Effects of increased elderly employment on other workers' employment and elderly's earnings in Japan*

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Abstract

This paper examines the effect of increased elderly employment, mainly caused by the legal obligation of continued employment up to pension eligibility age enacted in 2006, on employment of other workers and elderly's own earnings. I find no evidence for substitution between young full-time workers and elderly workers, while there might be modest crowd out of middle-aged female part-time workers. I also find substantial decline in earnings of baby boomers, who reach 60 after 2006, in their early sixties. These results suggest that firms primarily cut wages of elderly workers, and some firms reduced the number of female part-time workers, in response to the mandated continued employment of elderly workers.

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1. Introduction

Aging population is emerging as a serious social concern in many developed countries. Among others, Japan has experienced very rapid aging in the past few decades. Given this fast aging population and resulting pressure on the social security system, the government of Japan has been trying to ensure that older people can continue to work longer. At the same time, there is a concern that the excessive protection of elderly employment may deprive youths of employment opportunities. In theory, however, it is not necessarily for employers to reduce the number of younger workers if wages of older workers fall sufficiently to absorb the increased labor supply. Thus, this paper examines whether the increase in the number of elderly workers affected employment of other age group, and whether there was any adjustment through elderly worker's wages.

Specifically, I focus on the changes around the revision of the Elderly Employment Stabilization Law (hereafter EESL) in 2006, which mandated employers to continue employment of their incumbents up to the pension eligibility age. Kondo and Shigeoka (2015) have shown that this policy intervention indeed increased employment rate among men in their early sixties, and the effect is concentrated to employees in large firms. In the first half of the empirical analysis, I try to shed light on how the mandated continued employment due to the EESL revision affects the employment volume of workers in various age-range and part-time/full-time status. The idea is that, if an establishment has more workers in their late fifties right before the EESL revision, it has more workers reaching age 60 after the EESL revision, whom it has to offer continued employment. In the second half of the empirical analysis, I explore whether there was any adjustment in wages of the elder workers.

Specifically, I examine whether the earnings decline at age 60 became wider for cohorts eligible for mandated continued employment by the EESL.

Existing studies show mixed evidence about the substitutability between elderly workers and younger workers. On the one hand, Gruber, Milligan and Wise (2010) argue that there is no evidence of tradeoff between elderly employment and youth employment, and rather there is a positive association between them, based on studies from 12 OECD countries. Munnel and Wu (2012), for the case of the United States, and Zhang (2012), for the case of China, also claim that there is no substitution between young and old workers. Earlier studies in Japan (Oshio, Shimizutani and Sato Oishi, 2010, and Nagano, 2014) also show no evidence for tradeoff between young and old workers. On the other hand, Vestad (2012) show almost one-to-one replacement of retired elderly and newly hired young workers in Norway, and Martins, Novo and Portugal (2009) show substitution between old and young female workers in Portugal.

Consistent with the first line of the literature, I find that the increased elderly employment is not associated with a decline in hiring of young full-time workers. However, I also find suggestive evidence that re-employed elderly workers may crowd out middle-aged part-time female workers. Furthermore, the analysis of earnings show significant fall in earnings of male baby boomers, who reached 60 after the EESL revision, in their early sixties. These results suggest that, in response to the mandated continued employment by the EESL, firms primarily cut wages of elderly workers, and some firms reduced the number of female part-time workers, but most firms do not decrease hiring of young workers.

The rest of the paper is organized as follows. Section 2 details institutional background. Section 3 analyzes the employment of other workers using the

Employment Trend Survey, and Section 4 analyzes earnings changes using the Basic Survey of Wage Structure. Section 5 concludes.

2. Institutional Background

2.1 Pension Reform Act and the EESL revision

Japan's population is aging rapidly. As of 2010, the population ratio of elderly (65 years or older) is 23.1% (Population Census of Japan, 2010), which is the highest among the OECD countries. This rapid aging put an enormous fiscal pressure on the social security system. To mitigate this fiscal pressure and slow down the contraction of the labor force, the government of Japan implemented two major reforms: the Pension Reform Act in 2001 and the revision of the EESL in 2006. Both reforms are intended to promote employment of people in their early sixties.

The Pension Reform Act implemented in 2001 gradually raises the eligibility age from 60 to 65 for the fixed part of the pension benefit. When the Pension Reform Act was implemented, many private firms set 60 as the mandatory retirement age. Since the eligibility age of pension for employed workers had also been 60 until 2001, most employees in private companies were able to work until they became eligible for the full pension benefit. However, because of the Pension Reform Act, those who turned 60 in April 2001 or later could no longer start to receive the full pension benefit at the age of 60.

This growing gap between the pension eligibility age and mandatory retirement age, which was still 60 in most firms, emerged as a serious social concern. To fill this gap, five years after the implementation of the Pension Reform Act, the government of Japan legally mandated employers to offer continuous employment until the pension eligibility age by a revision of the EESL. Beginning with those who turned

60 in April 2006 (i.e., born in April 1946), employers have to take at least one of the following three measures: 1) raise the mandatory retirement age to the pension eligibility age, 2) abolish mandatory retirement, or 3) set up a formal rule for employment extension or reemployment.

