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Addressing the institutional disincentives to elderly employment in Japan*

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Abstract
This study examines how the decisions of the elderly on work/retirement and hours worked are related to the public pension and other related programs by constructing a single index of implicit tax (ITAX) that incorporates various factors related to institutional disincentives to working in Japan. Our regression model underscores that public pension and other related programs, taken together, discourage the elderly from working. Based on the regression results, we conduct simulations to show the extent to which the three policy reforms, that is, (1) abolishing the earnings test for pension benefits; (2) raising the eligibility age for pension benefits; and (3) extending the wage subsidy for the elderly can encourage the elderly to stay in the labor force longer and work longer hours. The simulation results highlight the relative effectiveness of raising the eligibility age.

Keywords: elderly; employment; health status; work capacity.
JEL Classification Codes: I1, J1, J2

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1. Introduction

An aging population is expected to have a substantial impact on the economy, because it is likely to put financial pressure on the sustainability of public pension programs, besides reducing the size of the labor force. Public pension programs were originally designed to be a social insurance against the risk of a lower ability to earn because of aging. In contrast to this expected role, public pension programs may discourage the elderly from staying in the labor force. Indeed, many studies have provided evidence of the negative impact of public pension programs on elderly labor supply and examined the effects of a series of recent pension reforms (e.g., Alonso-Ortiz, 2014; Coile, 2015; Gruber and Wise, 1999; Oshio et al., 2011).

The purpose of this study is to investigate how the employment of the elderly in Japan is associated with public pension and related programs, using a population-based, longitudinal survey data of middle-aged and older individuals. Based on the regression results, we further attempt to simulate the impacts of public pension and related policy reforms on the decisions of the elderly on work/retirement and hours worked. The results are expected to provide significant policy implications for addressing the institutional disincentives to elderly employment in Japan.

In terms of analytic strategy, this study has three features. First, it incorporates various factors related to disincentives to work, including public pension and related programs, into a single index of implicit tax (ITAX), rather than examining the relevance of each factor separately. ITAX is a concept proposed and investigated in National Bureau of Economic Research's project entitled "International Social Security" (Coile et al., 2019). We construct the ITAX, which is based on various institutional factors, and compute its value for each individual in each survey year by including the public programs that actually applied to him or her (Oshio et al., 2019). The utilization of ITAX allows us to capture in a consistent manner the effects of pension and other related programs on elderly employment.

Second, we distinguish between full-time and part-time work, rather than characterizing the elderly's decision as a choice between work and retirement;[1] this is because a substantial portion of Japanese male employees, after retiring from their primary full-time work, shift to part-time work rather than quitting the labor force (Shimizutani, 2011; Shimizutani and Oshio, 2010). It should also be noted that claiming pension benefits does not necessarily mean retirement in Japan; as described later, a substantial portion of Japanese pensioners are working even after retiring from their primary jobs, presumably to avoid a reduction in their pension benefits because of the earnings-tested pension program. To assess the relevance of the estimation results, we further investigate how average hours worked, which is a continuous variable and roughly corresponds to total labor supply, is associated with public pension and other related programs.

Third, we conduct simulations to estimate the impacts of three policy reforms: (1) abolishing the earnings test for pension benefits; (2) raising the eligibility age for pension benefits; and (3) extending the wage subsidy for the elderly on the elderly's decisions on work/retirement and hours worked. A number of studies have examined the effects of the earnings-tested reduction in pension benefits on the elderly's labor supply (Disney and Smith, 2002; Gruber and Orszag, 2003; Haider and Loughran, 2008). In Japan, studies have found mixed evidences about the impact of the earnings test program or its reforms in recent years (Ishii and Kurosawa, 2009; Shimizutani and Oshio, 2013; Yamada, 2012). Meanwhile, studies have shown that an increase in the eligibility age enhanced labor force participation

[1] This feature also distinguishes the current study from the NBER project, which focuses on the choice between work and retirement.

among the elderly in advanced countries including Japan (Atalay and Barrett, 2014; Staubli and Zweimüller, 2013; Ishii and Kurosawa, 2009; Shigeoka and Kondo, 2017). To complement the empirical evidences observed in these studies, this study attempts to simulate the impacts of these reforms on elderly decisions on work/retirement and hours worked.

The rest of this paper is organized as follows. Section 2 explains the data and institutional background. Section 3 presents the computation of ITAX and the descriptive analysis about its evolution and decomposition. Section 4 discusses the regression analysis to examine the association of ITAX with elderly decisions on work/retirement and hours worked. Based on the estimation results, Section 5 conducts simulations to assess the impacts of pension reforms on the elderly's labor supply. The last section concludes our study.

2. Data and background

2.1 Data

For this study, we utilize a twelve-wave panel dataset from "The Longitudinal Survey of Middle-Aged and Older Adults" (LSMOA). The survey in question is conducted annually by the Japanese Ministry of Health, Labour, and Welfare (MHLW) and the data for this study are from 2005–2016. The survey is held nationwide and population-based. Samples of the first wave were collected in November 2005 using a two-stage random sampling procedure. First, 2,515 districts were randomly selected from the 5,280 that were included in the MHLW's nationwide population-based "Comprehensive Survey of Living Conditions," which was conducted in 2004. The 5,280 districts in this survey were, in turn, randomly selected from approximately 940,000 national census districts. Second, 40,877 residents aged

50–59, as of October 30, 2005, were randomly selected from each of the selected districts based on the population of each district. The questionnaires were manually distributed to the respondents' homes, completed by them by November 2, 2005, and manually collected several days later. A total of 34,240 individuals responded to the LSMOA (response rate: 83.8%). These individuals represent the baseline sample for the subsequent survey waves in this study. Waves second through twelfth of the survey were conducted in early November of each year from 2006 to 2016 and 21,916 individuals continued participating in the study until the twelfth wave. No new respondents were added after the first wave. We use data from 10 cohorts—born during 1946–1955—in the empirical analysis below. The survey covered a variety of variables including employment, health, education, and family status; these were used as covariates in the regression analysis.

We focus on the respondents who had been working as employees in the private or public sector (i.e., after excluding the self-employed) until a year prior to the survey year. By excluding respondents for whom essential information is missing, we use 52,578 observations of 13,000 individuals. Table 1 summarizes the key features of the respondents participating in this study.

2.2 Public pension reforms in recent years

The Japanese government implemented a large-scale pension reform in the mid-1980s and has been reducing, since 2001, its outflow on pension benefits mainly by making gradual increases in the eligibility age for pension benefits. In the Employees' Pension Insurance (EPI) program, which covers company employees and public sector workers, a gradual extension of the eligibility age was achieved during the study period. For men, the eligibility age for the flat-rate (first-tier) benefit was 62 in 2005 and 2006; it increased to 63 during 2007–2009 and, then, to 64 during 2010–2012. It was finally increased to 65 in 2013 and has remained at that level. For women, the corresponding eligibility age for the flat-rate component was 61 during 2005–2007; this increased to 62 during 2008–2010, and to 63 in 2011–2013, and finally, to 64 during 2015–2016. Moreover, the male eligibility age for the wage-proportional (second-tier) benefits was increased from 60 to 61 during 2013–2015 and became 62 in 2016.

At the same time, the government has been encouraging the elderly to stay in the labor force longer by making a series of minor changes in the parameters of the earnings-tested pension program (*Zaishoku Rorei Nenkin*), besides introducing a wage subsidy for those aged 60–64 years (*Konenrei Koyo Keizoku Kyufukin*) in 1995. Their formulae for the current schemes are briefly described in sections A. 1 and A. 2 of the Appendix. Combined with the core schemes of public pension programs, these programs and their changes seem to have determined the level of ITAX and its changes.

