.028	-0.031	-0.015	0.074	-0.011	0.011
Fishery	0.023	-0.071	-0.026	0.115	-0.016	0.021
Mining	0.078	-0.028	-0.024	0.140	-0.015	0.004
Construction	0.107	-0.192	-0.087	0.403	-0.055	0.038
Manufacturing	0.108	-0.744	-0.279	1.185	-0.130	0.076
Wholesale	0.201	-0.316	-0.136	0.653	-0.099	0.099
Finance	0.050	-0.019	-0.016	0.087	-0.012	0.011
Transportation	0.271	-0.105	-0.102	0.515	-0.050	0.013
Services	0.271	-0.139	-0.086	0.501	-0.071	0.066
Government	0.185	-0.056	-0.073	0.331	-0.032	0.015
Unclassifiable	0.002	-0.003	-0.001	0.006	-0.001	0.001
<u>1960-1970</u>						
All	1.081	-1.230	0.688	-0.080	0.989	0.713
Agriculture	0.446	-0.140	0.065	-0.010	0.217	0.314
Forestry	0.014	-0.007	0.004	-0.001	0.011	0.007
Fishery	0.016	-0.022	0.009	-0.001	0.016	0.014
Mining	0.016	-0.006	0.006	-0.001	0.014	0.003
Construction	0.070	-0.137	0.072	-0.009	0.095	0.050
Manufacturing	0.015	-0.496	0.219	-0.022	0.219	0.095
Wholesale	0.158	-0.219	0.134	-0.013	0.145	0.110
Finance	0.036	-0.013	0.014	-0.002	0.021	0.016
Transportation	0.096	-0.061	0.061	-0.009	0.088	0.016
Services	0.158	-0.097	0.068	-0.009	0.118	0.077
Government	0.056	-0.032	0.035	-0.004	0.044	0.013
Unclassifiable	0.001	-0.000	0.000	-0.000	0.000	0.000
<u>1970-1980</u>						
All	1.778	-0.601	-3.668	-0.017	4.993	1.071
Agriculture	0.834	-0.032	-0.145	-0.001	0.665	0.347
Forestry	0.037	-0.001	-0.005	-0.000	0.036	0.007
Fishery	0.048	-0.008	-0.030	-0.000	0.071	0.016
Mining	0.027	-0.001	-0.008	-0.000	0.034	0.002
Construction	0.153	-0.091	-0.447	-0.002	0.600	0.092
Manufacturing	0.184	-0.211	-1.012	-0.005	1.239	0.172
Wholesale	-0.040	-0.126	-0.865	-0.003	0.760	0.193
Finance	0.068	-0.006	-0.090	-0.001	0.133	0.032
Transportation	0.170	-0.039	-0.354	-0.002	0.533	0.032
Services	0.269	-0.061	-0.503	-0.002	0.681	0.155
Government	0.029	-0.025	-0.205	-0.001	0.237	0.023
Unclassifiable	0.001	-0.000	-0.003	-0.000	0.004	0.001

Table 9. Age Composition Effect on Industry-Specific Crude Employment Rates, Females, 1950-1980

(Unit: %)

Industry	Age Groups					
	All Ages	15-19	20-24	25-39	40-59	60+
<u>1950-1960</u>						
All	-0.216	-1.957	-0.727	1.095	1.115	0.259
Agriculture	0.602	-0.601	-0.260	0.585	0.680	0.198
Forestry	0.005	-0.007	-0.003	0.007	0.007	0.001
Fishery	0.005	-0.011	-0.004	0.009	0.009	0.002
Mining	-0.003	-0.008	-0.003	0.004	0.004	0.000
Construction	0.009	-0.014	-0.003	0.013	0.017	0.001
Manufacturing	-0.539	-0.629	-0.153	0.132	0.100	0.011
Wholesale	-0.027	-0.260	-0.111	0.157	0.160	0.027
Finance	-0.034	-0.037	-0.018	0.011	0.009	0.001
Transportation	-0.051	-0.052	-0.024	0.016	0.008	0.000
Services	-0.154	-0.301	-0.124	0.143	0.110	0.017
Government	-0.027	-0.035	-0.019	0.017	0.009	0.001
Unclassifiable	-0.000	-0.002	-0.001	0.001	0.001	0.000
<u>1960-1970</u>						
All	0.123	-1.108	0.516	-0.713	1.002	0.427
Agriculture	0.406	-0.123	0.077	-0.247	0.437	0.262
Forestry	0.003	-0.003	0.002	-0.004	0.005	0.002
Fishery	0.003	-0.005	0.002	-0.006	0.009	0.004
Mining	0.001	-0.001	0.001	-0.002	0.002	0.000
Construction	0.012	-0.011	0.009	-0.015	0.024	0.004
Manufacturing	-0.260	-0.452	0.140	-0.140	0.159	0.032
Wholesale	0.014	-0.227	0.127	-0.137	0.180	0.070
Finance	-0.005	-0.033	0.021	-0.012	0.019	0.005
Transportation	-0.017	-0.032	0.018	-0.015	0.011	0.001
Services	-0.035	-0.205	0.108	-0.124	0.144	0.043
Government	0.002	-0.010	0.009	-0.012	0.012	0.003
Unclassifiable	0.000	-0.001	0.000	-0.000	0.001	0.000
<u>1970-1980</u>						
All	-1.021	-0.597	-3.250	-0.097	1.960	0.963
Agriculture	0.795	-0.019	-0.124	-0.015	0.530	0.422
Forestry	0.005	-0.000	-0.001	-0.000	0.005	0.002
Fishery	0.012	-0.001	-0.006	-0.001	0.013	0.006
Mining	0.000	-0.000	-0.002	-0.000	0.002	0.001
Construction	-0.014	-0.008	-0.007	-0.003	0.060	0.015
Manufacturing	-0.465	-0.220	-0.769	-0.024	0.434	0.113
Wholesale	-0.469	-0.160	-0.932	-0.025	0.431	0.217
Finance	-0.219	-0.039	-0.252	-0.003	0.052	0.023
Transportation	-0.089	-0.018	-0.107	-0.002	0.033	0.005
Services	-0.549	-0.123	-0.910	-0.022	0.364	0.143
Government	-0.025	-0.006	-0.065	-0.002	0.034	0.015
Unclassifiable	-0.001	-0.001	-0.004	-0.000	0.002	0.001