In reality, more than 80% of the firms chose the third option.[1] Reemployment after the mandatory "retirement" is quite common in Japan. Employees in Japan typically retire from regular employment (*seishain*) either in the month in which they reach turned 60 or at the end of the fiscal year during in which they reach turned 60. Here, the mandatory "retirement" in Japan merely means a termination of a so-called "life-time employment" contract. After this mandatory retirement, some workers leave the labor force or begin working for a new employer, but a substantial number of the "retired" employees are re-employed by the same employer on a different employment contract, namely as a non-regular workers, who is are typically paid much lower wages. The EESL revision legally mandated firms to offer such re-employment opportunities to all employees below the pension eligibility age.

Kondo and Shigeoka (2015) show that this revision actually increased the ratio of salaried workers among men in their early sixties, and the effect is concentrated to employees of large companies. Specifically, they find that the introduction of the mandated continued employment increased the population ratio of salaried workers at ages 60, 61 and 62 for the cohort born in 1946 by about 1-3 percentage point. They also find that this increase is mostly attributable to the increase in the employees at firms with 500 or more employees. In addition, the one year rise in the pension

[1] Among establishments with 30 or more employees, 81% of establishments still set 60 as the mandatory retirement age, and as of 2012, most of them had instituted an explicit rule for either reemployment (80%) or employment extension (20%) rather than extending the mandatory retirement age (General Survey on Working Conditions, MHLW, 2012).

eligibility age under this mandated continued employment increased the ratio of salaried workers at age 63 by about 4 percentage point.

It is important to note that, even before the EESL revision, no legal regulation prevented firms from hiring workers older than the mandatory retirement age of 60. Hence, the increase in employment of the elderly after the EESL revision can be viewed as a distortion caused by a government intervention. If the EESL forces employers to hire workers whom they would not hire otherwise, there must be some adjustment in response to this forced employment, through either changes in employment of workers in other age ranges or changes in wages of elderly workers themselves. Hence, I examine the former in Section 3 and the latter in Section 4.

2.2 Aging of Baby Boomers and "Year 2007 Problem"

The baby boom after the World War II was much more concentrated in Japan than other countries. The baby boomers in Japan are defined as those born in 1947-1949.[2] The cohort size of those born in 1947 is over 2.6 million, whereas that the cohort born in 1943 is 2.3 million.[3] Cohorts born in 1948 and 1949 also exceed 2.6 million, and then the cohort size shrinks to 2.3 million, the pre-WWII level, for the cohort born in 1950.

Consequently, in 2007, Japanese firms faced a sharp increase in the number of employees who reach 60, the mandatory retirement age. According to the Population Census 2010, the population size of those who reached 60 during November 2006-

[2] This definition is found in many official publications by Ministry of Health, Labour and Welfare.
[3] Numbers of births are taken from the Vital Statistics. Data for 1944-46 are not available because of the war.

October 2007[4] is about 2.15 million, whereas the population size of the cohort one year older is only about 1.34 million. This sharp increase in the number of employees reaching the mandatory retirement age is called "year 2007 problem (*2007-nen mondai*)" and widely publicized in media.

This "year 2007 problem" could have affected employers' behavior through the following two channels. First, the actual number of employees whom the employers have to offer continued employment increased, and wages and employment of other workers may have been adjusted accordingly. Second, in addition to the actual increase of the elderly workers, the publicized image about "year 2007 problem" may have worked as a trigger of drastic changes in wage structure and employment scheme. As pointed by Hamaaki et al (2012), population aging and prolonged economic stagnation brought pressure to flatten the wage-age profile of Japanese firms, which used to be much steeper than those in other developed countries. At the same time, as shown by Kawaguchi and Ohtake (2007) and Ariga and Kato (2010), wage cuts harms workers' productivity, and, due to the fear for that, many firms hesitate to cut wages. Under this circumstance, the "year 2007" problem might give the firms a good excuse to reform wage profiles.

3. Effects on Employment of Different Age and Type of Contract

3.1 Data: Establishment Panel Constructed from the Employment Trend Survey

The main source of data used in this section is the Employment Trend Survey (hereafter ETS), conducted by the Ministry of Health, Labor, and Welfare. I construct a panel of establishments from the ETS, although, as explained below, the matching

[4] Strictly speaking, the relevant population is those who reached 60 after April 2006; however, the best information available from the Population Census is the age as of October 31.

of the establishments over year is not perfect. Another limitation is that the ETS asks the number of employees in 5-year age range, not a single year age, thus the detailed cohort level analyses is not feasible. Even with these limitations, however, the ETS is the best available data for the analyses of employers' response to the EESL revision.