2.3 Work status and receiving pension benefits

Figure 1 depicts the evolution of the combination of work status and public pension benefits received; it uses the pooled data of all individuals in all the waves (2005 to 2016). Work status is divided into three categories: work full-time (working 30 hours or more per week); work part-time (less than 30 hours); and no work. Each work status is further subdivided depending on whether pension benefits are received. As seen in the left panel, the percentage of men working and not receiving pension benefits were more than 90% of all individuals in their late 50s; this figure declined sharply to below 70% at age 60, and declined even more with an increase in age. In contrast, the percentage of those not working and receiving benefits started to increase at the age of 60, to reach about 30% at the age of 65. The percentage of "working pensioners," who were full- or part-time workers receiving pension benefits, was around 20% of those aged 60 and increased to more than 50% for those aged 65 and above. While a substantial proportion of men continued to work full-time, the proportions of those working part-time work or in retirement continued to rise after the age of 60. The change in the work status and receiving of pension benefits with an increase in age for women is largely similar to that of men; however, the proportion of those working full-time is lower than that among men and there is a wider variety of choices of lifestyle before the age of 60.

3. Implicit tax rates (ITAX)

3.1 Definition and construction

ITAX incorporates public pension and related programs in a comprehensive and consistent manner (Coile et al., 2019). An individual generally faces two decisions at each year of his or her life: whether to keep working or retire and whether to claim benefits.[2] These two decision types should not be considered to be the same. As seen in Figure 2, there is a large number of working pensioners in their 60s; this shows that these two decisions are based on separate factors. In this study, we focus on the first decision, that is, the decision on work/retirement, and assume that individuals claim pension benefits once they reach the age of pension benefit eligibility, regardless of their decision about work/retirement. This assumption ignores the possibility of the simultaneity of the decisions on work/retirement and

[2] Regarding the decision on work/retirement, we actually consider not only the binary choice between work and retirement, but also the choices among full-time work, part-time work, and retirement, as well as the choice of hours worked per week.

claiming benefit, but is generally reasonable given that the age at which initial benefit is claimed coincide with the age of pension benefit eligibility. As noted in 2.1, we also concentrate our analysis on individuals who have stayed in the labor force as employees in both the private and public sectors up to the year prior to the survey year.

To construct ITAX, we first compute social security wealth (SSW) —the discounted value of all future net pension benefits—by applying the benefit formulae to each age and cohort, following Gruber and Wise (1999). We incorporate all institutional parameters related to public pension programs, including eligibility ages, benefit multipliers, and premiums paid to SSW.[3] To calculate the pension benefits, we also estimate average lifetime wage income. We utilize the wage reported during the survey years and assume that an individual had received the same wage during the period before the first wave (2005) as observed in that wave.[4] When an individual considers whether to carry on working for one more year, we assume that they expect their wage to remain from the same as that in the previous year. Considering that many individuals tend to accept reduced wages and/or shift from full-time work to part-time one to avoid an earnings-tested reduction in benefits, the above assumption is justified to examine the *ex-ante* effect of ITAX on retirement decisions. To calculate SSW, we assume that the annual discount rate was 3% for all individuals in the sample. We also calculate the survival rates at each age by the death rates for each year obtained from the MHLW's Life Tables for the 2005–2016 period

[3] Note that we focus on the respondents who had been working as employees in the private or public sector (i.e., excluding the self-employed) until one year prior to the survey year. For simplicity, we assume that these individuals, regardless of working full-time or part-time, were EPI members.

[4] We do not compute past wage profiles, considering the formula of wage-indexation of pension benefits in Japan. When calculating the benefits, the formula re-evaluates past wages using the average wage growth rate in the overall economy from the time of receiving the wage in the past to the time of claiming. For simplicity, we assume that the wage growth rates in previous years were equal across all industries and occupations. We also project each individual's contribution months (which were not available from the LSMOA) at each age by applying the average of months of contribution (392 months for males at age 61 and 383 months for females at age 60) obtained from the 2016 MHLW statistics.

and assume that each individual expects their future survival rate to be unchanged from that observed in the year considered.

Next, we calculate SSA and the accrual of SSW, which aims to the change in the promised social security benefits from working one additional year (Gruber and Wise, 1999). As noted above, we assume that an individual will claim benefits once he or she reaches the eligibility age, regardless of his or her decision on work/retirement. If an individual retires from work before age 60, he or she is required to pay the National Pension Insurance (NPI) 's premium, which is added to SSA because delaying retirement for one year can save it.[5] SSA can take both positive and negative values; its positive value indicates an incentive for delaying retirement, whereas its negative value indicates a disincentive for doing so.

Last, we calculate ITAX by incorporating: (i) an earnings-tested reduction in benefits; (ii) the wage subsidy for those aged 60–64; (iii) the employment insurance premium; and (iv) personal income tax,[6] in addition to SSA. Hence, ITAX is calculated as:

ITAX = [–SSA + (i) – (ii) + (iii) + (iv)] / wage obtained one year ago,

where an individual is assumed to evaluate the ratio of the *ex-ante* disincentive of public pension and related programs to the pre-tax wage obtained one year ago.

3.2 Evolution and decomposition

Figure 2 represents the evolution of ITAX over time for three different cohorts (born in 1947, 1950, and

5 This assumption ignores the possibility that an individual (woman, in particular) will become a dependent spouse of an EPI member before the age of 60 and, thus, will not be required to pay any NPI premium (i.e., become a Type 3 insured in the NPI program).

6 Owing to income deduction applied to public pension benefits, almost no income tax needs to be paid if there is no income other than public pension benefits.

1953) of men. As seen in this figure, ITAX was negative for all cohorts during their 50s, suggesting that individuals in this age group were motivated to keep working. However, ITAX turned positive at the age of 60 and remained positive after that; this suggests that individuals had an incentive to retire in their early 60s. ITAX peaked at the age of 60 for men in the 1947 and 1950 cohorts, showing that they were the most highly motivated to retire at that age, while ITAX peaked at age 61 for men of the 1953 cohort. This shift in the age at which ITAX peaked can be attributed to an extension of the eligibility age for claiming the wage-proportional benefit from 60 to 61 years.

Figure 3 decomposes ITAX for men of different ages by using the pooled sample. ITAX was negative for those below 60 when SSA was negative, indicating that the individuals expected future pension benefits to increase if they stayed in the labor force until the eligibility age. The major change occurred at the age of 60, when ITAX turned from negative to positive, for two major reasons. First, the negative effect of SSA on ITAX decreased markedly, meaning that the core component of the public pension program did not provide a major disincentive after the eligibility age. Second, an earnings-tested reduction in pension benefits raised ITAX substantially for individuals in their early 60s. This negative effect of the earnings test remained during their 60s, although the effect declined somewhat after the age of 65. Personal income tax raised ITAX across all ages, consistently discouraging individuals from working, while the wage subsidy reasonably reduced ITAX when individuals were in their early 60s.

