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Research Article

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Pension Reform and Improved Employment Protection: Effects on Older Men's Employment Outcomes

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Abstract: This study examines the impacts of demand-side (the improved employment protection law) and supply-side (pension reform) government interventions on older male workers' employment outcomes in Japan. To identify the effects of interventions implemented concurrently, we employ a difference-in-difference-in-differences (DDD) approach with variation in the bindingness of the revision of employment protection law as our specification strategy. Our results show that the revised employment protection law had a significant positive impact on employment. However, the results of the event study's DDD model show that the treatment effects do not last over time.

Keywords: employment promotion policy; older adult employment; pension reform

JEL Classification: J14; J18; J21; J23

List of Abbreviations

DDD	Difference-in-difference-in-differences
DID	Difference-in-differences
EESL	Elderly Employment Stabilization Law
EPI	Employee's Pension Insurance
LSMEP	Longitudinal Survey of Middle-aged and Elderly Persons
MHLW	Japan's Ministry of Health, Labour, and Welfare

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1 Introduction

Population aging is a common concern for many developed countries. Among them, Japan has the highest ratio of older adults (65 years or older), which was 28.9 % in 2021 and is still increasing (Cabinet Office 2022). As the aging population, along with the low fertility rate, has become a serious threat to the social security system, the Japanese government has continuously conducted pension reforms and policy revisions to promote older people's employment. The Japanese government implemented the Pension Reform Act, which gradually increased the pensionable age from 60 to 65 for two components of public pension benefits for employees: a fixed amount in 1994 and a remuneration-based amount in 2000. Moreover, the Elderly Employment Stabilization Law (EESL) was revised in 2006 and 2013 to further stimulate the employment of older adults.

We assume that there are two types of government interventions in the labor market: demand-side interventions, such as anti-discrimination laws or a ban on mandatory retirement; and supply-side interventions, which affect workers' incentives to work. In the Japanese context, extending the pension-eligible age is a supply-side government intervention, and strengthening the EESL is a demand-side government intervention. We examine the impacts of the 2013 EESL revision and pension reform on older male workers' employment outcomes in Japan using the Longitudinal Survey of Middle-aged and Elderly Persons (LSMEP).

This study is related to the literature identifying the effects of demand-side government intervention on employment. An extensive body of literature focuses on the anti-age discrimination laws or ban on mandatory retirement in the North American labor market from the 1960s to the 1980s. It evaluated the effect of prohibiting mandatory retirement in the United States (Adams 2004; Ashenfelter and Card 2002; Neumark and Stock 1999) and Canada (Shannon and Grierson 2004), using state- or province-specific changes in legislation. As reviewed in Neumark (2003), the literature finds that increasing employment protection for older workers has a positive but overall modest effect on their labor-force participation. With respect to Japan, the EESL, which is considered to be a demand-side intervention, does not address age discrimination. Instead, it encourages employers to hire incumbents, aged 60 to at least 65, through direct enforcement. Studies have shown that the 2006 EESL revision increased the employment rate among older workers (Kondo and Shigeoka 2017; Yamamoto 2008).

This study is also related to the research on the effect of supply-side government intervention on older adults' work incentives through changes in social security benefits (Atalay and Barrett 2015; Behaghel and Blau 2012; Engels et al. 2017; Gustman and Steinmeier 2005; Hanel and Riphahn 2012; Krueger and Pischke 1992;

Mastrobuoni 2009; Staubli and Zweimüller 2013). The results of these studies suggest that a reduction in social security benefits or an increase in the eligible age for social security has positive effects on the labor supply among older adults. Kondo and Shigeoka (2017) compared two Japanese cohorts and found a significant impact of the extension of the pensionable age on employment.

Although most previous literature examined the effect of demand- or supply-side interventions, demand-side interventions tend to be implemented concurrently with supply-side interventions. This is because the government wants to promote older adults' employment to compensate for their income loss from decreased social security benefits. Neumark and Song (2013) investigated the complementarity of demand- and supply-side government interventions. By examining state-level variation in age discrimination laws in the United States, they found that stronger age discrimination protections enhanced the positive impact of social security reforms (increasing the full retirement age and reducing benefits) on older adult employment.

The 2013 EESL revision in Japan was also enacted contemporaneously with the extension of the pensionable age for a remuneration-based part of the employees' public pension benefit. Yamada (2017) and Jiang (2023) examined the combined effects of the two interventions. Yamada (2017) found that the combined effects of EESL revision and pension reform on employment are positive. In contrast, Jiang (2023) concluded that the combined effects on employment were insignificant.

Although the two sides of interventions are difficult to disentangle, Rabaté (2019) identifies a labor-demand effect on retirement by using a unique natural experiment. He focused on the variation in mandatory retirement legislation across different industries. Employing a difference-in-difference-in-differences (DDD) approach, he found that exit rates from employment were higher when mandatory retirement was possible.

In this study, we exploit the DDD approach to examine the impacts of the 2013 EESL revision and pension reform on older male workers' employment outcomes.[1] Considering that the pensionable age was concurrently raised when the EESL was tightened, it is difficult to sort out the effects of the two sides of interventions by simply comparing affected and unaffected cohorts. To decompose the combined effects of the two interventions into the effects of pension reform and the EESL revision, we utilize the difference in the bindingness of the EESL revision within each

1 The analysis in this study is restricted to Japanese males. In Japan, women are more likely to quit their jobs after marriage and childbirth than those in other developed countries. Some women return to work after childbirth, whereas others do not. As Kondo and Shigeoka (2017) point out, few women remain in full-time employment until they reach the mandatory retirement age. Thus, working status is quite different between males and females during their careers.

cohort. Specifically, we exploit companies' mandatory retirement age variations across companies. The DDD model compares the relative outcomes of treatment versus control groups for whom the 2013 EESL revision *was not* binding to the relative outcomes of treatment versus control groups for whom the 2013 EESL revision *was* binding. Employing the DDD approach can identify the effect of pension reform and consequently reveal the effect of the EESL revision. Moreover, we estimate the event study's DDD model to examine the dynamics of the treatment effects. The present study contributes to the previous literature by unraveling the effects of pension reform and the EESL revision.

The remainder of this paper is structured as follows: Section 2 describes the institutional background of two major policy reforms in Japan. Section 3 exhibits our empirical strategy and models. The data are explained in Section 4. Estimated results are shown in Section 5, and Section 6 concludes the study.

2 Institutional Background

2.1 Japanese Public Pension System and the Previous Pension Reforms

The Japanese public pension system consists of two subsystems: the first is an earnings-related "Employee's Pension Insurance (EPI)" for mainly regular workers for businesses with five or more employees and for public servants, and the second is a flat-rate "National Pension" for individuals not covered by the EPI. Enrollment in one of these subsystems is mandatory for individuals.

The EPI benefits consist of two parts: a fixed amount and a remuneration-based amount. The former is designed to be equivalent to the benefit provided by the "National Pension" and determined by the employees' enrollment period in the EPI. The latter is determined based on their remuneration and enrollment period in the EPI. While the amount of the remuneration-based part differs widely depending on earnings before retirement, either part of the pension counts as an important part of income among pensioners.[2] The pensionable age for both parts of the EPI was 60 years until 2000, but has since been raised through a series of pension reforms.[3]

2 According to the 2012 FY Annual Report of Employees' Pension Insurance and National Pension (Pension Bureau of Ministry of Health, Labour and Welfare), the average amount of pension benefits of the EPI, including both the fixed- and remuneration-based amounts, was 162,138 yen at the end of the fiscal year of 2012 (approximately 2000 USD with the exchange rate at that time). Without the fixed part, it was 76,790 yen (approximately 960 USD).