Table 10. Employment Rate Effect on Industry-Specific Crude Employment Rates, Males, 1950-1980

(Unit: %)

Industry	Age Groups					
	All Ages	15-19	20-24	25-39	40-59	60+
<u>1950-1960</u>						
All	1.099	-0.070	-0.191	0.762	0.496	0.102
Agriculture	-10.503	-2.509	-1.926	-2.471	-2.611	-0.986
Forestry	-0.250	-0.081	-0.088	-0.039	-0.043	0.002
Fishery	-0.663	-0.162	-0.145	-0.118	-0.205	-0.034
Mining	-0.454	-0.075	-0.160	-0.194	-0.026	0.001
Construction	2.686	0.106	0.350	1.228	0.752	0.251
Manufacturing	5.171	1.716	1.366	0.801	1.066	0.223
Wholesale	3.646	0.816	1.105	0.518	0.802	0.404
Finance	0.686	0.039	0.108	0.328	0.135	0.077
Transportation	0.434	-0.044	-0.417	0.596	0.263	0.034
Services	1.796	0.227	0.117	0.573	0.682	0.197
Government	-1.245	-0.081	-0.462	-0.394	-0.264	-0.043
Unclassifiable	-0.184	-0.020	-0.027	-0.065	-0.056	-0.016
<u>1960-1970</u>						
All	-2.340	-2.064	-0.616	0.168	0.236	-0.114
Agriculture	-8.792	-0.663	-1.029	-3.518	-2.272	-1.309
Forestry	-0.631	-0.048	-0.103	-0.280	-0.150	-0.050
Fishery	-0.574	-0.070	-0.110	-0.246	-0.093	-0.055
Mining	-1.048	-0.040	-0.149	-0.578	-0.267	-0.014
Construction	1.427	0.104	0.126	0.736	0.330	0.131
Manufacturing	2.628	-0.926	-0.192	2.071	1.201	0.475
Wholesale	1.580	-0.388	0.355	1.628	-0.222	0.207
Finance	0.351	-0.019	0.005	0.178	0.111	0.075
Transportation	1.213	0.007	0.204	0.109	0.803	0.091
Services	1.491	-0.065	0.263	0.516	0.497	0.279
Government	-0.033	0.044	0.002	-0.465	0.332	0.053
Unclassifiable	0.044	0.002	0.006	0.018	0.014	0.004
<u>1970-1980</u>						
All	-5.125	-1.788	-1.128	-0.367	-0.311	-1.531
Agriculture	-5.456	-0.210	-0.248	-1.384	-2.445	-1.170
Forestry	-0.168	-0.005	-0.006	-0.106	-0.033	-0.018
Fishery	-0.301	-0.031	-0.023	-0.168	-0.042	-0.037
Mining	-0.306	-0.005	-0.014	-0.122	-0.153	-0.012
Construction	1.454	-0.241	0.028	0.604	1.052	0.011
Manufacturing	-3.696	-0.955	-1.114	-1.532	0.188	-0.284
Wholesale	1.705	-0.119	0.103	1.217	0.571	-0.067
Finance	0.424	-0.020	0.038	0.213	0.184	0.007
Transportation	-0.393	-0.086	-0.188	-0.231	0.142	-0.031
Services	1.598	-0.088	0.281	0.881	0.413	0.110
Government	-0.000	-0.032	0.012	0.239	-0.191	-0.029
Unclassifiable	0.012	-0.001	0.001	0.006	0.006	0.000

Table 11. Employment Rate Effect on Industry-Specific Crude Employment Rates, Females, 1950-1980

(Unit: %)