Unfortunately, the ETS does not keep a unique establishment identifier over the entire period, because it is not designed as panel data. However, the sampling weights of the ETS vary with the establishment size, and it is a complete survey for establishments with more than 500 employees. Thus, although the survey is designed as a repeated cross section, it is possible to construct a panel of establishments with more than 500 employees so long as the same establishment in different year's sample can be identified.

The respondents of the ETS are sampled from the list of establishments based on the Establishment and Enterprise Census (hereafter EEC), a complete survey of establishments conducted in every few years by the Statistics Bureau. The ETS respondents are re-sampled when a new list of establishments based on the new ECC becomes available, and the establishment ID within the ETS is renewed. Thus, the establishment ID within ETS can be linked only for a few years between the ECC.

For years 2004-2011, however, the identification number in the ECC is also available. Specifically, ETS 2004-2006 can be linked to ECC 2001, ETS 2007-2008 can be linked to ECC 2004, and ETS 2009-2011 can be linked to ECC 2006. Since the ECC provides the establishment ID in the previous ECC, I can link ETS 2004-2011 using the establishment ID available from the ECC.

Although ETS 2002 and 2003 are also sampled from ECC 1999, the establishment ID in the ECC is not available to me. Thus, I use prefecture, the number of employees and 2-digit industries to match establishments in ETS 2004 and

2003. This matching is not perfect; only about 60% of the establishments in 2003 survey are matched with those in 2004 survey. To link ETS 2002 with later years, I use the establishment ID within the ETS, which is common to 2003 and 2002 surveys.

I use the ratio of male full-time employee aged 55-59 as of the end of June 2003 as a proxy for the impact of the EESL revision in 2006 for each establishment. I choose 2003 as the base year because 2003 is the last year before the EESL revision was passed and announced in June 2004. I focus on male full-time workers, because in practice, the re-employment after mandatory retirement, which is mandated by the EESL, typically covers employees who were on full-time regular employment until the mandatory retirement age. Most women in the relevant cohort do not qualify for this condition.

For the outcome variable, I use the log number of employees and the ratio in total employment of the establishment for the following categories: total number of employees (log only), full-time employees, employees younger than 50, employees aged 50-59, employees aged 60 or older, full-time employees younger than 25, female part-time employees aged 35-55, and part-time employees aged 60 or older. The first two variables intended to see the effect on employment level, which could go either way: the increased number of elderly worker may push up the total employment, but if it suppress younger workers employment, total employment could fall. It is also *ex ante* ambiguous whether the number of employees younger than 50 will decrease. The effect on the number of employees aged 50-59 is expected to be negative; this is a mechanical effect in that, if the cohort size within firm is relatively large for those who were in their late fifties in 2003, that for younger cohorts should be small. Likewise, the effect on that on those aged 60 or older is expected to be positive. Full-time employees younger than 25 is intended to measure the degree of substitution or

complementarity between young and old workers, and female part-time employees is intended to capture substitution or complementarity between elderly men on re-employment contract and married women on non-regular contract.

Table 1 presents sample size and industry composition. The first column shows the sample used in the main analysis. I limited the sample to establishments that can be tracked at least from 2003 to 2008. Also, for comparison, I repeat the same analysis setting 2007 as the base year, instead of 2003. Column (2) shows the sample for this analysis, which includes establishments that can be tracked from 2006 to 2011. The industry compositions of the two samples are very similar. [5] Figure 2 shows the mean of outcome variables over years. Here, I pool the samples in two columns of Table 1 (of course many of them overlap).

3.2 Empirical Model

I estimate the following equation:

$$Y_{ijt} = \alpha + \sum_{\tau \neq 2003} \beta_\tau X_{ij} 1(t = \tau) + v_{jt} + u_i + \varepsilon_{ijt} \quad \ldots(1)$$

Where Y_{ijt} is the outcome variable of establishment i in industry j observed in year t, X_{ij} is the ratio of male full-time employees aged 55-59 among all male full-time employees in 2003. β_τ, the coefficient of X_{ij} , varies with year and is normalized to 0 in 2003, the base year. v_{jt} represents industry-year effect, and u_i represents the establishment fixed effect. ε_{ijt} is the remaining error, which may be correlated within establishment over time. To take into account for this potential correlation in ε_{ijt} , standard errors are clustered at the establishment level.

[5] Admittedly, the composition is not representative of the Japanese labor force because the sample is limited to large establishments that existed for long enough.

β_τ represents changes in the outcome variables for establishments that had more employees reaching age 60 under the legal obligation of continued employment until the pension eligibility age, relative to other establishments. If a plot of β_τ over τ shows some trend breaks around 2006, such a change in trend is likely to be attributable to the revision of the EESL implemented in 2006. On the other hand, if the plot of β_τ shows some secular trend, it may simply reflect a dynamic pattern of employee's age composition which is not related to the EESL. If so, changing the base year should not change such secular trends. To check this, I also estimate the same equation replacing the base year with 2007, one year after implementation of the revised EESL.