4. Regression

4.1 Model specification

We estimate the multinomial logistic models to explain an individual's choice among full-time work, part-time work, and retirement by ITAX and other related variables, focusing on the respondents in the 55–70 age group; these individuals had been working as employees up to one year prior to the survey year. In addition to ITAX, which is a key explanatory variable, we include the ratios of SSW and lifetime income to the wage obtained one year ago and a binary variable of working full-time an year before the survey. Higher SSW is expected to promote retirement because it means a higher level of assets available in lifetime, while higher lifetime income encourages working because it means a higher ability to earn wage income. Experience of full-time work is likely to raise the probability of continuing to do so. As control variables, we also include a set of binary variables on health: prevalence of each of six non-communicable diseases (diabetes, heart disease, stroke, hypertension, hyperlipidemia, and cancer), poor self-rated health, having any problem in activities of daily living (ADL), and current smoking status, as well as caregiving for any family members, educational attainment (graduated from junior high school, or college or above [from high school is the base category]). Poorer health conditions and caregiving may discourage individuals from working. We also include a continuous variable of age and its squared value for age-specific factors, which are assumed to be nonlinear. We estimate these regression models separately for men and women.

Next, we estimate the Tobit models to explain hours worked per week. Specifically, we replace a trinary variable of the elderly choice of work and retirement with a continuous variable of hours worked per week (which is set to zero if one retires). Then, we estimate the left-censored Tobit models to explain hours worked by the same set of ITAX and other explanatory variables as the multinomial logistic models. Hours worked are expected to be negatively associated with ITAX.

4.2 Estimation results

Table 2 summarizes the results of the multinomial logistic models for men in terms of the marginal effects.[7] The total amount of the marginal effects for each variable is equal to zero. Most notably, ITAX is positively associated with retirement and part-time work and negatively related to full-time work; a 1% increase in ITAX reduces the probability of full-time work by 0.166 percentage points and raises those of retirement and part-time work by 0.132 and 0.034 percentage points, respectively. SSW is negatively associated with full-time work and positively associated with retirement and part-time work. In contrast, lifetime income and full-time work one year before the survey are positively associated with full-time work and negatively associated with retirement and part-time work. These results are reasonable and in line with expectations. The estimated coefficients on health variables indicate that health problems generally discourage working. Caregiving reduces the probability of full-time work, while having a spouse and higher educational attainment increase it.

Table 3 shows the results for women. ITAX has a positive impact on retirement, as in the case of men, but its magnitude (0.043) is substantially smaller than that for men (0.132); further, ITAX is not significantly related to full-time work or part-time work. These results suggest that women's decision on work/retirement is less sensitive to institutional incentives compared to men's; this probably reflecting women's more diversified lifestyle; indeed, a substantial portion of women are working part-time before the eligibility age, as can be seen in Figure 1. The association between health variables and decision on work/retirement is more limited than for men. In contrast with men, having a spouse and higher

[7] The Hausman and McFadden test shows that the null hypothesis of the independence of irrelevant alternatives cannot be rejected at the 5% significance level for both men and women. The marginal effects are calculated after multinomial logistic regressions.

educational attainment are negatively associated with full-time work.

Table 4 reports the results of the Tobit models to explain hours worked per week by ITAX and other variables. In line with expectations, hours worked are negatively associated with ITAX; a 1% increase in ITAX will reduce hours worked by 0.0741 and 0.0252 hours (i.e., 4.4 and 1.5 minutes) for men and women, respectively. This regression analysis ignores the discontinuity of hours worked between full-time and part-time work, but the results suggest a negative effect of the current programs on the elderly's labor supply.

5. Simulations

5.1 Assumptions

Based on the estimated association between ITAX and the decision on work/ retirement, we conduct simulations to estimate the impacts of: (1) abolishing the earnings test for pension benefits; (2) raising the eligibility age for pension benefits; and (3) extending the wage subsidy for elderly employees. Specifically, for (1), we assume that pensioners will face no earnings-tested reduction in benefits, regardless of their wage or benefit amounts. For (2), we assume that an individual cannot claim a flat-rate or wage-proportional component of EPI benefit until the age of 70 and will be required to keep paying premiums until that age. If an individual retires before the age of 70, we assume that he or she will be required to pay NPI premiums until the age of 70.[8] Additional premium contributions—both EPI and NPI—will be reflected in future pension benefits. It should be noted that the earnings test, which is currently applied to those aged 60–69, will be automatically abolished in (2). Last, for (3), we assume

[8] Under the current public pension scheme, an individual does not need to pay the NPI premium after reaching the age of 60.

that the wage subsidy now applied to those aged 60–64 will be extended until the age of 69, leaving the current subsidy formula unchanged.

To estimate the impacts of these policy reforms, we first compute the counterfactual values of each individual's ITAX under each reform. Then, we calculate the probability of full-time work, part-time work, and retirement for each individual by combining the counterfactual values of ITAX and the estimated coefficients on ITAX obtained from the multinomial logistic models. In the case where the eligibility age is raised, we additionally compute the counterfactual SSW and the impact of its change from the actual value. Finally, we take the average of these estimated probabilities across individuals of the same age.

5.2 Counterfactual ITAX

The evolution of the counterfactual ITAX with age under each reform, averaged across the male cohorts, is depicted in Figure 4. The actual ITAX, which is shown as a benchmark, turns from negative to positive at the age of 50, as shown in Figure 4. If the earnings test is abolished, the hike in ITAX at the age of 60 will be substantially reduced and ITAX will remain close to zero until age 64. ITAX will turn somewhat positive at the age of 65, reflecting a reduction in the severity of the earnings test after the age of 60 and beyond because of a rise in the threshold for reduction in benefits. However, the counterfactual ITAX remains below the actual ITAX. Last, an extension of the wage subsidy will reduce ITAX for those between the ages of 65 and 69; the extent of the expected reduction in ITAX is similar to that obtained on abolishing the earnings test.

Raising the eligibility age to 70 will result in a quite different evolution of ITAX with age.

Individuals' incentive to work declines during their 50s, reflecting a reduction in the discounted value of additional future benefits, which cannot be claimed until the age of 70. The counterfactual ITAX will start to decline at the age of 60, mainly because: (i) postponing retirement will not only raise the future pension benefits, but also result in saving caused by the non-payment of NPI premium and (ii) individuals will no longer face an earnings-tested reduction in benefits.

5.3 Simulated impacts of decisions about work and retirement

The simulated impacts of the three pension reforms on the elderly's decision on work and retirement are summarized in Table 5 for the age group of 60–64 and 65–69, as well as for men and women. "Actual" indicates the actual probability of each outcome observed in the study sample, and "Predicted (A)" indicates the probability estimated by the multinomial logistic regression models. "Simulated" indicates the probability of abolishing the earnings test (B_1), extending the eligibility age (B_2) and extending the wage subsidy (B_3), that is, the effects of the three reforms. For each reform, the simulated impact ("Impact") is computed by subtracting "Simulated" from "Predicted." To help understand the simulation results, Figure 5 graphically compares the results of abolishing the earnings test and raising the eligibility age for men.[9]

We find that abolishing the earnings test will raise the probability of full-time work by 2.9 percentage points for men aged 60–64; it is projected to reduce their probabilities of retirement and part-time work by 2.3 and 0.6 percentage points, respectively. The impacts for those aged 65–69 were

[9] We do not graphically show the results of extending the wage subsidy because it does not affect those aged 60–64 and; for those aged 65–69, it provides results that are very similar to those obtained on abolishing the earnings test.

relatively limited, that is, +1.0, –0.7, and –0.3 percentage points for full-time work, retirement, and part-time work, respectively. The difference between the two age groups is presumably accounted for by a higher threshold for an earnings-tested reduction in pension benefits, as well as lower levels of wage earnings for those aged 65–69.