Industry	Age Groups					
	All Ages	15-19	20-24	25-39	40-59	60+
<u>1950-1960</u>						
All	2.947	0.503	0.765	0.931	0.758	-0.010
Agriculture	-8.299	-2.099	-1.849	-2.118	-1.852	-0.381
Forestry	0.152	-0.000	0.019	0.056	0.065	0.012
Fishery	0.198	0.011	0.006	0.081	0.075	0.025
Mining	-0.081	-0.032	-0.032	-0.014	-0.002	-0.001
Construction	0.584	0.022	0.070	0.189	0.275	0.028
Manufacturing	4.043	1.389	1.080	0.863	0.680	0.031
Wholesale	3.420	0.810	1.011	0.684	0.724	0.191
Finance	0.439	0.041	0.078	0.179	0.131	0.011
Transportation	0.308	0.021	0.072	0.176	0.037	0.002
Services	2.540	0.481	0.477	0.830	0.671	0.080
Government	-0.285	-0.125	-0.148	0.018	-0.031	0.001
Unclassifiable	-0.086	-0.013	-0.015	-0.028	-0.024	-0.006
<u>1960-1970</u>						
All	-0.315	-1.649	0.068	-0.892	2.126	0.031
Agriculture	-8.833	-0.766	-1.547	-3.923	-1.887	-0.709
Forestry	-0.264	-0.019	-0.044	-0.103	-0.080	-0.018
Fishery	-0.183	-0.026	-0.027	-0.073	-0.038	-0.018
Mining	-0.087	-0.008	-0.015	-0.037	-0.026	-0.001
Construction	0.187	0.002	0.066	0.083	0.029	0.007
Manufacturing	3.195	-0.598	0.206	1.585	1.766	0.235
Wholesale	2.684	-0.060	0.774	0.900	0.823	0.247
Finance	0.672	0.100	0.244	0.039	0.237	0.052
Transportation	0.146	-0.025	0.000	0.043	0.121	0.008
Services	1.900	-0.242	0.379	0.573	1.011	0.178
Government	0.237	-0.009	0.020	0.019	0.165	0.042
Unclassifiable	0.024	0.002	0.004	0.007	0.009	0.002
<u>1970-1980</u>						
All	-3.339	-1.706	-0.073	0.111	-0.862	-0.808
Agriculture	-7.513	-0.142	-0.345	-2.507	-3.417	-1.101
Forestry	-0.035	-0.002	-0.001	-0.021	-0.009	-0.002
Fishery	-0.089	-0.006	-0.010	-0.042	-0.022	-0.009
Mining	-0.033	-0.002	-0.005	-0.011	-0.014	-0.001
Construction	0.496	-0.010	0.028	0.195	0.255	0.028
Manufacturing	-1.178	-0.961	-0.718	-0.149	0.638	0.013
Wholesale	1.765	-0.236	-0.057	1.137	0.836	0.085
Finance	0.705	-0.014	0.335	0.282	0.061	0.042
Transportation	0.032	-0.064	-0.030	0.021	0.093	0.011
Services	2.328	-0.255	0.713	1.084	0.672	0.114
Government	0.154	-0.016	0.012	0.110	0.040	0.007
Unclassifiable	0.027	-0.000	0.005	0.010	0.011	0.002

1950-1960. The negative age effects reflect the greater loss of male lives during World War II. Nevertheless, the positive effect of previous fertility decline is much more noticeable in the 25-39 group for males than for females. The same is true if we compare the 40-59 groups for the 1970-1980 period.

On an industry-by-industry basis, the positive effects of aging are greatest in agriculture for each period and for each sex. Although in 1950 agriculture employed the largest proportion in each age group, the exodus of young people from agriculture in the postwar period led to a very uneven age distribution of agricultural workers by 1980. Therefore, the negative age composition effects in agriculture for males 15-19 and 20-24 in the 1970-1980 period are not very large in comparison to those for manufacturing. In the manufacturing industry the loss of young males has been offset by the gain of older males, but the total age composition effect for 1970-1980 is only 0.184 percent in comparison to 0.834 for agriculture. In the first two decades female workers in manufacturing also were heavily concentrated in the two youngest groups, so the aging of the population has led to strong negative age composition effects for females in that industry. This phenomenon can be seen in general for industries in the lower portion of each of the panels for females. In other words, because the secondary and tertiary sector female workers have tended to be young, the aging of the population has led to negative age composition effects for those industries.

The only industry with a negative age composition effect for males is wholesale and retail trade for the 1970-1980 period. In 1970 this industry employed the second largest proportion of the 15-19 and 20-24 male groups, and in 1980 was the largest employer of each, so it was especially affected by the absolute decline in population in these age groups.

Turning to Tables 10 and 11, we see the overall decline in employment rates in the past two decades, especially for the youngest and oldest males and females. In the 1950s, young men and women made their big move from agriculture to manufacturing, to wholesale and retail trade, or to school. In the 1960s, more young people left agriculture, but the youngest group also showed a decline in employment in manufacturing, indicating school as the principal destination. In the 1970s, for every industry there was a decrease in the employ-

ment of 15-19 males and females. Also in the 1970s, there was a decline in the employment rate of the 20-24 groups in manufacturing. For females, this decline was partially offset by an increase in the employment rate in the service industry, which by 1980 was the largest employer of this group with 22.6 percent on the payroll.

For the oldest group, there have been increases in employment in the secondary and tertiary sectors to offset at least partially the decline in employment in agriculture. Females 60 and over have been drawn especially to wholesale and retail trade and to services, as have males to a lesser extent. Even so, in 1980 agriculture was still the number one employer of this age group with 7.6 percent of the females and 14.9 percent of the males or approximately one-third of the employed persons in each group.