3.3 Results

Table 2 shows estimated β_τ in equation (1), the coefficients of the interaction term of the ratio of male full-time workers aged 55-59 in 2003 and year dummies. Column (1) shows that establishments that had relatively more male full-time employees in their late fifties before the EESL revision reduced their relative employment size. The size of the effect is, however, modest: 1% point increase in the share of male full-time workers aged 55-59 in 2003 reduces the total employment by at most 0.4% (in 2008). Furthermore, columns (2) and (3) show insignificant effects on full-time employees and those younger than 50.

As expected, columns (4) and (5) show that the number of employees in their fifties decreases and that in their sixties increases. This is a mechanical change, since those who were in their late fifties in 2003 become early sixties by 2008.

Interestingly, the ratio of male full-time workers aged 55-59 in 2003 has a significantly positive effect on the number of full-time employees younger than 25.

This implies that, even under the mandated continued employment under the EESL, employers hire young workers as more incumbent workers reach 60. In other words, hiring of new graduates increases as the number of workers who reach the mandatory retirement age, even if firms have to offer re-employment opportunities after the mandatory retirement. This result suggests that re-employed elderly workers do not perfectly substitute young full-time workers.

In contrast, there is a significantly negative effect for female part-time workers aged 35-54 after the EESL was revised in 2006. Moreover, the number of part-time employees aged 60 or older significantly increased. These results suggest that re-employed elderly workers, many of whom are part-time, and female part-time workers, many of whom are married and the secondary earner of the household, are substitutes.

Table 3 confirms the same pattern when the outcome variables are employment share, rather than the log of number of employees.

Table 4 show the estimated effect of the ratio of age 55-59 in 2007, instead of 2003, and Figure 2 compares the estimated β_τs in Tables 2 and 4. For some reason, the number of all employees, full-time employees, and employees younger than 50 are smaller in the base year (2007) than the other years, thus most of the coefficients are positive and many of them are statistically significant. This should be rather interpreted as an anomaly of 2007. For the number of employees in their fifties and sixties, and that of fulltime employees younger than 25, the same pattern as in Table 2 is observed. In contrast, female part-time workers do not decrease when the base year is set to 2007. This may imply that the substitution between female part-time workers and re-employed elderly workers are caused by the revised EESL, and once the adjustment was done, the number of female part-time workers stopped to decrease.

4. Effects on Elderly's Earnings

4.1 Data: Basic Survey of Wage Structure

The main source of data used in this section is the Basic Survey of Wage Structure (hereafter BSWS), conducted by the Ministry of Health, Labor, and Welfare. The BSWS is cross-sectional survey of establishments, and it asks surveyed establishments to choose their employees randomly and answer detailed information of their salaries, employment status, gender, age, and educational background. It also provides with information at the establishment level such as industry and firm size. I pool all workers in surveys conducted in 1998-2011.

As the outcome variable, I use the annual earnings excluding bonus. Over-time pay and other compensations are included. I exclude bonus because the survey asks monthly earnings in June of the survey year and bonus in the previous calendar year. This is particularly a problem when analyzing the wage change at the retirement and reemployment, because a 60-year-old worker who is currently on the re-employment contract may answer bonus that he received before the mandatory retirement.

I limit the sample to male regular employees aged 48-65 and born in 1943-1949. More precisely, since the BSWS includes only the age as of June of the survey year, and the EESL defines cohort as those born between April of the year and March of the next year, I define the cohort as (survey year – age – 1). Thus, the sample includes male regular employees born between July 1943 and June 1950.

Table 5 presents the summary statistics, and Figure 3 shows the earnings profile of age 55-65. As seen from the figure, earnings drop sharply at 60. The pre-60 annual earnings are on average about 5 million yen, and it drops to less than 4 million yen.

Figure 3 also shows how the profile has changed over different cohorts; the decline after age 60 is getting slightly steeper for younger cohorts.

4.2 Empirical Model

To measure the relative changes in earnings after age 60 for each birth-year cohort, I estimate the following equation:

$$\log \mathrm{Y}_{ci} = \beta_0 a_{ci} + \beta_1 a_{ci}^2 + 1(a_{ci} \geq 60)(\beta_2 + \beta_3 a_{ci} + \beta_4 a_{ci}^2)$$
$$+ \sum_{\theta \neq 1945} \gamma_\theta \, 1(\mathrm{c} = \theta) \times 1(a_{ci} \geq 60) + \delta \mathrm{X}_{ci} + \varepsilon_{ci} \quad \ldots(2)$$

Where a_{ci} is age of individual i who was born in year c, and the first half of the right hand side is intended to approximate the shape of earnings profile around age 60. The parameter of my interest is the coefficient of the interaction term between cohort dummy and dummy for being older than 60, γ_θ. It captures the differences in the drop in earnings at age 60 across cohorts. X_{ci} includes other control variables such as education, cohort dummies and calendar year dummies.