Raising the eligibility age to 70 will have larger impacts than abolishing the earnings test. The extended eligibility age is expected to reduce the probability of retirement by 6.3 and 5.9 percentage points for men aged 60–64 and 65–69, respectively. This pension reform is also expected to encourage more men to shift from part-time work to full-time one than is achieved by abolishing the earning test; the probability of full-time work will rise by 9.8 and 11.4 percentage points for those aged 60–64 and 65–69, respectively. These larger impacts are reasonable, considering that raising the eligibility age will automatically be accompanied by the repeal of the earnings test until that age and a reduction in the lifetime pension benefits (SSW). The impact of extending the wage subsidy will be limited to those aged 65–69 and its magnitude will be very similar to that obtained on abolishing the earnings test for this age group. This is consistent with the result that the two reforms will lead to a similar ITAX for those aged 65–69, as can already be seen in Figure 4.

Compared to the results for men, the simulated impacts of pension reforms are more modest for women. Specifically, abolishing the earnings test has a negligible impact on both age groups; this presumably reflects the limited and insignificant association between ITAX and women' decisions on work/retirement, as observed in Table 3. Another possible reason is that a substantial portion of women are working part-time, limiting the case of an earnings-tested reduction in pension benefits. However, raising the eligibility age is found to encourage women to keep working and shift from part-time to full-time work, albeit to a lesser extent than men; this probably reflects the greater incentive to work caused by a reduction in SSW because of the postponing of the initial benefit claim.

In these simulations, we do not incorporate the positive impact of enhanced labor force participation on the benefits through the "macroeconomic slide." This is based on the assumption that each individual takes the institutional parameters as exogenously given. A rise in the benefits through the "macroeconomic slide" is likely to encourage workers to keep working, because the additional premium payment is expected to raise the future benefit compared to the current programs.

5.4 Simulated impact on hours worked

Table 6 summarizes the simulated impacts of the three policy reforms on hours worked per week. Because we set hours worked as zero for those who retired, the average hours worked reported in this table roughly correspond to the total labor supply provided by the elderly. As with the results in Table 5, the most remarkable impact on hours worked is caused by raising the eligibility age; it will increase hours worked by around 10% for both men and women in both age groups. Compared with the raising of the eligibility age, the other two reforms will have smaller impacts, consistent with the results in Table 5.

It should be noted that these simulation results ignore the possibility of a shift across retirement, part-time work, and full-time work that is likely to be accompanied by discontinuous changes in the hours worked. However, the results suggest that raising the eligibility age may have substantial impact on overall hours worked, and, thus, the overall labor input provided by the elderly.

6. Conclusions

We investigated how elderly employment is associated with public pension programs in Japan by using population-based, longitudinal data of middle-aged and older individuals. By utilizing a single index of implicit tax (ITAX), which incorporates various aspects of public pension and other programs, we examined how the elderly workers' decisions on work/retirement and hours worked are influenced by it. Our estimation results confirmed that public pension programs work as a disincentive to work. Based on these estimation results, our simulation results underscored the potential impacts of pension-related policy reforms on elderly decisions on work/retirement and hours worked.

Most notably, we showed that abolishing the earnings test can reduce the probability of retirement by 2.3 and 0.7 percentage points for men aged 60–64 and 65–69, respectively; further, raising the eligibility age for pension benefits to 70 can reduce it by 6.3 and 5.9 percentage points for the 60–64 and 65–69 age groups, respectively. Extending the wage subsidy to the age of 69 will have similar impacts on those aged 65–69 as abolishing the earnings test. The impacts on women's decisions are found to be somewhat limited; this probably reflects their more diversified lifestyles, but the impacts will likely become more remarkable as elderly women get more opportunities to work as full-time workers.

We recognize that this study has several limitations and issues that need to be addressed in future research. First, the simultaneity of decisions concerning retirement and claiming benefit is ignored in this study. The fact that working pensioners shape a main pathway from the time they are part of the workforce until retirement suggests that the two decisions are not identical. An analysis on the joint decision making on retirement and claiming behavior is necessary to fully understand the elderly's behavioral responses to social security incentives. Second, other institutional factors that are not incorporated in ITAX are likely to have affected the elderly's labor supply. Notably, a revision of the Elderly Employment Stabilization Law that requires firms to either abolish the mandatory retirement age or raise it to 65 years (effective as of April 2006) probably confounded the results of pension reforms in recent years. Third, we concentrated on the respondents who had been working as employees until one year prior to the study survey, because our regression models were supposed to examine the probability of staying in the labor force or leaving it. In reality, however, we observe from the LSMOA dataset that there are some individuals who resumed working after staying out of the labor force for a while. Future research should capture more diversified pathways from work to retirement. Lastly, the two-way causality between health and labor force participation should be elaborated. Our regression analysis treated health variables as covariates and ignored the impact of retirement/work on health.

Despite these limitations, the results in this study suggest that policy reforms, which are supposed to reduce the negative effects of the current pension schemes on work, can potentially encourage the elderly to stay in the labor force longer and promote a shift from part-time work to full-time work among the elderly. These impacts are expected to enhance growth potential under an aging population, by realizing the health capacity to work (Oshio and Shimizutani, 2019). In addition, higher revenues from pension premiums and personal taxes can likely help to enhance the adequacy of the public pension program by raising the benefits and allocating more resources to assist the fragile elderly.

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Appendix

A.1 Formula of the earnings test for the pension benefit: *Zaishoku Rorei Nenkin*

Letting W and B denote the current (standardized) wage and pre-earnings-test pension benefit, respectively, the earnings-tested reduction in the pension benefit (D; thousand yen per month) for those aged 60–64 years is given by

$$D = \min[\max(0.5(W + B - 280), 0) + \max(0.5(W - 470), 0), B] \quad \text{if} \quad B < 280,$$

$$= \min[\max(0.5W, 0) + \max(W - 470, 0), B] \quad \text{if} \quad B \geq 280,$$

and for those aged 65–69,

$$D = \min[\max(0.5(W + B_2 - 470), 0), B_2],$$

where B_2 denotes the wage-proportional component of EPI benefit. Note that the parameters in the formulae above are the current ones and minor revisions have been made during the survey years.

A.2 Formula of the wage subsidy for the elderly: *Konenrei Koyo eikzoku Kyufukin*

Letting W and W_{59} denote the current wage and the wage at the age of 59, respectively, the wage subsidy (S; thousand yen per month) is given by

$$S = 0.15W_{59} \quad \text{if} \quad W < 0.61W_{59},$$

$$= (137.25W_{59} - 183W)/28 \quad \text{if} \quad 0.61W_{59} \leq W < 0.75W_{59},$$

$$= 0 \quad \text{if} \quad 0.75W_{59} \leq W$$

for those aged 60–64 years. If one receives the pension benefit, it will be reduced by 0–6% of the standardized wage in proportion to the ratio of the subsidy to the current wage. In calculating the wage subsidy for the elderly, we subtract this reduced pension benefit from the wage subsidy calculated from the above formula.