3 The pensionable age for the "National Pension" has been 65 since its establishment in 1961.

The Pension Reform Act of 1994 incrementally increased the pensionable age for EPI's fixed part from 60 to 65 years for male employees, starting in 2001. This reform resulted in male cohorts born in 1949 or later receiving the fixed part at 65 years of age, while the pensionable age for the remuneration-based part remained at 60 years of age. Kondo and Shigeoka (2017) examined the effects of the extension of the pensionable age for the fixed part of EPI on the employment of older adults using the Labour Force Survey. They compared cohorts born in 1944 (control group) who receive the EPI's fixed part at age 62 and those born in 1945 (treatment group) who receive it at the age of 63 and found a significant impact of the extension of the pensionable age on employment.

In 2000, another Pension Reform Act was undertaken to gradually increase the pensionable age for the EPI's remuneration-based part from 60 to 65 years for male employees, starting in 2013. Male cohorts born in 1953 and 1954 were the first to be affected by both of these reforms, as they began receiving pension benefits from the remuneration-based part at the age of 61.[4] Consequently, they would receive no pension at the age of 60.

2.2 Mandatory Retirement and the Previous Revisions of EESL

In Japan, most companies have a mandatory retirement policy wherein regular workers must retire at a certain age. Since the first major revision of the EESL in 1998, employers can no longer set a mandatory retirement age below 60.[5] Prior to the 2006 EESL revision, most Japanese employees generally retired in the month they turned 60. However, following the aforementioned pension reform, the discrepancy between retirement and pensionable age had indeed become a concern for older workers.

By revising the EESL in 2006, the Japanese government mandated employers to offer older workers continuous employment up to the higher pensionable age throughout Japan. The 2006 revision of the EESL mandated companies to offer employment opportunities until age 63 for the 1946 cohort while exempting the 1945 cohort from continuous employment after age 60. Thus, employment opportunities after age 60 were not guaranteed for the 1945 cohort. Kondo and Shigeoka (2017) compared the 1945 (control group) and 1946 (treatment group) cohorts and found significant positive impacts of the 2006 EESL revision on employment. However,

4 Throughout this study, the "cohort born in year X" is identified as those born between April of year X and March of the following year. This is because Japan's fiscal year starts in April and ends in March of the following calendar year. Most regulations on social security and employment are based on this rule.

5 The EESL was first enacted in 1971 to promote the employment of middle-aged and older people.

employers could refuse to provide employment opportunities to workers who did not meet the criteria set by their labor-management agreement.

In contrast, the 2013 EESL revision mandated firms to employ all workers who wished to continue employment until age 65, uniformly throughout Japan, with penalties. In the revised EESL, the government publishes the names of companies that do not comply with the obligation. In other words, when older workers reach age 60, employers are required to offer continuous employment up to age 65 for those born after 1953, while they have the option to refuse to offer the same opportunity to those born before 1952.

2.3 Co-occurrence of Pension Reform and Enactment of Revised EESL in 2013

In 2013, the revised EESL and extension of the pensionable age for the EPI's remuneration-based part were enacted concurrently. In Table 1, we summarize how each reform was applied to each cohort by birth year. With the 2013 EESL revision, the 1953 and 1954 cohorts did not receive a pension at age 60 but were offered employment opportunities until age 65.

Yamada (2017), using the and Jiang (2023), using the Keio Household Panel Survey, examined the effect of the 2013 EESL revision combined with the extension of the pensionable age in the remuneration-based part of the EPI. Yamada (2017) compared the 1952 cohort (control group) and the 1953 cohort (treatment group) and concluded that the combined effects of EESL revision and pension reform on employment are positive. In contrast, Jiang (2023) compared the cohorts born between April 1953 and January 1956 (treatment group) and the cohorts born between February 1950 and March 1953 (control group) and found that the combined effects on employment were insignificant. Additionally, Yamada (2017) and Jiang (2023) conducted analyses with sub-groups by employment status and firm size at the employees' workplaces at age 59 to examine whether the combined effects may be more concentrated among regular employees or those in large-sized firms. They indicated that the combined impacts could be more significant for regular employees working for a large company.

To decompose the combined effects into those of the EESL revision and pension reform, it is beneficial to utilize the difference in the bindingness of the EESL revision within each cohort in the DDD model. Employing the DDD model, we investigate the impacts of the revised EESL and pension reform on the labor force participation, employment, and unemployment of older male adults. The details are provided in the next section.

Table 1: Pensionable age and employment legally mandated by age for Japanese men.

Birth year-month of respondents	Pensionable age of the EPI remuneration-based part	The lower bound of mandatory retirement age	Whether affected by the 2013 EESL revision
Control group			
1951.4–1952.3 (cohort born in 1951)	60	60	No
1952.4–1953.3 (cohort born in 1952)	60	60	No
Treatment group			
1953.4–1954.3 (cohort born in 1953)	61	60	Yes
1954.4–1955.3 (cohort born in 1954)	61	60	Yes

3 Empirical Strategy

3.1 Analytical Framework

Continued employment opportunities at age 60 began to differ between the treatment and control groups after the 2013 EESL revision. Meanwhile, the eligibility age of the EPI's remuneration-based part for the treatment group was raised to 61 by the pension reform, whereas the eligible age for the control group remained at 60. Thus, when the older adults in the treatment group reached 60, they could continue working but without any public pension benefits.

Considering that the pensionable age was raised when the EESL was tightened, it is difficult to identify the effects of the demand- and supply-side interventions by comparing affected and unaffected cohorts. To identify the effects of pension reform and the EESL revision on labor market outcomes in the DDD framework, we exploit a company's mandatory retirement age variation that makes the difference in the bindingness of the EESL revision within each cohort. Although most companies set the retirement age at 60 before the 2013 revision, some companies set it at over 60 or did not set it. The 2012 General Survey on Working Conditions, conducted by the Ministry of Health, Labour and Welfare, reported that 83 % of companies with a mandatory retirement policy set the mandatory retirement age at 60.

To understand how the DDD model reveals the effects of the EESL revision and pension reform, we compare two difference-in-differences (DID) models. The first DID compares outcomes between cohorts born in 1953 or 1954 (treatment group) and those born in 1951 or 1952 (control group), both of whom were employed by firms with either no mandatory retirement age or a mandatory retirement age over 60 when they were 55. Given that these firms already had a mandatory retirement age greater than 60, the EESL revision did not impose any binding constraints on the individuals employed by them. Consequently, the first DID model helps identify the effects of extending the pensionable age. The second DID compares outcomes between cohorts born in 1953 or 1954 (treatment group) and those born in 1951 or 1952 (control group), both of whom worked for firms with a mandatory retirement age of 60 when they were 55. The individuals employed by these firms with a mandatory retirement age of 60 were subject to the EESL revision and pension reform. The difference between the first and second DIDs is considered to be the effect identified in the DDD model.

3.2 Econometric Models

We set the age of 59 as baseline and estimate the following DDD model:

$$
\begin{aligned}
Y_{it} = {} & \alpha_1 + \beta_1 Treat_i + \gamma_1 MRA60_i + \delta_1 Treat_i \times MRA60_i + \alpha_{60} Age_{60it} \\
& + \beta_{60} Treat_i \times Age_{60it} + \gamma_{60} Age_{60it} \times MRA60_i + \delta_{60} Treat_i \times Age_{60it} \\
& \times MRA60_i + \theta_1 Unempr_t + \theta_2 Marital_{it} + \mu_i + e_{it}
\end{aligned} \tag{1}
$$

where Y_{it} denotes one of the three outcomes for individual i at year t: a dummy for being in the labor force (LF_{it}), employment (E_{it}), and unemployment (U_{it}).[6] $Treat_i$ is a dummy variable equal to 1 if the individual i belongs to the treatment group. $MRA60_i$ is a dummy variable equal to 1 if the individual i worked for a firm where the mandatory retirement age was 60 at the age of 55. Age_{60it} is a dummy variable equal to 1 if an individual i's age is 60 in year t. μ_i is a time-invariant individual fixed effect and e_{it} is an idiosyncratic error. Because labor market status at age 60 could differ among cohorts, we control for average unemployment rates in year t ($Unempr_t$). We also control for the marital status of individual i in year t ($Marital_{it}$).