In summary, changes in the age composition of the population in Japan in the postwar period have had significant effects on employment patterns. Most notable have been the passage of the baby boom cohort through the youngest groups of the labor force and the overall aging of the population. Nevertheless, these effects are small when compared with the changes that have taken place in age- and industry-specific employment rates. The postwar period has been one of rapid economic and social development in Japan, and this development has been reflected in shifts in industrial structure and in more education and more leisure, rather than employment, for some age groups.^{4/}

V. Age Structural Effects on Relative Wages

In the previous section, we have analyzed the effect of changes in age composition on the pattern of employment in postwar Japan. In addition to affecting overall employment, one might expect that changing age distribution would also influence the age-earnings profile. If workers of different ages are not perfect substitutes for each other in production, that is, if older workers do jobs different from those of younger workers, then we would expect that a change in the relative supply of the two age groups of workers would have an effect on the relative wages of the groups. In her earlier work, Martin (1982a) investigated changes in the Japanese age-earnings profile from 1962 to 1978. Her preliminary results indicated a negative cohort size effect on wages. We now have three more years of data, as well

as revised estimates of labor force size and wage data by industry, and will update and expand that analysis.^{5/}

The source of data for the analysis is the Basic Survey on Wage Structure (BSWS), which is conducted on an annual basis by the Ministry of Labour. Although it is nationwide in its coverage and the sample included 65,000 firms in 1981, this survey is limited in that it covers only firms with ten employees or more, thus excluding numerous small firms of the cottage-industry type. It should be noted also that BSWS does not collect information on the agriculture and government industries and that data on the service industry is not available for every year, so it has been excluded from our analysis.

Figures 2 and 3 depict the age-earnings profiles in selected years for males and females respectively. Both males and females are grouped into the following six age categories: 20-24, 25-29, 30-34, 35-39, 40-49, 50-59, and 60+. In these graphs, the age-earnings profile is represented by the ratio of average monthly earnings (excluding bonuses) for each age group to earnings of the age group 20-24. The age-earnings profile for males fell from 1962 to 1973. From 1973 to 1974, there was little change, but from 1975 to 1981 the differentials in relative earnings among age groups expanded again, thus making the age-earnings profile for 1981 similar to that for 1966.

The age-earnings profile for females is quite different from that for males. Generally, there are two peaks reflecting the segmented careers of most women. As mentioned earlier, traditionally Japanese females have left the labor force when they married or, more recently, when they began childbearing, and then returned when the children left home. Because they have not been part of the lifetime employment system, because they generally have not had long stretches of uninterrupted service, and because, even if they did, they were not rewarded as much for seniority as their male counterparts, the female age-earnings profile is much flatter (note the larger scale, as well as the shape). However, the pattern of change in the profile is similar to that for males. In the 1960s and early 1970s, the female profile fell, but in the last half of the 1970s increased. Another notable change in the female age-earnings profile has been in the age at which earnings are the highest: from the thirties in the 1960s to the late twenties in the early 1970s and to the fifties in the late 1970s.

Let us now examine the sources of these changes in the age-

FIGURE 2
 RATIO OF AVERAGE MONTHLY EARNINGS
 FOR EACH AGE GROUP TO EARNINGS OF 20-24 GROUP,
 JAPANESE MALES, 1962, 1966, 1974, 1981

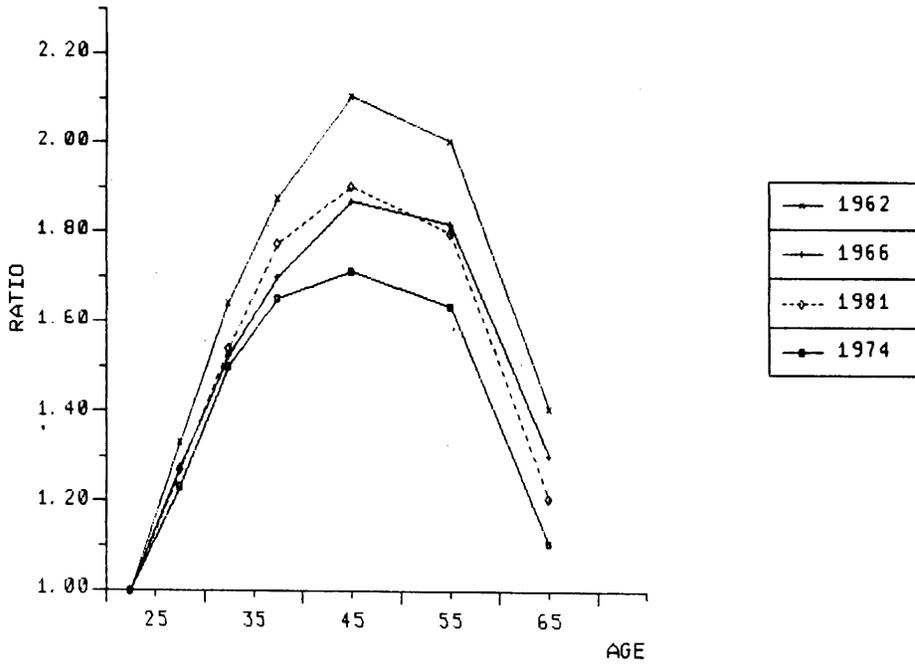
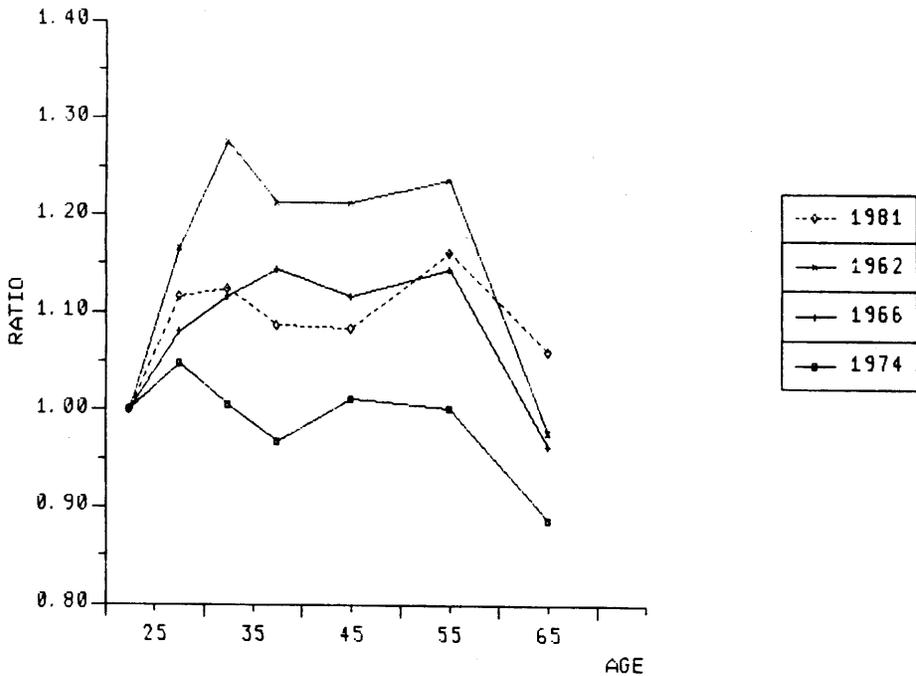