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Table 1. Key characteristics of respondents

		Men	Women	Total
Proportion (%)				
Retired		9.6	10.7	10.1
Part-time		7.0	35.2	18.6
Full-time		83.4	54.1	71.3
Diabetes		13.3	6.1	10.4
Heart disease		6.0	2.4	4.5
Stroke		1.9	0.9	1.5
Hypertension		33.8	25.5	30.3
Hyperlipidemia		18.2	18.8	18.4
Cancer		2.4	2.1	2.2
Poor self-rated health		16.7	13.8	15.5
ADL problem		5.7	9.1	7.1
Smoking		33.5	9.3	23.5
Caregiving		9.1	12.6	10.6
Married		91.2	79.3	86.3
Proportion (%)				
Educational level				
Junior high school		14.5	16.2	15.2
High school		55.9	77.2	65.0
College or above		29.6	6.7	19.8
Social security wealth	*M*	24.5	18.0	21.8
(JPY, million)	*SD*	(6.9)	(6.6)	(7.5)
Lifetime income	*M*	154.1	65.9	117.6
(JPY, million)	*SD*	(55.2)	(48.5)	(68.2)
Monthly wage	*M*	395.3	180.6	307.3
(JPY, thousand)	*SD*	(340.9)	(225.0)	(317.0)
Hours worked per week	*M*	37.2	28.2	33.4
	SD	(15.1)	(14.9)	(15.7)
Age	*M*	(59.6)	(59.5)	(59.6)
	SD	(3.2)	(3.2)	(3.2)
Number of observations		30,804	21,711	52,515
Number of individuals		7,450	5,550	13,000

Figure 1. Evolution of the work and pension benefits combination with age

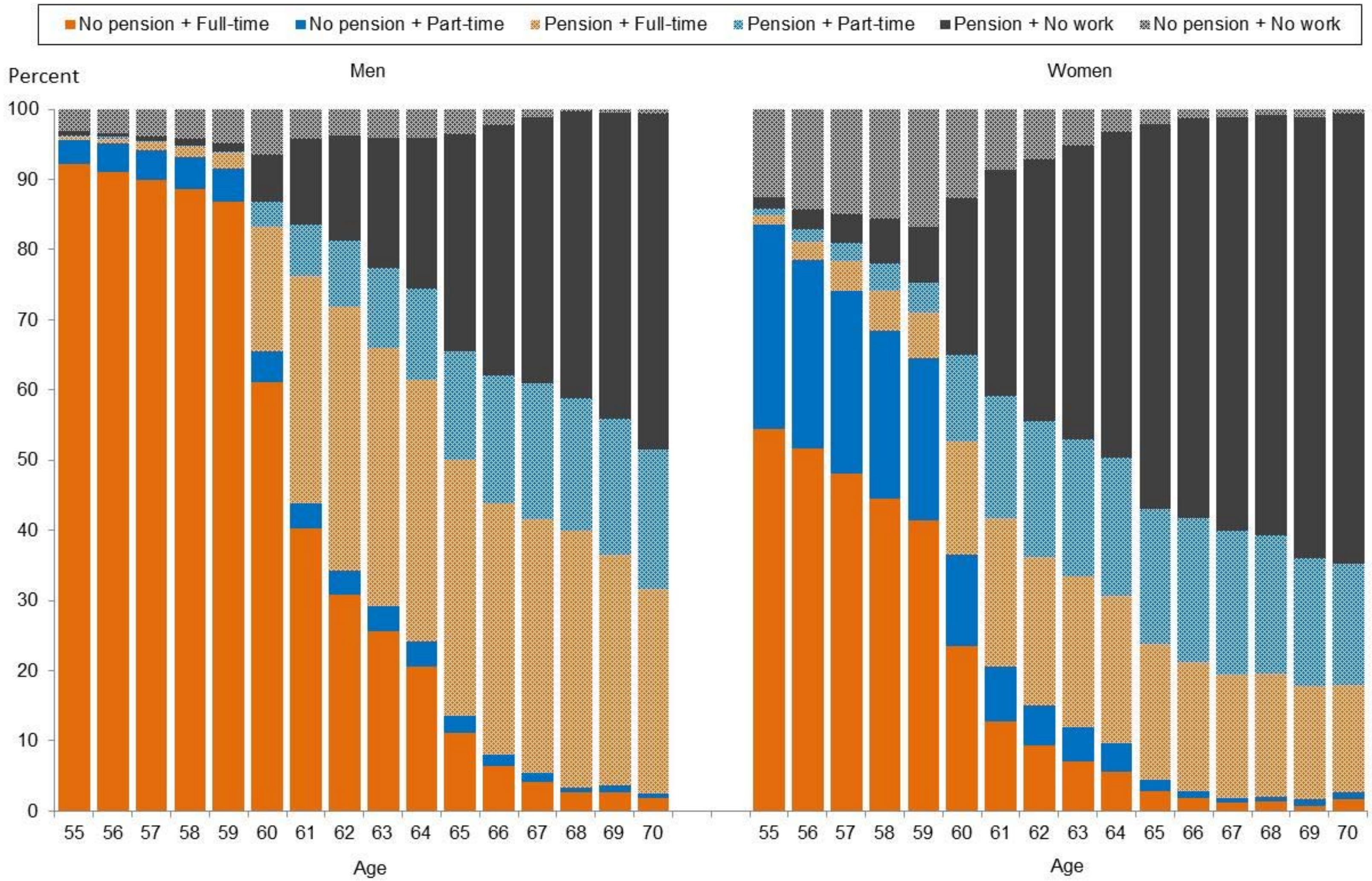


Figure 2. Evolution of the implicit tax rate (ITAX) with age across three male cohorts