4.3 Results

Table 6 presents γ_θs, the estimated drop in earnings at age 60 of cohort θ relative to cohort 1945. Figure 3 plots the estimated coefficients in columns (1), (3) and (4) over θ. Column (1) reports estimates from the entire sample; the cohort born in 1947 and later experience larger declined in the earnings at age 60. The timing of earnings decline is one year later than the EESL revision, and coincides to the so-called "year 2007 problem." To put it another way, the baby boomers experienced larger earnings decline upon their mandatory retirement and re-employment. Column (2) confirms that the results do not change much when industry and firm size are controlled.

Columns (3) and (4) report the estimates from subsample of large and small firms. The decline in relative earnings of baby boomers for is much greater in large firms. This is consistent with the results of Kondo and Shigeoka (2015) that the increase in elderly employment due to the EESL is concentrated to large firms, because the mandatory retirement policy was implemented more strictly at large firms.

5. Conclusion

This paper has examined the effect of increased elderly employment, mainly caused by the legal obligation of continued employment up to pension eligibility age enacted in 2006, on employment of other workers and elderly's own earnings.

Consistent with the existing studies such as Gruber, Milligan and Wise (2010), I find no evidence for substitution between young full-time workers and elderly workers. As already pointed out by Böheim (2014), since youth unemployment is a pressing problem in many developed countries, many of which also suffer from population aging, the lack of trade-off between young and old workers has an important policy implication. Despite the popular perception, policies to promote elderly employment do not harm employment prospects of the young.

I also find substantial decline in earnings of baby boomers, who reach 60 after 2006, in their early sixties. Combined with the modest negative effect on middle-aged female part-time workers, it suggests that firms primarily cut wages of elderly workers, and some firms reduced the number of female part-time workers, in response to the mandated continued employment of elderly workers.

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Table 1. Summary statistics of the Employment Trade Survey

Establishments with 500 or more employees

	2002-2008, base year= 2003 (main sample)	2006-2011, base year=2007 (comparison)
Sample size in the base year	1021	835
Mean % of age 55-59 in male fulltime employees in the base year	9.0%	10.8%
Industry composition		
Manufacture	54.8%	57.5%
Information and communication	3.4%	3.2%
Trade	4.7%	4.3%
Finance	2.5%	1.8%
Medical and nursing	23.0%	21.4%
Other services	5.4%	7.3%
Other non-service industries	6.3%	4.4%

Figure 1: Mean of outcome variables in Employment Trade Survey, by year

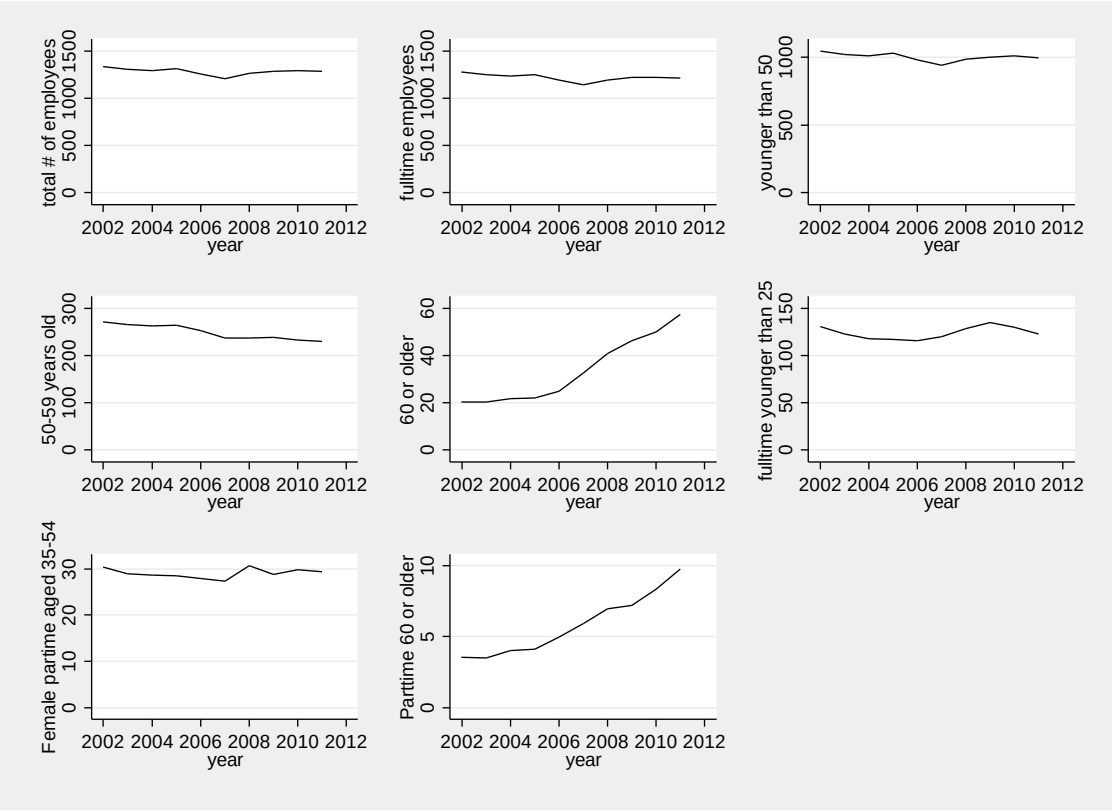

Table 2 The effect of the ratio of 55-59 years old in male fulltime workers in 2003 on log number of various type of employees