FIGURE 3
 RATIO OF AVERAGE MONTHLY EARNINGS
 FOR EACH AGE GROUP TO EARNINGS OF 20-24 GROUP,
 JAPANESE FEMALES, 1962, 1966, 1974, 1981



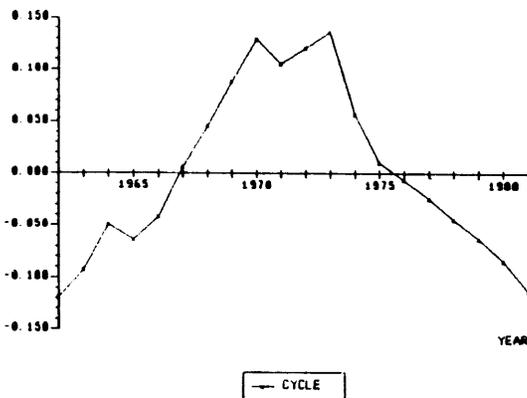
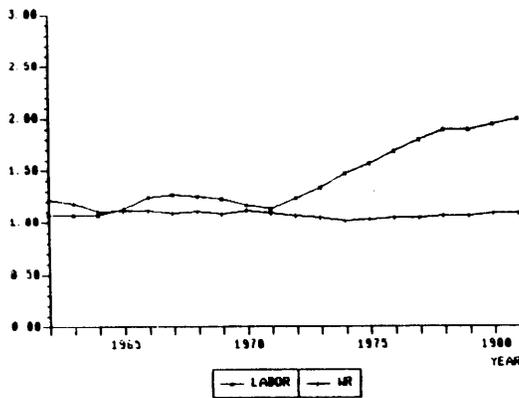
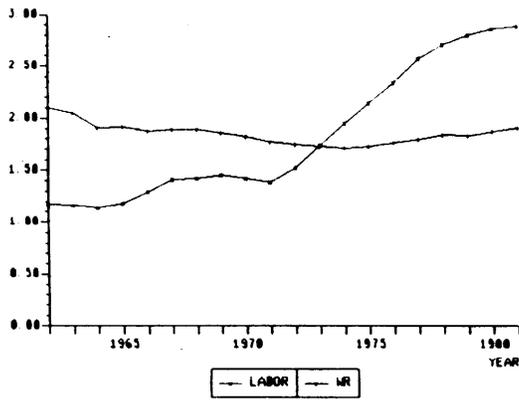
earnings pattern. Using data from 1962 to 1981, we have undertaken several regression analyses. The dependent variable we use is the wage ratio (WR) or the ratio of earnings of workers ages 40-49 to earnings of workers 20-24. As explanatory variables we use: (i) CYCLE, the deviation of the logarithm of real gross domestic product (GDP) from its trend (Economic Planning Agency, 1975, 1982, and 1983a), and (ii) LABOR, the ratio of the labor force size for ages 40-49 to that for 20-24 (Ministry of Labour, Annual Report on the Labour Force Survey, various years).

The first explanatory variable is expected to reflect the influence of changes in the general economic situation on the age-earnings profile. It might be expected that because of employers' greater commitment to and investment in older workers and because of their desire to attract young workers in high-growth periods, there would be a negative relationship between the dependent variable and the economic growth variable. That is, young workers would do relatively well in boom periods, but older workers would not be so negatively affected as younger workers in slow-growth periods.