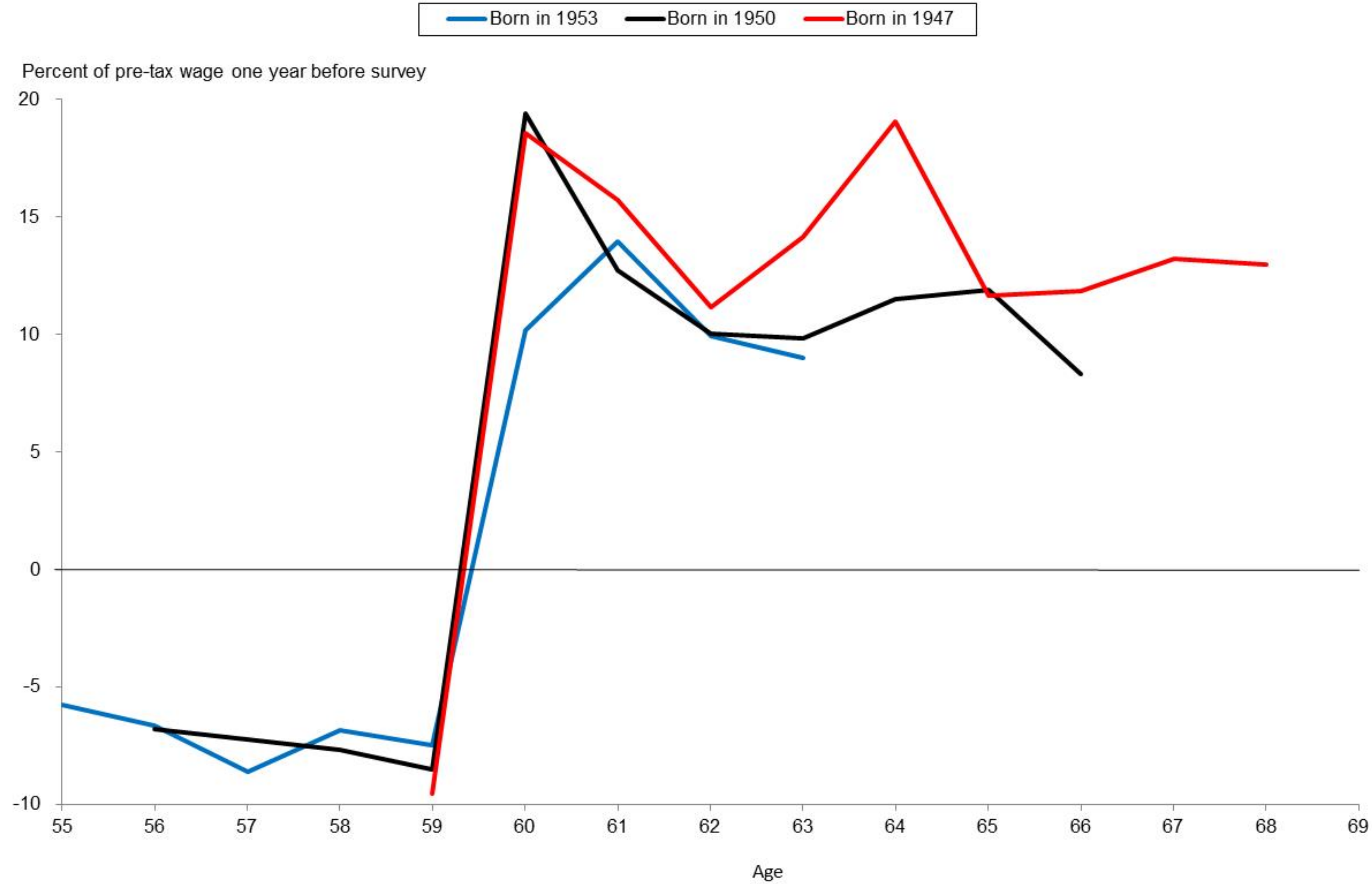


Figure 3. Evolution of the composition of the implicit tax rate with age for men

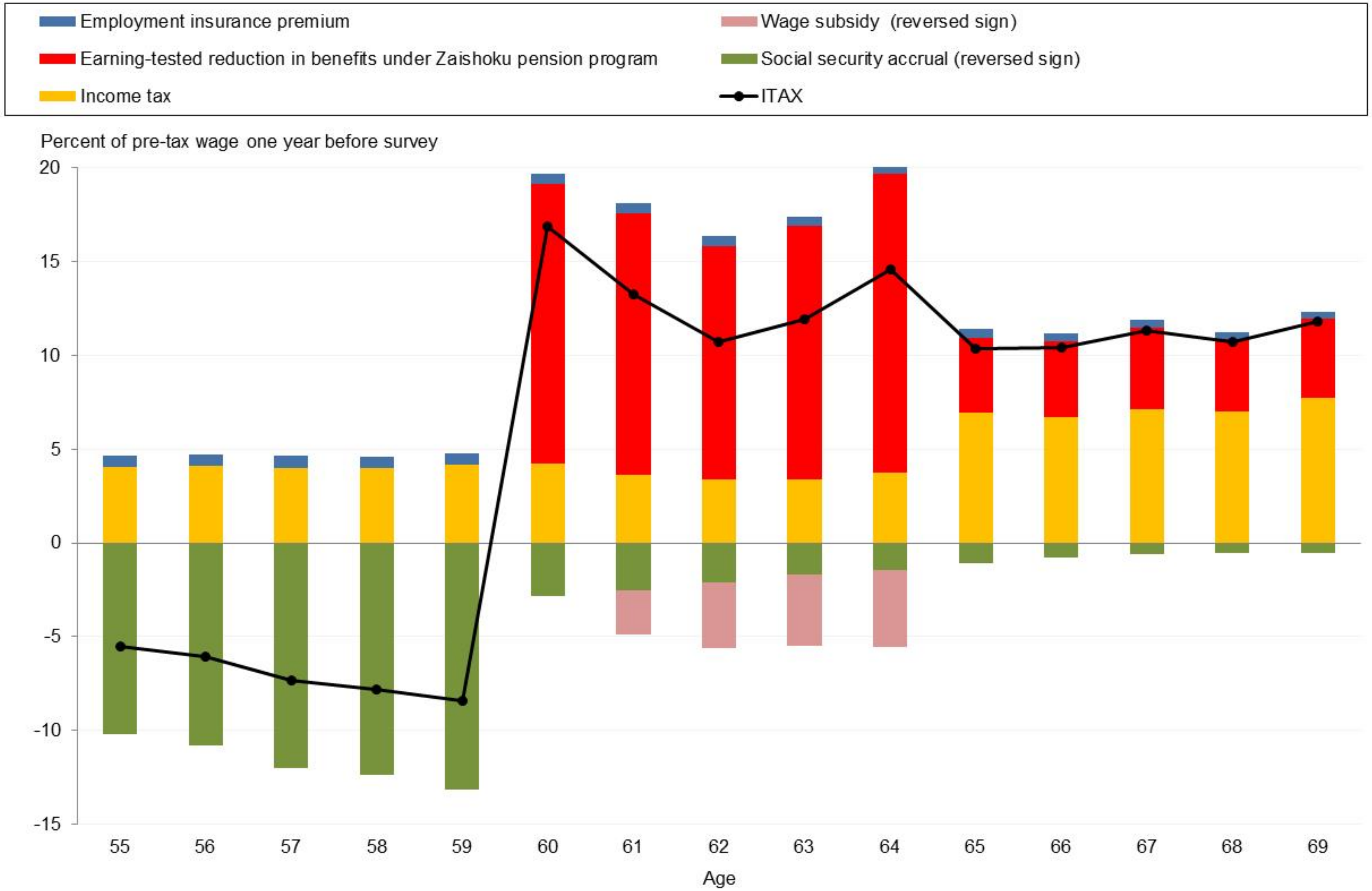


Table 2. Results of the multinomial logistic model to explain retirement, part-time work, and full-time work for men (N = 30,804)

	Retirement			Part-time work			Full-time work		
	dy/dx		SE	*dy/dx*		SE	*dy/dx*		SE
ITAX	0.132	***	(0.017)	0.034	***	(0.010)	–0.166	***	(0.022)
SSW/wage	0.010	***	(0.002)	0.005	***	(0.001)	–0.014	***	(0.002)
Lifetime income /wage	–0.001	***	(0.000)	–0.001	***	(0.000)	0.002	***	(0.000)
Full-time work one year before	–0.101	***	(0.006)	–0.140	***	(0.003)	0.241	***	(0.007)
Diabetes	0.007		(0.005)	–0.002		(0.004)	–0.005		(0.006)
Heart disease	0.024	***	(0.006)	0.005		(0.005)	–0.029	***	(0.008)
Stroke	0.037	***	(0.011)	0.007		(0.008)	–0.044	***	(0.013)
Hypertension	–0.002		(0.004)	–0.005		(0.003)	0.007		(0.004)
Hyperlipidemia	–0.021	***	(0.005)	–0.001		(0.003)	0.022	***	(0.005)
Cancer	0.037	***	(0.009)	0.022	***	(0.006)	–0.059	***	(0.010)
Poor self-rated health	0.019	***	(0.005)	0.005		(0.003)	–0.024	***	(0.005)
ADL problem	0.045	***	(0.006)	0.013	**	(0.005)	–0.058	***	(0.007)
Smoking	0.001		(0.004)	–0.010	***	(0.003)	0.009	*	(0.004)
Caregiving	0.020	***	(0.006)	0.007		(0.004)	–0.026	***	(0.006)
Married	–0.020	***	(0.006)	–0.003		(0.004)	0.023	***	(0.007)
Junior high school	0.013	*	(0.005)	0.010	**	(0.004)	–0.022	***	(0.006)
College or above	–0.016	***	(0.004)	0.001		(0.003)	0.015	***	(0.004)
Age	0.029		(0.019)	0.046	***	(0.013)	–0.075	***	(0.023)
Age squared /100	–0.020		(0.015)	–0.032	**	(0.011)	0.052	**	(0.018)

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 3. Results of the multinomial logistic model to explain retirement, part-time work, and full-time work for women ($N = 21{,}711$)