	(1) Total # of employees	(2) Full-time employees	(3) Younger than 50	(4) 50-59 years old	(5) 60 or older	(6) Full-time younger than 25	(7) Female part-time 35-54 years old	(8) Part-time 60 or older
Ratio of age 55-59 in 2003	0.060	0.0300	0.154**	0.012	-0.433*	0.074	-0.042	-0.178
×2002	[0.063]	[0.056]	[0.061]	[0.117]	[0.250]	[0.164]	[0.227]	[0.161]
Ratio of age 55-59 in 2003	-0.026	0.054	0.009	-0.251***	0.551**	0.705***	-0.143	0.474**
×2004	[0.036]	[0.052]	[0.038]	[0.092]	[0.235]	[0.213]	[0.198]	[0.201]
Ratio of age 55-59 in 2003	-0.120*	-0.017	-0.052	-0.613***	1.035***	0.995***	-0.137	0.574**
×2005	[0.069]	[0.078]	[0.074]	[0.195]	[0.309]	[0.314]	[0.236]	[0.284]
Ratio of age 55-59 in 2003	-0.238***	-0.101	-0.115	-1.007***	1.437***	1.365***	-0.331	0.987***
×2006	[0.077]	[0.091]	[0.093]	[0.262]	[0.398]	[0.360]	[0.259]	[0.336]
Ratio of age 55-59 in 2003	-0.245	0.164	0.082	-1.836***	1.318*	2.404***	-0.999**	0.783*
×2007	[0.165]	[0.256]	[0.212]	[0.541]	[0.677]	[0.684]	[0.508]	[0.467]
Ratio of age 55-59 in 2003	-0.415***	-0.206	-0.107	-2.098***	1.328***	1.648***	-0.570*	1.147**
×2008	[0.103]	[0.135]	[0.139]	[0.501]	[0.504]	[0.502]	[0.319]	[0.467]
Observations	6,728	6,728	6,728	6,728	6,728	6,728	6,728	6,728
R-squared	0.033	0.021	0.025	0.100	0.270	0.065	0.046	0.093
Number of establishments	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021

Table 3 The effect of the ratio of 55-59 years old in male fulltime workers in 2003 on employment share of various type of employees

	(1) Full-time employees	(2) Younger than 50	(3) 50-59 years old	(4) 60 or older	(5) Full-time younger than 25	(6) Female part-time 35-54 years old	(7) Part-time 60 or older
Ratio of age 55-59 in 2003	0.000	0.040***	-0.023	-0.017**	-0.032***	-0.006	-0.002
×2002	[0.011]	[0.013]	[0.015]	[0.008]	[0.009]	[0.009]	[0.003]
Ratio of age 55-59 in 2003	0.000	0.023*	-0.036***	0.013***	0.048***	-0.011*	0.005***
×2004	[0.006]	[0.012]	[0.014]	[0.004]	[0.011]	[0.006]	[0.002]
Ratio of age 55-59 in 2003	0.007	0.048	-0.084**	0.036***	0.088***	-0.024***	0.011**
×2005	[0.015]	[0.030]	[0.034]	[0.007]	[0.019]	[0.008]	[0.004]
Ratio of age 55-59 in 2003	0.009	0.091**	-0.137***	0.046***	0.112***	-0.036**	0.011***
×2006	[0.020]	[0.044]	[0.050]	[0.010]	[0.024]	[0.016]	[0.004]
Ratio of age 55-59 in 2003	0.124*	0.217**	-0.278***	0.061**	0.161***	-0.134**	0.009
×2007	[0.073]	[0.101]	[0.106]	[0.026]	[0.037]	[0.066]	[0.006]
Ratio of age 55-59 in 2003	0.005	0.208**	-0.336***	0.128***	0.150***	-0.062**	0.014**
×2008	[0.028]	[0.082]	[0.110]	[0.033]	[0.033]	[0.025]	[0.006]
Observations	6,728	6,728	6,728	6,728	6,728	6,728	6,728
R-squared	0.032	0.072	0.121	0.161	0.115	0.048	0.056
Number of establishments	1,021	1,021	1,021	1,021	1,021	1,021	1,021

Table 4 The effect of the ratio of 55-59 years old in male fulltime workers in 2007 on log number of various type of employees