The variable LABOR is incorporated in our analysis to represent the effect of age structural changes on relative wages.^{6/} Although changes in the educational attainment of the age groups 20-24 and 40-49 might be another possible explanatory variable, it has not been included in the present study for two reasons. First of all, data on the educational attainment of these two age groups are not available for each year of the period under consideration. Secondly, there is fragmentary evidence that changes in the age-earnings profile occurred independently of changes in the educational attainment of these age groups (Martin, 1982a).

Before presenting the regression results, let us briefly discuss how the dependent and explanatory variables have changed over time. Figure 4 displays the levels and trends of these key variables over the period 1962-1981. The top panel of Figure 4 shows the changing patterns of the wage ratio (WR) and the labor force ratio (LABOR) for males. The wage ratio declined almost monotonically from 2.104 to 1.870 over the period 1962-1966. It then climbed briefly to 1.888 in 1967 and 1.891 in 1968 before resuming its decline to a minimum value of 1.711 in 1974. The wage ratio increased the rest of the decade and reached 1.901 in 1981. LABOR increased steadily from a value of 1.172

FIGURE 4. MOVEMENT OF KEY VARIABLES, 1962-1981



in 1962 to 1.452 in 1969, when the effect of the baby boom cohort on the 20-24 group became apparent. Those born between 1947 and 1949 were 20 to 22 years old in 1969. Accordingly, the labor ratio declined for two years before resuming its increase throughout the rest of the 1970s, as the Japanese population aged. In 1981 the labor ratio for males was 2.883.

Similar patterns of change are followed by the wage and labor ratios for females in the middle panel of Figure 4, although the changes are not so great as for males. The female wage ratio declined from a high of 1.213 in 1962 to a minimum of 1.012 in 1974 and then increased to 1.084 in 1981. The labor ratio increased from 1.066 in 1962 to 1.262 in 1967 and then fell to 1.131 in 1971. By 1981, the female labor ratio had a value of 1.989. The male labor ratio is always higher because male participation at ages 40-49 is higher than at ages 20-24, whereas the reverse is true for females.

In general, until around 1974 the wage ratios and labor ratios moved in opposite directions. However, after 1974 all of these ratios increased. In contrast, as shown in the bottom panel of Figure 4, throughout the period under consideration the cycle variable moved in a direction opposite to the wage ratios. The high-growth period of the late 1960s and early 1970s coincided with the lowest values of the wage ratios.

Now, let us discuss the wage ratio regression results. The upper panel of Table 12 summarizes the results of the regression analysis of the natural logarithm of the wage ratio for males 40-49 relative to males 20-24, using the natural logarithm of the labor force ratio and the business cycle indicator as explanatory variables separately and jointly. When entered into a regression equation by itself, the labor force ratio has a negative, but insignificant, effect on the total monthly earnings ratio. When combined with the cycle variable, however, the labor force ratio does have a significant negative effect. The cycle variable by itself explains slightly more than 40 percent of the variation in the wage ratio.

The lower panel of Table 12 presents the regression results for females. Unlike males, the labor force ratio by itself shows a significant negative effect upon the female wage ratio, whereas the cycle variable alone does not have a significant effect. But, like the case of males, the equation with both variables shows significant negative

Table 12. Results of Regression Analysis for Males and Females, Ages 40 to 49 versus Ages 20 to 24, 1962 to 1981

Sex	Constant	Explanatory Variables		\bar{R}^2
		LABOR	CYCLE	
Males	0.6490	-0.0663 (0.0343)	--	0.1262
	0.6128	--	-0.4453* (0.1126)	0.4351
	0.6623	-0.0905* (0.0188)	-0.5163* (0.0767)	0.7475
Females	0.1183	-0.1151* (0.0376)	--	0.3057
	0.0808	--	-0.2259 (0.1121)	0.1389
	0.1301	-0.1514* (0.0259)	-0.3411* (0.0694)	0.6962

Values in parentheses below each coefficient are standard errors.

* significantly different from zero at the five percent level.

effects for both.

The above regression results were based on the wage ratio between the two age groups 40-49 and 20-24. Tables 13 and 14 present the wage ratio regression results for other age group combinations for males and females respectively. We present only the results for the equations in which both explanatory variables are entered. The results are fairly consistent. For males, there is a negative CYCLE effect for all age combinations, and a negative LABOR effect for all except 35-39/25-29 and 30-34/25-29. The implication is that these age groups are more substitutable for one another than the others. For females, four of the combinations show negative LABOR effects: 40-49/25-29, 35-39/20-24, 30-34/20-24, and 25-29/20-24. Five of the combinations have negative CYCLE effects, and these effects are especially large

Table 13. Results of Regression Analysis for Males, Various Age Groups, 1962 to 1981

Age Groups	Constant	Explanatory Variables		\bar{R}^2
		LABOR	CYCLE	
40-49/35-39	0.1487	-0.1560* (0.0143)	-0.0790* (0.0236)	0.8784
40-49/30-34	0.2376	-0.1452* (0.0203)	-0.2170* (0.0340)	0.8905
40-49/25-29	0.3911	-0.0713* (0.0289)	-0.3640* (0.0534)	0.7443
35-39/30-34	0.0981	-0.0882* (0.0360)	-0.1654* (0.0264)	0.8715
35-39/25-29	0.2870	-0.0182 (0.0362)	-0.2722* (0.0374)	0.7309
35-39/20-24	0.5398	-0.0475* (0.0225)	-0.3844* (0.0606)	0.6682
30-34/25-29	0.1836	-0.0191 (0.0212)	-0.0712* (0.0283)	0.1852
30-34/20-24	0.4406	-0.0599* (0.0184)	-0.2163* (0.0556)	0.4499
25-29/20-24	0.2597	-0.0663* (0.0183)	-0.1322* (0.0504)	0.4080

Values in parentheses below each coefficient are standard errors.