Our identification strategy relies on comparing the two different DID models: the first and second DIDs. In the first DID, we focus on the individuals employed by firms with no mandatory retirement age or one over 60 ($MRA60 = 0$), while the second DID focuses on those employed by firms with a mandatory retirement age of 60 ($MRA60 = 1$). Using equation (1), we can express the first (equation (2)) and the second (equation (3)) DID models:

$$
\begin{aligned}
Y_{it} = {} & \alpha_1 + \beta_1 Treat_i + \alpha_{60} Age_{60it} + \beta_{60} Treat_i \times Age_{60it} + \theta_1 Unempr_t \\
& + \theta_2 Marital_{it} + \mu_i + e_{it} \qquad \text{if } MRA60_i = 0
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
Y_{it} = {} & (\alpha_1 + \gamma_1) + (\beta_1 + \delta_1) Treat_i + (\alpha_{60} + \gamma_{60}) Age_{60it} + (\beta_{60} + \delta_{60}) Treat_i \\
& \times Age_{60it} + \theta_1 Unempr_t + \theta_2 Marital_{it} + \mu_i + e_{it} \qquad \text{if } MRA60_i = 1
\end{aligned} \tag{3}
$$

When estimating equations (1)–(3) using a fixed-effects model, we set the parameters α_1, β_1, γ_1 and δ_1 as 0.

6 The LSMEP asks the respondent whether they are *usually* in paid work ("Yes [a]" or "No"). Then, if they answer "No," they are asked the following question: Do you want a paid job ("Yes" or "No [b]")? When they answer "Yes," they are asked the final question: Are you looking for a paid job ("Yes [c]" or "No [d]")? The variables are defined as follows: $E_i = 1$ if they are in paid work [a], =0 otherwise; $U_i = 1$ if they are unemployed [c], =0 otherwise; $LF_i = 1$ if the respondent is in paid work [a] or unemployed [c], =0 otherwise.

We assume that the EESL revision did not affect the transition for the employees between firms with no mandatory retirement age or one over 60 ($MRA60 = 0$) and firms with a mandatory retirement age of 60 ($MRA60 = 1$). When $MRA60 = 0$, the EESL revision was not binding for the employees. Additionally, the DDD model assumes that there is no potential difference in pension incentives between employees with $MRA60 = 0$ and those with $MRA60 = 1$. Under these assumptions, the parameter β_{60} measures the effect of extending the pensionable age, and the parameter δ_{60} measures the effect of the EESL revision on the outcomes at age 60 relative to 59, as illustrated in Figure 1.

An event study model helps to examine the dynamics of the treatment effect. Additionally, we set the age of 59 as baseline and estimate the following event study's DDD model:

$$\begin{aligned} Y_{it} = {} & \alpha_1 + \beta_1 Treat_i + \gamma_1 MRA60_i + \delta_1 Treat_i \times MRA60_i + \sum_a \alpha_a Age_{ait} \\ & + \sum_a \beta_a Treat_i \times Age_{ait} + \sum_a \gamma_a Age_{ait} \times MRA60_i + \sum_a \delta_a Treat_i \\ & \times Age_{ait} \times MRA60_i + \theta_1 Unempr_t + \theta_2 Marital_{it} + \mu_i + \varepsilon_{it}, \end{aligned} \tag{4}$$

$$a = 58, 60, 61, \text{ and } 62,$$

where ε_{it} is an idiosyncratic error. The event study model estimates the interaction terms ($Treat \times Age_a$ and $Treat \times Age_a \times MRA60$) capturing the treatment effect of the EESL revision and pension reform for each age period relative to age 59. As we

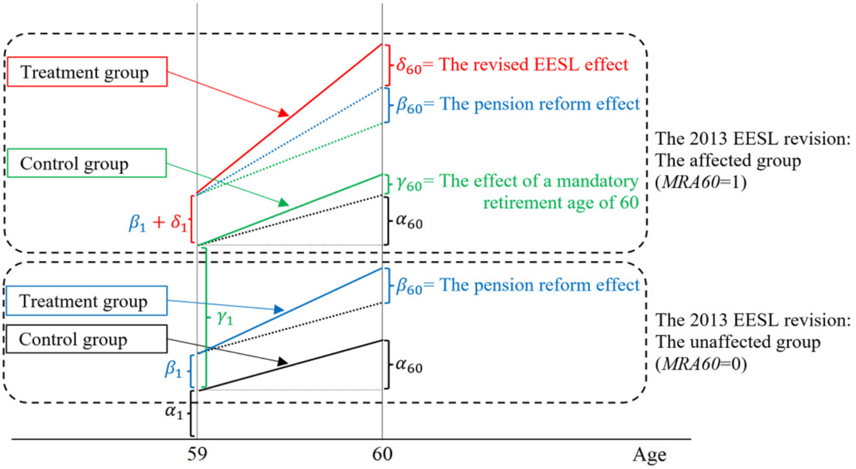

Figure 1: DDD model diagram.

are using a fixed effects model to estimate equation (4), we set parameters α_1, β_1, γ_1 and δ_1 to 0.

4 Data

This study uses data from the LSMEP conducted by Japan's Ministry of Health, Labour and Welfare (MHLW) since 2005. The LSMEP is a nationwide population-based panel survey. The survey objects were randomly selected from males and females, aged 50 to 59, as at the end of October 2005, through stratified two-stage sampling. A total of 34,240 individuals responded (response rate: 83.8 %) and are tracked annually. We use data from the fifth to the twelfth waves of the LSMEP (average attrition rate of 3.8 % in each wave); 21,916 individuals remained in the twelfth wave. No new respondents were added after the first wave (Ministry of Health, Labour and Welfare 2023).

The sample is restricted to individuals who meet the following four criteria: (i) are male; (ii) are part of the cohorts born in between 1951 and 1954; (iii) are aged from 58 to 62; and (iv) have information on all relevant variables available. The final sample includes 13,309 person-year observations.

When the Japanese government conducts a survey to compile official statistics, it complies with Japan's Statistics Law, which requires the survey to be reviewed from statistical, legal, ethical, and other viewpoints. We obtained the survey data from the MHLW with its official permission; therefore, this study did not require further ethical approval.

5 Estimation Results

Panels A and B in Table 2 present the descriptive statistics for respondents aged 58 to 62 and those aged 59 to 60, respectively. The mean value of covariate *Unempr* in both Panels A and B shows a slight difference among cohorts. This suggests that labor market status at age 60 differs slightly among cohorts. Before showing the estimation results, we check the pre-treatment balances between the treatment and control groups. As shown in Figure 2, there are no visual differences in the pre-treatment dynamics of the four groups. The parallel trend assumption is thus plausible.

Table 3 presents the combined impacts of the EESL revision and the pension reform on employment. Columns (1) and (2) show the significant positive impacts on labor force participation and employment. The results comparing the cohorts born in 1952 and 1953, shown in Column (5), are consistent with those of Yamada (2017),

Table 2: Descriptive statistics.