	(1) Total # of employees	(2) Full-time employees	(3) Younger than 50	(4) 50-59 years old	(5) 60 or older	(6) Full-time younger than 25	(7) Female part-time 35-54 years old	(8) Part-time 60 or older
Ratio of age 55-59 in 2007	0.553***	0.614**	0.900***	-0.122	-1.467***	1.374***	0.484	-0.59
×2006	[0.191]	[0.244]	[0.235]	[0.262]	[0.412]	[0.424]	[0.786]	[0.401]
Ratio of age 55-59 in 2007	0.295*	0.307	0.831***	-1.222***	-0.367	1.641***	0.431	0.542
×2008	[0.178]	[0.232]	[0.218]	[0.248]	[0.416]	[0.405]	[0.739]	[0.376]
Ratio of age 55-59 in 2007	0.384*	0.371	1.130***	-1.859***	0.228	1.887***	0.827	0.576
×2009	[0.199]	[0.256]	[0.269]	[0.281]	[0.484]	[0.509]	[0.764]	[0.577]
Ratio of age 55-59 in 2007	0.243	0.225	1.114***	-2.649***	0.216	1.895***	0.942	1.073**
×2010	[0.192]	[0.252]	[0.222]	[0.291]	[0.512]	[0.469]	[0.846]	[0.523]
Ratio of age 55-59 in 2007	0.411*	0.395	1.468***	-3.156***	0.465	2.485***	1.268	1.213**
×2011	[0.221]	[0.282]	[0.272]	[0.331]	[0.517]	[0.524]	[0.864]	[0.510]
Observations	4,840	4,840	4,840	4,840	4,840	4,840	4,840	4,840
R-squared	0.055	0.044	0.079	0.144	0.305	0.087	0.058	0.094
Number of establishments	835	835	835	835	835	835	835	835

Figure 2 The effects of the ratios of 55-59 years old in male fulltime workers in 2003 and 2007 on selected outcomes (log number of employees)