* significantly different from zero at the five percent level.

for the 35-39/20-24 and 30-34/20-24 combinations. For the 40-49/35-39 group there are positive coefficients for both LABOR and CYCLE. There is also a positive CYCLE coefficient for 40-49/30-34. We obtain similar results when we use the population ratio as an explanatory variable instead of LABOR, so it is not the case that higher wages are inducing greater participation of the 40-49 group relative to the 35-39 group. We speculate that these positive coefficients stem from the peculiarities of the female labor market, but do not have a

Table 14. Results of Regression Analysis for Females, Various Age Groups, 1962 to 1981

Age Groups	Constant	Explanatory Variables		\bar{R}^2
		LABOR	CYCLE	
40-49/35-39	-0.0952	0.1711* (0.0346)	0.1999* (0.0401)	0.7777
40-49/30-34	-0.0207	0.0219 (0.0312)	0.3633* (0.0476)	0.8197
40-49/25-29	0.0827	-0.1300* (0.0355)	0.0067 (0.0562)	0.4073
35-39/30-34	-0.0060	-0.1078 (0.1342)	0.1760 (0.0958)	0.0810
35-39/25-29	-0.0219	0.0221 (0.1209)	-0.3289* (0.1174)	0.2446
35-39/20-24	-0.0228	-0.3097* (0.0632)	-0.8178* (0.1202)	0.7068
30-34/25-29	-0.0044	-0.0355 (0.0634)	-0.4565* (0.0772)	0.6365
30-34/20-24	-0.0173	-0.2618* (0.0443)	-1.0143* (0.0959)	0.8590
25-29/20-24	0.0548	-0.0917* (0.0271)	-0.2805* (0.0576)	0.5352

Values in parentheses below each coefficient are standard errors.

* significantly different from zero at the five percent level.

precise explanation at hand.

Although the results are not shown in the tables, we should mention that for males the cycle variable alone has a significant negative effect on the wage ratio in all but one case (40-49/35-39). There is a negative coefficient for the labor ratio variable alone for the 40-49/35-39, 40-49/30-34, 35-39/30-34, and 25-29/20-24 combinations. For females, LABOR has a negative effect for the 40-49/25-29 case and a positive effect for 40-49/35-39 and 40-49/30-34. CYCLE has

a positive effect for the last two combinations and a negative effect for 35-39/25-29, 35-39/20-24, 30-34/25-29, 30-34/20-24, and 25-29/20-24. In general, the cycle variable appears to play a more important role than the labor ratio in the determination of the wage ratio.

To identify sources within the economy of the negative age compositional effects on relative wages at the macro level, we have re-estimated the same equations on the basis of industry-specific time-series wage and economic growth data. Only the labor data used here are at the national level. The industries included in these regressions are (i) mining, (ii) construction, (iii) manufacturing, (iv) finance and insurance, (v) wholesale and retail trade, (vi) transportation and communication, and (vii) electricity, gas and water supply. We have concentrated on the 40-49/20-24 combination, so the results shown in Table 15 are comparable to those for all industries that were presented in Table 12.

Let us first discuss industries in which there is a significant negative cohort effect on the wage ratio. These industries are manufacturing, wholesale and retail trade, transportation and communication, and electricity, gas and water supply. In the manufacturing industry, the cohort size effect for males is larger than the case of all industries. The coefficients for the other industries with significant negative effects for males are similar to the overall results. For females, the size of the coefficients on the labor force ratio tend to be smaller than that for females in all industries.

These industry-specific regression results seem to suggest that especially for males the manufacturing industry is an important source of the negative sign for the coefficients on the cohort size variable at the aggregate national level. This result is not surprising, because the manufacturing industry employed over half the male workers included in our analysis for 1962 and 43.1 percent of those in 1981. For the males in the mining and finance industries, there are positive cohort size effects, but because these industrial labor groups are relatively small, their effects are masked at the aggregate level.

VI. Summary and Concluding Remarks

The Japanese population has undergone considerable change in its age composition in the postwar period. After the postwar baby boom

Table 15. Industry-Specific Wage Ratio (40-49/20-24) Regression Results for Males and Females, 1962-1981