Panel A: Respodents aged 58 to 62																
		All					***MRA*60 = 1**					***MRA*60 = 0**				
		All	**By cohort**				**All**	**By cohort**				**All**	**By cohort**			
			Control		**Treatment**			**Control**		**Treatment**			**Control**		**Treatment**	
			Born in 1951	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**
Number of observations		13309	3869	3577	3005	2858	10767	3205	2917	2400	2245	2542	664	660	605	613
Number of persons		2942	881	791	655	615	2375	729	642	521	483	567	152	149	134	132
Variable	Definition	Mean					Mean					Mean				
LF	=1 if the respondent is in paid work or is in unemployment, =0 otherwise	0.923 (0.267)	0.920 (0.272)	0.909 (0.287)	0.921 (0.269)	0.945 (0.227)	0.914 (0.281)	0.913 (0.282)	0.895 (0.306)	0.914 (0.280)	0.939 (0.239)	0.961 (0.194)	0.953 (0.211)	0.971 (0.167)	0.950 (0.217)	0.969 (0.173)
E	=1 if the respondent is in paid work, =0 otherwise	0.894 (0.308)	0.889 (0.315)	0.879 (0.327)	0.894 (0.309)	0.919 (0.273)	0.883 (0.321)	0.882 (0.323)	0.861 (0.346)	0.885 (0.319)	0.912 (0.284)	0.937 (0.244)	0.920 (0.271)	0.956 (0.205)	0.926 (0.263)	0.945 (0.229)
U	=1 if the respondent is in unemployment, =0 otherwise	0.029 (0.169)	0.031 (0.173)	0.031 (0.173)	0.028 (0.165)	0.027 (0.161)	0.030 (0.172)	0.031 (0.172)	0.034 (0.182)	0.029 (0.167)	0.027 (0.163)	0.024 (0.154)	0.033 (0.179)	0.015 (0.122)	0.025 (0.156)	0.024 (0.155)

Table 2: (continued)

		Panel A: Respodents aged 58 to 62														
		All					***MRA*60 = 1**					***MRA*60 = 0**				
		All	**By cohort**				**All**	**By cohort**				**All**	**By cohort**			
			Control		**Treatment**			**Control**		**Treatment**			**Control**		**Treatment**	
			Born in 1951	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**
Treat	=1 if the respondent belongs to the treatment group, =0 otherwise	0.441	0.000	0.000	1.000	1.000	0.431	0.000	0.000	1.000	1.000	0.479	0.000	0.000	1.000	1.000
		(0.496)	(0.000)	(0.000)	(0.000)	(0.000)	(0.495)	(0.000)	(0.000)	(0.000)	(0.000)	(0.500)	(0.000)	(0.000)	(0.000)	(0.000)
*MRA*60	=1 if mandatory retirement age of the firm where the respondent was employed at aged 55 is 60, and zero if the mandatory retirement age is either above 60 or not set	0.809	0.828	0.815	0.799	0.786	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000
		(0.393)	(0.377)	(0.388)	(0.401)	(0.411)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
*Age*58	=1 if the respondent's age is 58, =0 otherwise	0.211	0.216	0.212	0.208	0.205	0.211	0.215	0.212	0.209	0.206	0.209	0.217	0.211	0.207	0.201
		(0.408)	(0.411)	(0.409)	(0.406)	(0.404)	(0.408)	(0.411)	(0.409)	(0.407)	(0.405)	(0.407)	(0.412)	(0.408)	(0.405)	(0.401)

Table 2: (continued)

Panel A: Respodents aged 58 to 62																
		All					*MRA*60 = 1					*MRA*60 = 0				
		All	By cohort				All	By cohort				All	By cohort			
			Control		Treatment			Control		Treatment			Control		Treatment	
			Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954
*Age*60	=1 if the respondent's age is 60, =0 otherwise	0.195 (0.397)	0.192 (0.394)	0.197 (0.398)	0.195 (0.397)	0.198 (0.399)	0.196 (0.397)	0.193 (0.394)	0.197 (0.398)	0.195 (0.397)	0.198 (0.399)	0.195 (0.396)	0.188 (0.391)	0.198 (0.399)	0.195 (0.397)	0.199 (0.400)
*Age*61	=1 if the respondent's age is 61, =0 otherwise	0.191 (0.393)	0.187 (0.39)	0.190 (0.392)	0.195 (0.396)	0.192 (0.394)	0.191 (0.393)	0.187 (0.390)	0.191 (0.393)	0.195 (0.396)	0.191 (0.393)	0.191 (0.393)	0.188 (0.391)	0.185 (0.388)	0.193 (0.395)	0.197 (0.398)
*Age*62	=1 if the respondent's age is 62, =0 otherwise	0.103 (0.304)	0.101 (0.302)	0.099 (0.298)	0.109 (0.312)	0.105 (0.306)	0.103 (0.303)	0.102 (0.302)	0.099 (0.299)	0.108 (0.310)	0.103 (0.304)	0.105 (0.307)	0.099 (0.299)	0.097 (0.296)	0.114 (0.318)	0.111 (0.314)

Table 2: (continued)

		Panel A: Respodents aged 58 to 62														
		All					***MRA*60 = 1**					***MRA*60 = 0**				
		All	**By cohort**				**All**	**By cohort**				**All**	**By cohort**			
			Control		**Treatment**			**Control**		**Treatment**			**Control**		**Treatment**	
			Born in 1951	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**		**Born in 1951**	**Born in 1952**	**Born in 1953**	**Born in 1954**
Unempr	Yearly (%) unemployment rate, which is reported by the labour force survey conducted by the statistics bureau of Japan	4.468 (0.622)	4.926 (0.412)	4.607 (0.57)	4.239 (0.505)	3.914 (0.479)	4.475 (0.622)	4.925 (0.412)	4.605 (0.571)	4.238 (0.504)	3.915 (0.480)	4.439 (0.624)	4.927 (0.415)	4.615 (0.565)	4.243 (0.506)	3.913 (0.478)
Marital	=1 if the respondent is unmarried, separated, or divorced, =0 otherwise.	0.907 (0.291)	0.906 (0.291)	0.895 (0.306)	0.910 (0.286)	0.919 (0.273)	0.914 (0.280)	0.921 (0.270)	0.901 (0.299)	0.911 (0.284)	0.924 (0.265)	0.876 (0.329)	0.836 (0.371)	0.871 (0.335)	0.904 (0.295)	0.899 (0.302)

Table 2: (continued)