	Retirement			Part-time work			Full-time work		
	dy/dx		SE	*dy/dx*		SE	*dy/dx*		SE
ITAX	0.043	**	(0.015)	0.001		(0.025)	–0.044		(0.039)
SSW/wage	0.005	***	(0.001)	0.005	***	(0.001)	–0.010	***	(0.002)
Lifetime income /wage	–0.001	***	(0.000)	–0.001	***	(0.000)	0.002	***	(0.000)
Full-time work one year before	–0.013	*	(0.006)	–0.363	***	(0.009)	0.376	***	(0.014)
Diabetes	0.004		(0.009)	–0.012		(0.010)	0.007		(0.010)
Heart disease	0.017		(0.014)	–0.009		(0.015)	–0.008		(0.017)
Stroke	0.023		(0.021)	0.008		(0.021)	–0.031		(0.025)
Hypertension	–0.007		(0.005)	0.006		(0.005)	0.001		(0.006)
Hyperlipidemia	0.004		(0.005)	–0.007		(0.006)	0.003		(0.006)
Cancer	0.072	***	(0.012)	–0.021		(0.017)	–0.050	**	(0.017)
Poor self-rated health	0.019	**	(0.006)	–0.012		(0.007)	–0.007		(0.007)
ADL problem	0.023	**	(0.007)	–0.002		(0.009)	–0.021	*	(0.009)
Smoking	–0.022	**	(0.008)	0.016	*	(0.008)	0.006		(0.009)
Caregiving	0.033	***	(0.006)	0.003		(0.007)	–0.035	***	(0.007)
Married	0.012	*	(0.006)	0.021	***	(0.007)	–0.033	***	(0.007)
Junior high school	–0.001		(0.007)	-0.014		(0.007)	0.014		(0.008)
College or above	0.009		(0.008)	0.013		(0.009)	–0.022	*	(0.011)
Age	0.101	***	(0.022)	-0.070	***	(0.021)	–0.031		(0.024)
Age squared /100	–0.082	***	(0.018)	0.060	***	(0.017)	0.022		(0.020)

$^{***}\ p < 0.001$, $^{**}\ p < 0.01$, $^{*}\ p < 0.05$

Table 4. Estimation results of Tobit models to explain hours worked per week

	Men			Women		
	Coef.		SE	Coef.		SE
ITAX	–7.41	***	(0.74)	–2.52	***	(0.34)
SSW/wage	–0.46	***	(0.05)	-0.31	***	(0.02)
Lifetime income /wage	0.05	***	(0.01)	0.05	***	(0.00)
Full-time work one year before	13.37	***	(0.40)	14.50	***	(0.21)
Diabetes	–0.27		(0.27)	0.46		(0.39)
Heart disease	–1.70	***	(0.38)	0.17		(0.61)
Stroke	–2.96	***	(0.67)	–1.56		(1.00)
Hypertension	0.09		(0.20)	0.06		(0.22)
Hyperlipidemia	0.92	***	(0.24)	–0.07		(0.24)
Cancer	–3.88	***	(0.60)	–5.08	***	(0.66)
Poor self-rated health	–1.36	***	(0.26)	–0.95	***	(0.29)
ADL problem	–4.23	***	(0.41)	–1.53	***	(0.34)
Smoking	0.50	*	(0.20)	0.75	*	(0.32)
Caregiving	–1.14	***	(0.31)	–1.76	***	(0.28)
Married	1.30	***	(0.32)	–1.49	***	(0.24)
Junior high school	–0.39		(0.30)	0.49		(0.27)
College or above	0.72	***	(0.20)	–1.29	***	(0.37)
Age	–2.33	*	(0.92)	–2.96	***	(0.92)
Age squared /100	1.42		(0.75)	2.23	**	(0.75)
Pseudo R^2	0.0178			0.0426		
No. of left censored respondents	3,038			2,379		
N	28,153			21,284		

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Figure 4. Evolution of counterfactual implicit tax rates (ITAX) with age