Industry/ Sex	Constant	Explanatory Variables		\bar{R}^2
		LABOR	CYCLE	
Mining/Males	0.3091	0.0518* (0.0244)	-0.1083 (0.1347)	0.1591
Mining/Females	0.0413	-0.0330 (0.0417)	-0.1293 (0.1510)	-0.0454
Construction/Males	0.4155	0.0118 (0.0187)	-0.2763* (0.0433)	0.6892
Construction/Females	-0.0155	0.0236 (0.0352)	-0.2127* (0.0533)	0.4771
Manufacturing/Males	0.6816	-0.1400* (0.0266)	-0.3484* (0.0830)	0.6547
Manufacturing/Females	-0.0085	-0.0664* (0.0269)	-0.1805* (0.0551)	0.3701
Finance/Males	0.8548	0.0751* (0.0294)	-0.2902* (0.1223)	0.3800
Finance/Females	0.4779	-0.1156 (0.0641)	-0.5110 (0.1745)	0.3043
Wholesale/Males	0.7881	-0.1037* (0.0170)	-0.4298* (0.0566)	0.8041
Wholesale/Females	0.1831	-0.1138* (0.0307)	-0.1826* (0.0669)	0.4404
Transport/Males	0.6071	-0.1276* (0.0238)	-0.3597* (0.0649)	0.7180
Transport/Females	0.3176	-0.0732* (0.0334)	-0.0872 (0.0597)	0.1600
Electricity/Males	0.8150	-0.0916* (0.0209)	-0.3305* (0.0617)	0.6690
Electricity/Females	0.5317	-0.1354* (0.0306)	0.2320* (0.0591)	0.7113

from 1947 to 1949, fertility declined dramatically, and the aging of the population that has already begun is expected to accelerate in the next several decades. In this paper we have shown how these changes in age distribution have affected employment patterns and wages in Japan. In both the major pieces of analysis of the paper we have found that age composition is an important factor, but not necessarily the most important one.

Certainly changing population age distribution has affected the age distribution of the work force and the employment patterns of the various industries. For example, in 1950 in the manufacturing industry 30.6 percent of the male employees and 57.0 percent of the female employees were under age 25, but by 1980 the percentages were 10.2 and 14.7 respectively. Nevertheless, the changes in age composition of the population took place at the same time that there were changes in labor force participation and in the industrial structure of the economy.

In the relative wage analysis, we found that the ratio of older to younger workers has a significant negative effect on the relative earnings of these groups. However, the oil shocks and recessions coincided with the passage of the baby boom through the younger age groups of the work force and with the overall aging of the population, so economic factors tended to outweigh demographic factors in the analysis. Therefore, we cannot argue that changes in population age distribution have been the most important determinants of the age distribution of the work force or of relative wages.

Even so, we continue to believe that age distribution has played an important role and will increase its role in these matters as time goes by. It is not surprising that the Japanese baby boom has not had the impact of the American baby boom. There is a great difference--a duration of 3 years versus 17. The former can get lost in a business cycle, while the latter stands out. What will demand greater attention is the aging of the Japanese population. Casual empiricism indicates the seriousness with which the Japanese view the problem. Surely the Japanese press devotes more inches of print to aging issues than any in the world. The Economic Planning Agency (1983b) in its recent Japan in the Year 2000 cites "the arrival of the aging society" as one of the three major trends in Japan's future. Several of the largest corporations have announced plans for encouraging early re-

tirement to lower their wage bills, at the same time that the government is pushing the companies to raise their official age limits.

What may indeed be fortuitous is the coincidence of the growing importance of the tertiary industries with the aging of the population. Employers in these industries seem to be willing to hire older workers. Of the total number of newly hired employees in 1981, 21.4 percent found their jobs in the service industry. Of newly hired employees age 55 and over, 30.9 percent found their jobs in services (Ministry of Labour, 1983b: 22). So even if workers must leave their "lifetime jobs" in their late fifties, opportunities may be open to them elsewhere. Moreover, Japanese workers seem to be willing to make these switches. There is a strong desire to work up through old age in Japan. As Ogawa and Suits (1983) found in their analysis of survey data, workers under age 55 have a strong preference for the extension of their working lives even if it means the sacrifice of increasing wages or of a handsome retirement benefit. Thus, we have probably seen only the beginning of the effect that the aging of the population will undoubtedly have on the seniority wage and lifetime employment systems in Japan.

VII. Acknowledgements

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Notes

- 1/ Nor are the systems universal for men. They do predominate, however, in the large companies. In 1981, over 70 percent of male workers were considered regular employees in nonagricultural industries (Ministry of Labour, 1983a: 123) and 39 percent were employees in companies with ten or more employees (Ministry of Labour, 1983b: 104).
- 2/ For an analysis of the age pattern of unemployment in Japan (Martin, 1982b).
- 3/ It should be noted also that in this decomposition technique the changes in age composition and in specific employment rates are assumed to occur linearly over time. For this reason, the value of the technique is limited when applied to longer-term analysis. Moreover, different age grouping may yield different results.
- 4/ One issue that we have not been able to address with the methodology employed above is that of the effect of age composition on employment. Another point that has not been made due to the limitations of the analysis is that there has been a significant increase in employment of females in Japan in the last half of the 1970s and in the early 1980s--females ages 20 to 49 have increased their labor force participation. Whether this change is a lasting one based on a revolution in women's roles or one reflecting the need for additional household income is yet to be seen (Martin, 1982b).
- 5/ Unfortunately, we still do not have access to individual level data, so we cannot carry out more sophisticated analysis of cohort size effects, such as has been done with United States data (Welch, 1979).
- 6/ In some of our preliminary analysis we used the ratio of the population, rather than labor force, ages 40-49 to that of 25-29. The results were virtually the same as those reported here. We also tried using the growth rate of GDP as our economic variable, but it exhibited large year-to-year fluctuations and did not contribute greatly to the explanation of the change in WR.

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