Panel B: Respodents aged 59 to 60															
	All					*MRA*60 = 1					*MRA*60 = 0				
	All	By cohort				All	By cohort				All	By cohort			
		Control		Treatment			Control		Treatment			Control		Treatment	
		Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954
Number of observations	4606	1304	1234	1052	1016	3730	1078	1016	838	798	876	226	218	214	218
Number of persons	2303	652	617	526	508	1865	539	508	419	399	438	113	109	107	109
Variable	Mean					Mean					Mean				
LF	0.936	0.936	0.917	0.939	0.957	0.929	0.931	0.905	0.935	0.953	0.965	0.961	0.973	0.954	0.973
	(0.246)	(0.246)	(0.277)	(0.241)	(0.204)	(0.257)	(0.255)	(0.295)	(0.248)	(0.214)	(0.185)	(0.196)	(0.164)	(0.212)	(0.164)
E	0.904	0.897	0.875	0.915	0.936	0.895	0.891	0.858	0.910	0.930	0.942	0.925	0.955	0.935	0.955
	(0.296)	(0.305)	(0.332)	(0.280)	(0.247)	(0.308)	(0.313)	(0.35)	(0.288)	(0.256)	(0.235)	(0.265)	(0.21)	(0.248)	(0.21)
U	0.033	0.040	0.043	0.024	0.022	0.035	0.040	0.048	0.026	0.023	0.023	0.036	0.019	0.019	0.019
	(0.178)	(0.194)	(0.201)	(0.153)	(0.146)	(0.184)	(0.196)	(0.213)	(0.157)	(0.149)	(0.15)	(0.186)	(0.135)	(0.136)	(0.135)
Treat	0.449	0.000	0.000	1.000	1.000	0.439	0.000	0.000	1.000	1.000	0.494	0.000	0.000	1.000	1.000
	(0.498)	(0.000)	(0.000)	(0.000)	(0.000)	(0.497)	(0.000)	(0.000)	(0.000)	(0.000)	(0.501)	(0.000)	(0.000)	(0.000)	(0.000)
*MRA*60	0.810	0.827	0.824	0.797	0.786	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000
	(0.393)	(0.379)	(0.382)	(0.403)	(0.411)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
*Age*60	0.225	0.000	0.000	0.500	0.500	0.220	0.000	0.000	0.500	0.500	0.247	0.000	0.000	0.500	0.500
	(0.418)	(0.000)	(0.000)	(0.501)	(0.501)	(0.414)	(0.000)	(0.000)	(0.501)	(0.501)	(0.432)	(0.000)	(0.000)	(0.502)	(0.502)

Table 2: (continued)

Panel B: Respodents aged 59 to 60															
	All					*MRA*60 = 1					*MRA*60 = 0				
	All	By cohort				All	By cohort				All	By cohort			
		Control		Treatment			Control		Treatment			Control		Treatment	
		Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954		Born in 1951	Born in 1952	Born in 1953	Born in 1954
Unempr	4.463	4.973	4.608	4.264	3.839	4.470	4.973	4.608	4.261	3.834	4.435	4.974	4.610	4.274	3.859
	(0.501)	(0.291)	(0.213)	(0.316)	(0.284)	(0.501)	(0.291)	(0.213)	(0.317)	(0.282)	(0.5)	(0.291)	(0.213)	(0.313)	(0.291)
Marital	0.911	0.907	0.901	0.912	0.929	0.919	0.924	0.903	0.915	0.935	0.879	0.824	0.890	0.902	0.904
	(0.286)	(0.292)	(0.300)	(0.285)	(0.259)	(0.275)	(0.266)	(0.297)	(0.281)	(0.247)	(0.327)	(0.383)	(0.314)	(0.299)	(0.296)

Figures reported in in parentheses are standard deviation.

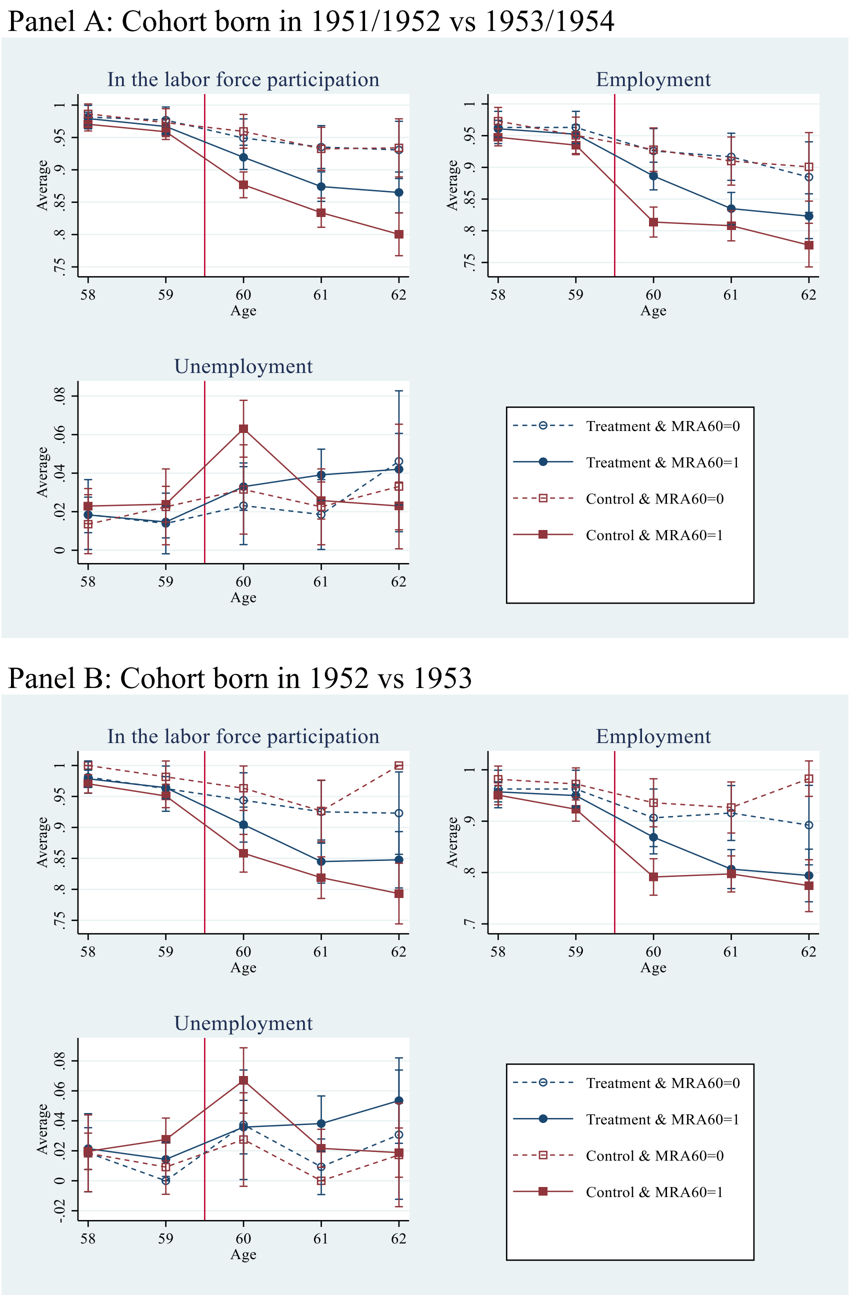

Figure 2: Parallel trend assumption. We plot the means of the outcome using the corresponding 95 % confidence intervals over age for the four groups using a balanced panel.

Table 3: Combined impact of demand- and supply-side interventions on employment for older adults.

	Control: born in 1951/1952 Treatment: born in 1953/1954			Control: born in 1952 Treatment: born in 1953		
Dependent variable	**(1)** $LF_i = 1$	**(2)** $E_i = 1$	**(3)** $U_i = 1$	**(4)** $LF_i = 1$	**(5)** $E_i = 1$	**(6)** $U_i = 1$
Treatment × *Age*60	0.026[b]	0.044[c]	−0.018[a]	0.040[b]	0.047[b]	−0.006
	(0.009)	(0.013)	(0.008)	(0.012)	(0.016)	(0.012)
*Age*60	−0.076[c]	−0.106[c]	0.030[b]	−0.050[b]	−0.096[c]	0.047[b]
	(0.013)	(0.016)	(0.010)	(0.018)	(0.022)	(0.016)
Unempr	−0.016	−0.005	−0.011	0.099	0.063	0.036
	(0.032)	(0.035)	(0.023)	(0.052)	(0.065)	(0.044)
Marital	−0.065	−0.060	−0.005	−0.003	−0.007	0.004
	(0.059)	(0.058)	(0.009)	(0.034)	(0.047)	(0.014)
Constant	1.099[c]	1.025[c]	0.074	0.502[a]	0.656[a]	−0.154
	(0.158)	(0.170)	(0.110)	(0.243)	(0.307)	(0.205)
Number of observations	4606	4606	4606	2286	2286	2286
Number of persons	2303	2303	2303	1143	1143	1143
R^2	0.049	0.069	0.013	0.057	0.080	0.016

(1) [a,b] and [c]indicate statistical significance at the 10 %, 5 % and 1 % levels, respectively. (2) Standard errors in parentheses are adjusted for two levels of clustering (individuals and cohort × age).

who used the same data but included more observations from age 53 to 60. There may be several reasons why Jiang (2023) did not observe significant effects. One possibility is that she used smaller datasets, which could have affected the statistical power of the analysis. Another reason could be the possible confusion between the treatment and control groups, possibly due to the lack of information on the exact birth month.