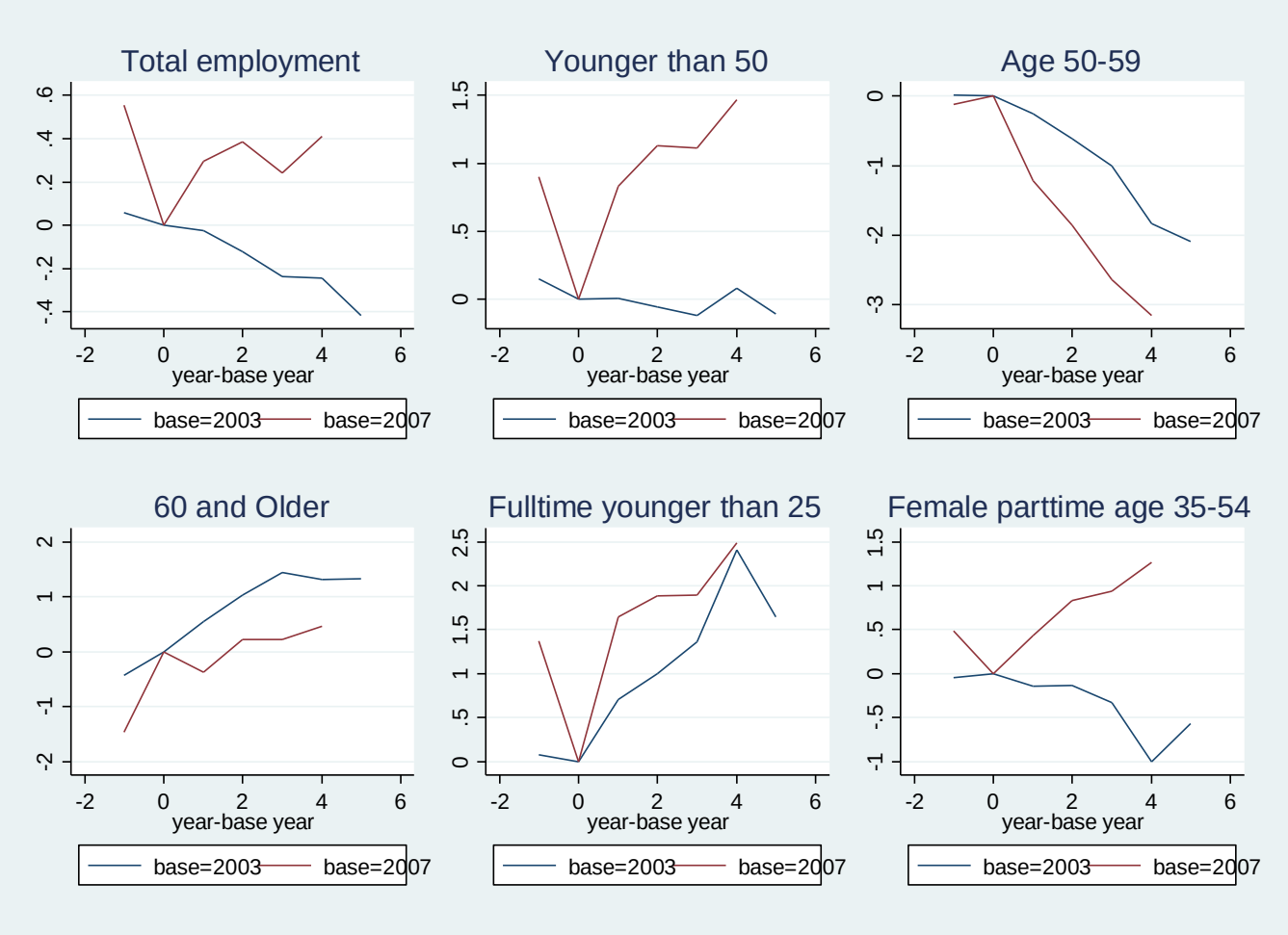

Table 5 Summary Statistics of the Basic Survey of Wage Structure

Male regular employees 48-65 years old, born in 1943-1949

Sample size (total)	1,357,477
Annual earnings excluding bonus (thousand yen)	4984.0
Log annual earnings	8.42
Education	
Junior high school	19.8%
High school	55.6%
Tech/Junior college (2 year)	3.7%
4yr College and more	20.9%
Firm size	
Large (500 or more)	38.8%
Medium (100-499)	23.5%
Small (less than 100)	37.7%

Figure 3 Earnings profile of age 55-65, by cohort

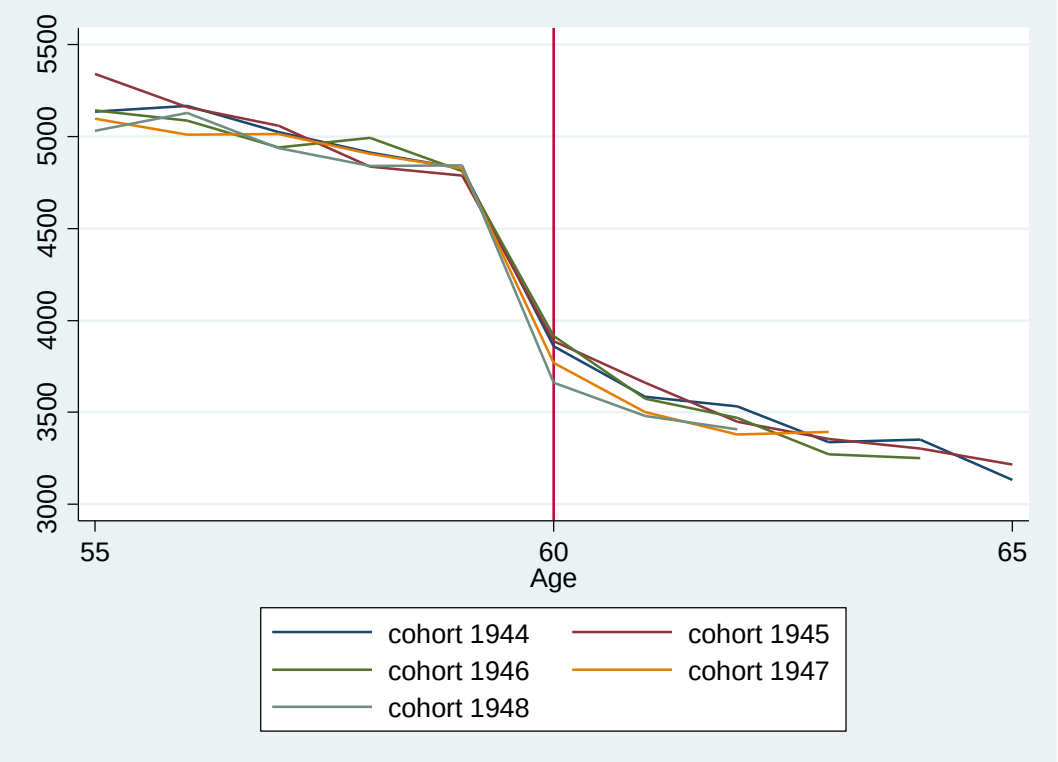

Table 6 The estimated drop in earnings at age 60 by cohort, relative to 1945 cohort

	(1)	(2)	(3)	(4)
Sample	All	All	Large firm (emp>500)	Small firm (emp<100)
Cohort 1943	-0.001	0.004	-0.005	-0.006
	[0.010]	[0.010]	[0.020]	[0.014]
Cohort 1944	0	0.004	-0.001	-0.006
	[0.010]	[0.010]	[0.022]	[0.014]
Cohort 1946	-0.001	-0.012	-0.013	0.01
	[0.009]	[0.009]	[0.018]	[0.012]
Cohort 1947	-0.018*	-0.031***	-0.036*	-0.017
	[0.010]	[0.010]	[0.019]	[0.014]
Cohort 1948	-0.034***	-0.045***	-0.076***	-0.022
	[0.012]	[0.012]	[0.023]	[0.016]
Cohort 1949	-0.066***	-0.077***	-0.104***	-0.041**
	[0.015]	[0.015]	[0.032]	[0.020]
Control for Industry and firm size	No	Yes	No	No
Observations	1,357,477	1,307,879	526,316	512,090
R-squared	0.247	0.352	0.316	0.143

Figure 4 The estimated drop in earnings at age 60 relative to 1945 cohort, by cohort and firm size