To identify the effects of pension reform and the EESL revision on labor market outcomes, we have employed the DDD framework. As mentioned in Section 4, considering that the DDD estimation is based on the difference between two DID estimations, it is helpful to examine these two DID estimations separately. Table 4 presents the results of the first (equation (2)) and second (equation (3)) DID estimations. As the EESL revision was not binding for the employees with $MRA60 = 0$, we can identify the effects of extending the pensionable age in the first DID model. Columns (1a) and (2a) show that the coefficients of $Treat \times Age_{60}$ (parameters β_{60} in equation (2)) are insignificant. By contrast, in the second DID model (Columns (1b) and (2b)), where the employees were subject to the EESL revision and pension reform, the coefficients of $Treat \times Age_{60}$ (parameters $\beta_{60} + \delta_{60}$ in equation (3)) for labor force participation and employment are significantly positive. There are significant differences in the coefficients of $Treat \times Age_{60}$ between Columns (1a)

Table 4: Impact of supply-side interventions on employment for older adults.

Dependent variable	Control: born in 1951/1952, Treatment: born in 1953/1954						Control: born in 1952, Treatment: born in 1953					
	$LF_i = 1$		$E_i = 1$		$U_i = 1$		$LF_i = 1$		$E_i = 1$		$U_i = 1$	
	The first DID (1a)	The second DID (1b)	The first DID (2a)	The second DID (2b)	The first DID (3a)	The second DID (3b)	The first DID (4a)	The second DID (4b)	The first DID (5a)	The second DID (5b)	The first DID (6a)	The second DID (6b)
Treatment × *Age*60	−0.013	0.033[b]	−0.014	0.055[c]	0.002	−0.022[b]	0.003	0.047[b]	−0.025	0.062[b]	0.028	−0.015
	(0.014)	(0.012)	(0.020)	(0.014)	(0.021)	(0.009)	(0.021)	(0.015)	(0.028)	(0.019)	(0.023)	(0.013)
*Age*60	−0.001	−0.092[c]	−0.021	−0.123[c]	0.020	0.032[b]	−0.009	−0.058[b]	−0.049	−0.105[b]	0.040	0.047[b]
	(0.018)	(0.016)	(0.022)	(0.019)	(0.021)	(0.011)	(0.027)	(0.021)	(0.037)	(0.027)	(0.028)	(0.018)
Unempr	0.036	−0.028	0.005	−0.006	0.031	−0.021	0.030	0.114	−0.043	0.089	0.073	0.025
	(0.040)	(0.040)	(0.056)	(0.042)	(0.059)	(0.026)	(0.068)	(0.062)	(0.107)	(0.077)	(0.084)	(0.050)
Marital	0.016	−0.101	0.019	−0.097	−0.003	−0.004	0.024	−0.031	0.049[a]	−0.044	−0.024	0.013
	(0.013)	(0.082)	(0.015)	(0.079)	(0.008)	(0.012)	(0.017)	(0.040)	(0.024)	(0.057)	(0.017)	(0.017)
Constant	0.794[c]	1.184[c]	0.916[c]	1.061[c]	−0.121	0.123	0.812[a]	0.456	1.121[a]	0.564	−0.309	−0.108
	(0.187)	(0.194)	(0.263)	(0.198)	(0.275)	(0.122)	(0.326)	(0.289)	(0.510)	(0.359)	(0.401)	(0.234)
Number of observations	876	3730	876	3730	876	3730	432	1854	432	1854	432	1854
Number of persons	438	1865	438	1865	438	1865	216	927	216	927	216	927
R^2	0.015	0.058	0.018	0.082	0.002	0.016	0.010	0.069	0.041	0.090	0.025	0.016
Test of difference in coefficients	6.07[b]		10.54[c]		1.12		2.93[a]		6.19[b]		2.70	

(1) [a,b] and [c] indicate statistical significance at the 10 %, 5 % and 1 % levels, respectively. (2) Standard errors in parentheses are adjusted for two levels of clustering (individuals and cohort × age). (3) The samples consist of individuals with *MRA*60 = 0 in the first DID and those with *MRA*60 = 1 in the second DID.
(4) Test of difference in coefficients reports a chi-squared test of the null hypothesis that the difference in coefficients of *Treatment* × *Age*60 between Columns (a) and (b) equals zero.

Table 5: Impact of demand-side interventions on employment for older adults.

	Control: born in 1951/1952 Treatment: born in 1953/1954			Control: born in 1952 Treatment: born in 1953		
Dependent variable	**(1)** $LF_i = 1$	**(2)** $E_i = 1$	**(3)** $U_i = 1$	**(4)** $LFi = 1$	**(5)** $E_i = 1$	**(6)** $U_i = 1$
Treatment × *Age*60 × *MRA*60	0.048[b]	0.069[c]	−0.021	0.034	0.071[a]	−0.037
	(0.020)	(0.021)	(0.021)	(0.025)	(0.032)	(0.022)
Treatment × *Age*60	−0.014	−0.014	−0.000	0.011	−0.012	0.023
	(0.014)	(0.019)	(0.021)	(0.021)	(0.026)	(0.020)
*Age*60 × *MRA*60	−0.069[c]	−0.099[c]	0.030[a]	−0.074[b]	−0.095[b]	0.021
	(0.013)	(0.016)	(0.015)	(0.021)	(0.024)	(0.016)
*Age*60	−0.019	−0.024	0.005	0.011	−0.018	0.029
	(0.015)	(0.018)	(0.015)	(0.023)	(0.026)	(0.018)
Unempr	−0.015	−0.004	−0.011	0.097	0.061	0.035
	(0.032)	(0.035)	(0.024)	(0.052)	(0.065)	(0.044)
Marital	−0.066	−0.062	−0.004	−0.014	−0.016	0.002
	(0.058)	(0.056)	(0.009)	(0.033)	(0.050)	(0.017)
Constant	1.097[c]	1.022[c]	0.075	0.525[a]	0.672[a]	−0.147
	(0.156)	(0.168)	(0.110)	(0.242)	(0.307)	(0.204)
Number of observations	4606	4606	4606	2286	2286	2286
Number of persons	2303	2303	2303	1143	1143	1143
R^2	0.054	0.076	0.014	0.064	0.086	0.017

(1) [a,b] and [c]indicate statistical significance at the 10 %, 5 % and 1 % levels, respectively. (2) Standard errors in parentheses are adjusted for two levels of clustering (individuals and cohort × age).

and (1b) and between (2a) and (2b), respectively. These are similar to those shown in Columns (4a)–(5b). Thus, while the impacts of pension reform are insignificant in the first DID model, the combined impacts of the EESL and pension reform are significant in the second DID model. The evidence from the two DID estimations suggests that a significant portion of the combined impacts can be attributed to the EESL revision.

Suppose that there is no potential difference in pension incentives between employees with $MRA60 = 0$ and those with $MRA60 = 1$. In other words, the pension reform effects between the groups with $MRA60 = 0$ and $MRA60 = 1$ are the same, as shown in Figure 1. In this case, the parameter δ_{60} in DDD model (equation (1)) captures the effects of the revised EESL. To identify the effects of pension reform (the parameter β_{60}) and the EESL revision (the parameter δ_{60}) on labor market outcomes, we present the estimation results of the DDD model in Table 5. Columns (1) and (2) show that the coefficients of $Treat \times Age_{60} \times MRA60$ (the parameters δ_{60}) are significantly positive for labor force participation and employment, while the coefficients of $Treat \times Age_{60}$ (the parameters β_{60}) are insignificant. In the case

Table 6: The timing of the impact of demand-side interventions on employment for older adults.

Sample	**Unbalanced panel**						**Balanced panel**					
	Control: Born 1951/1952 Treatment: Born in 1953/1954			**Control: Born 1952 Treatment: Born in 1953**			**Control: Born in 1951/1952 Treatment: Born in 1953/1954**			**Control: Born in 1952 Treatment: Born in 1953**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Dependent variable	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$
Treatment × *Age*58 × *MRA*60	0.007	0.033[a]	−0.025[a]	−0.015	0.000	−0.016	0.009	0.015	−0.007	−0.008	−0.014	0.006
	(0.014)	(0.017)	(0.013)	(0.016)	(0.023)	(0.011)	(0.017)	(0.023)	(0.013)	(0.017)	(0.026)	(0.013)
Treatment × *Age*60 × *MRA*60	0.040[a]	0.071[c]	−0.031[a]	0.020	0.067[b]	−0.047[b]	0.048[b]	0.067[b]	−0.019	0.031	0.068[a]	−0.036[a]
	(0.022)	(0.021)	(0.018)	(0.029)	(0.030)	(0.016)	(0.021)	(0.023)	(0.019)	(0.026)	(0.033)	(0.018)
Treatment × *Age*61 × *MRA*60	0.026	0.019	0.007	−0.025	−0.019	−0.006	0.033	0.012	0.020	−0.007	−0.019	0.012
	(0.023)	(0.023)	(0.014)	(0.028)	(0.030)	(0.012)	(0.023)	(0.025)	(0.013)	(0.031)	(0.034)	(0.007)
Treatment × *Age*62 × *MRA*60	0.051[a]	0.069[b]	−0.018	0.053[a]	0.060[a]	−0.006	0.055	0.048	0.008	0.069[b]	0.039	0.030[a]
	(0.028)	(0.032)	(0.021)	(0.028)	(0.031)	(0.017)	(0.032)	(0.038)	(0.022)	(0.029)	(0.032)	(0.015)
Treatment × *Age*58	−0.007	−0.026	0.019	0.014	−0.004	0.017	−0.009	−0.016	0.007	0.007	0.003	0.004
	(0.017)	(0.016)	(0.012)	(0.011)	(0.018)	(0.014)	(0.020)	(0.022)	(0.013)	(0.014)	(0.024)	(0.016)
Treatment × *Age*60	−0.003	−0.009	0.006	0.015	−0.006	0.021	−0.012	−0.006	−0.006	0.007	−0.007	0.013
	(0.014)	(0.018)	(0.017)	(0.023)	(0.026)	(0.016)	(0.015)	(0.020)	(0.018)	(0.021)	(0.029)	(0.018)
Treatment × *Age*61	0.004	−0.003	0.007	0.037	0.014	0.023[a]	−0.000	0.001	−0.002	0.023	0.010	0.013[a]
	(0.020)	(0.020)	(0.015)	(0.022)	(0.021)	(0.012)	(0.019)	(0.021)	(0.013)	(0.021)	(0.022)	(0.006)
Treatment × *Age*62	0.002	−0.035	0.037[a]	−0.013	−0.051[a]	0.038[a]	−0.005	−0.022	0.017	−0.032	−0.044[a]	0.011
	(0.025)	(0.027)	(0.018)	(0.020)	(0.023)	(0.018)	(0.028)	(0.030)	(0.017)	(0.019)	(0.020)	(0.014)
*Age*58 × *MRA*60	−0.002	−0.022	0.020[a]	0.007	0.009	−0.002	−0.005	−0.012	0.007	0.002	0.019	−0.017
	(0.010)	(0.017)	(0.011)	(0.013)	(0.020)	(0.009)	(0.013)	(0.022)	(0.013)	(0.015)	(0.024)	(0.012)

Table 6: (continued)

Sample	Unbalanced panel						Balanced panel					
	Control: Born 1951/1952 Treatment: Born in 1953/1954			Control: Born 1952 Treatment: Born in 1953			Control: Born in 1951/1952 Treatment: Born in 1953/1954			Control: Born in 1952 Treatment: Born in 1953		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$
$Age60 \times MRA60$	-0.070^{c}	-0.106^{c}	0.036^{b}	-0.071^{b}	-0.102^{c}	0.031^{b}	-0.072^{c}	-0.101^{c}	0.029^{b}	-0.073^{c}	-0.094^{c}	0.021
	(0.014)	(0.016)	(0.013)	(0.022)	(0.022)	(0.012)	(0.015)	(0.015)	(0.012)	(0.022)	(0.025)	(0.015)
$Age61 \times MRA60$	-0.083^{c}	-0.093^{c}	0.010	-0.061^{b}	-0.076^{c}	0.015^{a}	-0.088^{c}	-0.089^{c}	0.001	-0.076^{b}	-0.079^{b}	0.003
	(0.016)	(0.017)	(0.012)	(0.019)	(0.023)	(0.007)	(0.017)	(0.017)	(0.011)	(0.026)	(0.028)	(0.004)
$Age62 \times MRA60$	-0.131^{c}	-0.138^{c}	0.007	-0.153^{c}	-0.152^{c}	−0.001	-0.132^{c}	-0.123^{c}	−0.008	-0.167^{c}	-0.149^{c}	−0.018
	(0.022)	(0.024)	(0.015)	(0.020)	(0.019)	(0.009)	(0.027)	(0.027)	(0.013)	(0.021)	(0.022)	(0.010)
*Age*58	0.008	0.022	−0.014	0.002	−0.001	0.002	0.009	0.015	−0.005	0.005	−0.007	0.012
	(0.013)	(0.016)	(0.009)	(0.008)	(0.017)	(0.012)	(0.016)	(0.022)	(0.011)	(0.012)	(0.024)	(0.015)
*Age*60	−0.008	−0.014	0.006	−0.016	−0.030	0.014	−0.004	−0.017	0.013	−0.012	−0.032	0.021
	(0.011)	(0.015)	(0.012)	(0.021)	(0.028)	(0.016)	(0.012)	(0.014)	(0.012)	(0.019)	(0.028)	(0.019)
*Age*61	−0.029	−0.027	−0.002	-0.053^{c}	−0.038	−0.015	−0.023	−0.027	0.004	-0.035^{a}	−0.028	−0.007
	(0.019)	(0.018)	(0.013)	(0.016)	(0.023)	(0.015)	(0.017)	(0.016)	(0.012)	(0.017)	(0.020)	(0.012)
*Age*62	−0.009	−0.001	−0.007	0.024	0.026	−0.003	−0.003	−0.008	0.005	0.042^{c}	0.033^{a}	0.010
	(0.023)	(0.025)	(0.016)	(0.015)	(0.024)	(0.021)	(0.026)	(0.026)	(0.014)	(0.013)	(0.017)	(0.017)
Unempr	0.023^{b}	0.024^{b}	−0.001	0.028^{c}	0.030^{b}	−0.002	0.021^{b}	0.021^{a}	0.001	0.028^{c}	0.029^{b}	−0.001
	(0.009)	(0.011)	(0.005)	(0.005)	(0.012)	(0.009)	(0.008)	(0.011)	(0.005)	(0.004)	(0.012)	(0.008)
Marital	−0.005	0.010	−0.015	0.030	0.013	0.017	0.016	0.029	−0.013	0.064^{a}	0.044	0.020
	(0.030)	(0.033)	(0.016)	(0.030)	(0.051)	(0.024)	(0.034)	(0.039)	(0.020)	(0.029)	(0.063)	(0.035)

Table 6: (continued)

Sample	Unbalanced panel						Balanced panel					
	Control: Born 1951/1952 Treatment: Born in 1953/1954			Control: Born 1952 Treatment: Born in 1953			Control: Born in 1951/1952 Treatment: Born in 1953/1954			Control: Born in 1952 Treatment: Born in 1953		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$	$LF_i = 1$	$E_i = 1$	$U_i = 1$
Constant	0.861[c]	0.822[c]	0.039	0.800[c]	0.786[c]	0.014	0.851[c]	0.823[c]	0.028	0.770[c]	0.766[c]	0.004
	(0.046)	(0.051)	(0.025)	(0.018)	(0.040)	(0.033)	(0.046)	(0.054)	(0.025)	(0.019)	(0.047)	(0.030)
Number of observations	13,309	13,309	13,309	6582	6582	6,582	11,515	11,515	11,515	5715	5715	5715
Number of persons	2942	2942	2942	1446	1446	1446	2303	2303	2303	1143	1143	1143
R^2	0.078	0.075	0.008	0.089	0.086	0.011	0.075	0.072	0.009	0.088	0.085	0.012

(1) [a,b] and [c] indicate statistical significance at the 10 %, 5 % and 1 % levels, respectively. (2) Standard errors in parentheses are adjusted for two levels of clustering (individuals and cohort × age).

of comparison between cohorts born in 1952 and 1953, the coefficients of $Treat \times Age_{60} \times MRA60$ (the parameters δ_{60}) are significantly positive for employment (Column (5)). The results from the DDD estimation, which rely on the assumption that employees in $MRA60 = 0$ and $MRA60 = 1$ face similar pension incentives, imply that the EESL revision has significantly positive impacts on employment.

Regarding dynamics, the treatment effects of the revised EESL do not last over time. Table 6 presents the results for the event study's DDD model, where the coefficients of $Treat \times Age_{61} \times MRA60$ are insignificant in Columns (1)–(12). The treatment effects of the EESL revision on employment seem to be short-term.

6 Conclusions

We examined the impacts of the 2013 EESL revision and pension reform on older male workers' employment outcomes by exploiting the DDD approach. Furthermore, we estimated the event study's DDD model to examine the dynamics of the treatment effects.

The estimation of the basic DID model confirmed that the combined impacts of the EESL revision and pension reform on labor force participation and employment were significantly positive. To decompose the combined effects of the two interventions into the effects of pension reform and the EESL revision, we utilized the difference in the bindingness of the EESL revision within each cohort. Specifically, we exploited companies' mandatory retirement age variations across different companies.

By comparing results of two DID estimations, we found that a significant portion of the combined impacts can be attributed to the EESL revision, while the impacts of pension reform were found to be insignificant. The results from DDD estimation showed that the revision of EESL had significantly positive impacts on employment. It is important to note that the treatment effects of the revised EESL did not last over time. These results imply that government intervention on the demand side, such as the 2013 EESL revision, can be effective, at least in the short run, for increasing employment among Japanese older adult males.

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Data availability: The data are available from MHLW with a license and are not publicly available.

References

Adams, S. J. 2004. “Age Discrimination Legislation and the Employment of Older Workers.” *Labour Economics* 11 (2): 219–41.
Ashenfelter, O., and D. Card. 2002. “Did the Elimination of Mandatory Retirement Affect Faculty Retirement?” *The American Economic Review* 92 (4): 957–80.
Atalay, K., and G. Barrett. 2015. “The Impact of Age Pension Eligibility Age on Retirement and Program Dependence: Evidence from an Australian Experiment.” *The Review of Economics and Statistics* 97 (1): 71–87.
Behaghel, L., and D. M. Blau. 2012. “Framing Social Security Reform: Behavioral Responses to Changes in the Full Retirement Age.” *American Economic Journal: Economic Policy* 4 (4): 41–67.
Cabinet Office. 2022. *Annual Report on the Ageing Society FY2022*. Tokyo: Sanwa (in Japanese).
Engels, B., J. Geyer, and P. Haan. 2017. “Pension Incentives and Early Retirement.” *Labour Economics* 47: 216–31.
Gustman, A. L., and T. L. Steinmeier. 2005. “The Social Security Early Entitlement Age in a Structural Model of Retirement and Wealth.” *Journal of Public Economics* 89 (2–3): 441–63.
Hanel, B., and R. T. Riphahn. 2012. “The Timing of Retirement: New Evidence from Swiss Female Workers.” *Labour Economics* 19 (5): 718–28.
Jiang, M. 2023. “Do Employment Promotion Policies Affect Employment or Job Transfer Among Older Adults? Evidence from Japan.” *Ageing and Society* 43 (5): 1022–41.
Kondo, A., and H. Shigeoka. 2017. “The Effectiveness of Demand-Side Government Intervention to Promote Elderly Employment: Evidence from Japan.” *ILR Review* 70 (4): 1008–36.
Krueger, A. B., and J. S. Pischke. 1992. “The Effect of Social Security on Labor Supply: A Cohort Analysis of the Notch Generation.” *Journal of Labor Economics* 10 (4): 412–37.
Mastrobuoni, G. 2009. “Labor Supply Effects of the Recent Social Security Benefit Cuts: Empirical Estimates Using Cohort Discontinuities.” *Journal of Public Economics* 93 (11–12): 1224–33.
Ministry of Health, Labour and Welfare. 2023. *Outline of the 12th Longitudinal Survey of Middle-Aged and Elderly Persons*. Also available at: https://www.mhlw.go.jp/english/database/db-ls/ls.html.
Neumark, D. 2003. “Age Discrimination Legislation in the United States.” *Contemporary Economic Policy* 21 (3): 297–317.
Neumark, D., and J. Song. 2013. “Do Stronger Age Discrimination Laws Make Social Security Reforms More Effective?” *Journal of Public Economics* 108: 1–16.
Neumark, D., and W. A. Stock. 1999. “Age Discrimination Laws and Labor Market Efficiency.” *Journal of Political Economy* 107 (5): 1081–125.
Rabaté, S. 2019. “Can I Stay or Should I Go? Mandatory Retirement and the Labor-Force Participation of Older Workers.” *Journal of Public Economics* 180: 104078.
Shannon, M., and D. Grierson. 2004. “Mandatory Retirement and Older Worker Employment.” *Canadian Journal of Economics* 37 (3): 528–51.

Staubli, S., and J. Zweimüller. 2013. "Does Raising the Early Retirement Age Increase Employment of Older Workers?" *Journal of Public Economics* 108: 17—32.

Yamada, A. 2017. "Increase in Employment Rate and Income Blank Due to Raising the Eligibility Age to Receive Pension Payment." In *Employment of Elderly People in a Declining Population Society, Edited by Japan Institute for Labour Policy and Training*, 194—229. Tokyo: Japan Institute for Labour Policy and Training Press. (in Japanese).

Yamamoto, I. 2008. "Analyses of the Effects of the EESL Revision." In *Dynamism of Household Behaviors in Japan IV*, edited by Y. Higuchi and M. Seko, 161—73. Tokyo: Keio University Press. (in Japanese).