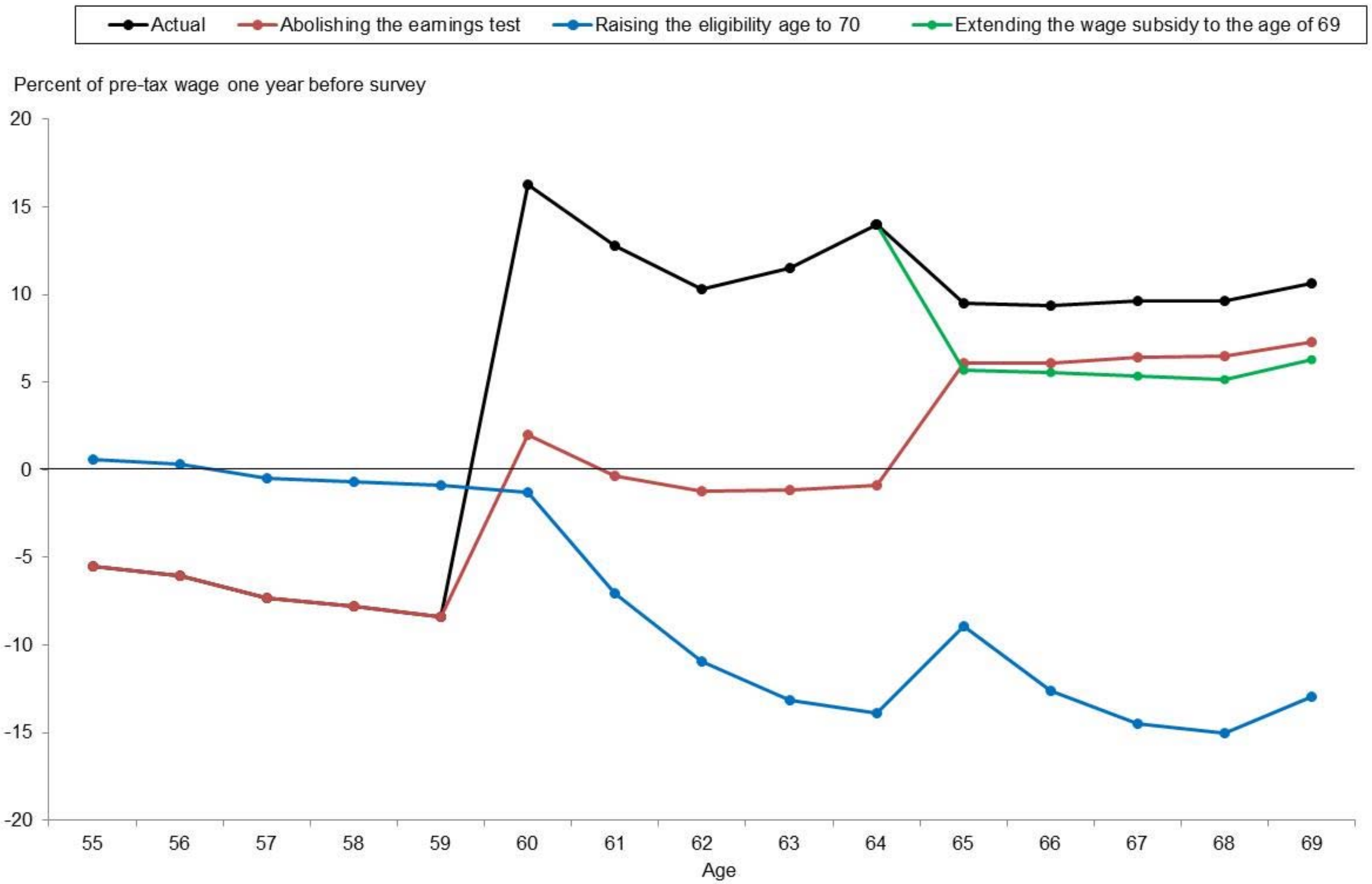
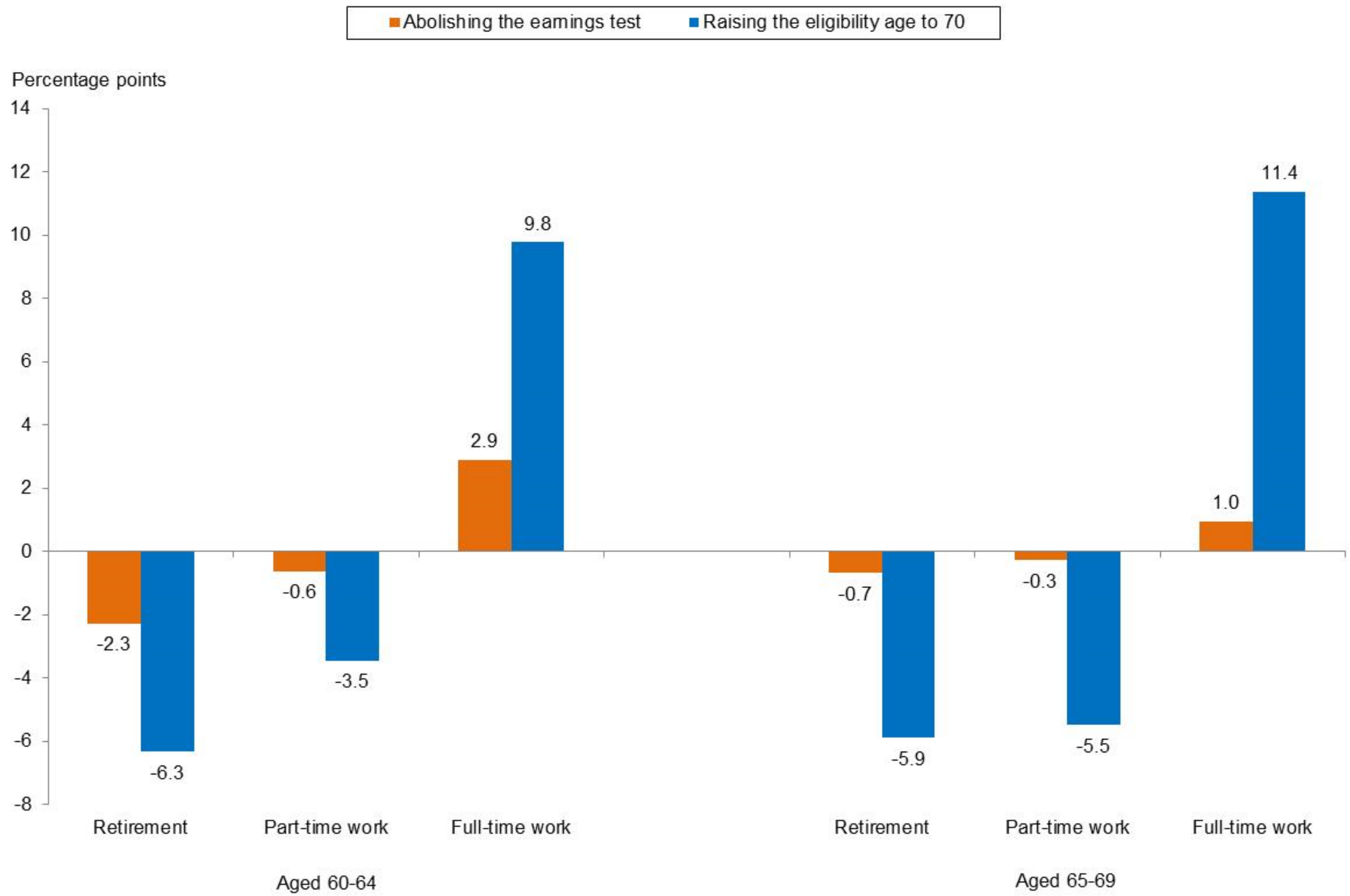


Table 5. Simulation results of policy reforms on the probabilities of work and retirement

Percent	Aged 60–64 years			Aged 65–69 years		
	Retirement	Part-time work	Full-time work	Retirement	Part-time work	Full-time work
Men						
Actual	13.3	10.1	76.6	17.4	24.2	58.5
Predicted *(A)*	13.2	9.5	77.3	15.0	24.4	60.5
Simulated						
Abolishing the earnings test (B_1)	10.9	8.9	80.2	14.4	24.1	61.5
Raising the eligibility age to 70 (B_2)	6.8	6.1	87.1	9.2	18.9	71.9
Extending the wage subsidy to the age of 69 (B_3)	13.2	9.5	77.3	14.4	24.1	61.5
Impact (percentage points)						
Abolishing the earnings test ($B_1 - A$)	–2.3	–0.6	2.9	–0.7	–0.3	1.0
Raising the eligibility age to 70 ($B_2 - A$)	–6.3	–3.5	9.8	–5.9	–5.5	11.4
Extending the wage subsidy to the age of 69 ($B_3 - A$)	0.0	0.0	0.0	–0.7	–0.3	1.0
Women						
Actual	13.8	37.9	48.3	14.4	45.9	39.7
Predicted *(A)*	13.6	37.3	49.1	12.0	47.5	40.5
Simulated						
Abolishing the earnings test (B_1)	13.4	37.2	49.4	12.0	47.5	40.5
Raising the eligibility age to 70 (B_2)	9.4	34.9	55.6	9.0	46.2	44.8
Extending the wage subsidy to the age of 69 (B_3)	13.6	37.3	49.1	12.0	47.5	40.5
Impact (percentage points)						
Abolishing the earnings test ($B_1 - A$)	–0.2	0.0	0.2	0.0	0.0	0.0
Raising the eligibility age to 70 ($B_2 - A$)	–4.2	–2.3	6.5	–3.1	–1.3	4.3
Extending the wage subsidy to the age of 69 ($B_3 - A$)	0.0	0.0	0.0	–0.1	0.0	0.1

Figure 5. Simulated impacts of the two pension reforms for men



Note: Based on the simulation results presented in Table 4.

Table 6. Simulation results of the policy reforms on hours worked per week

	Men			Women		
Age	60–64	65–69	60–69	60–64	65–69	60–69
Actual	34.8	28.8	33.7	25.6	23.1	25.1
Predicted (*A*)	32.7	27.4	31.7	25.1	23.0	24.7
Simulated						
Abolishing the earnings test (B_1)	33.7	27.7	32.7	25.2	23.1	24.8
Raising the eligibility age to 70 (B_2)	36.1	30.7	35.2	27.7	25.1	27.2
Extending the wage subsidy to the age of 69 (B_3)	32.7	27.7	31.8	25.1	23.1	24.7
Impact						
Abolishing the earnings test ($B_1 - A$)	1.1	0.3	0.9	0.1	0.0	0.1
(% change)	(3.3)	(1.1)	(2.9)	(0.4)	(0.1)	(0.4)
Raising the eligibility age to 70 ($B_2 - A$)	3.4	3.4	3.4	2.6	2.1	2.5
(% change)	(10.5)	(12.3)	(10.8)	(10.2)	(9.0)	(10.0)
Extending the wage subsidy to the age of 69 ($B_3 - A$)	0.0	0.3	0.1	0.0	0.0	0.0
(% change)	(0.0)	(1.2)	(0.2)	(0.0)	(0.2)	(0.0)

Note: Hours worked are set to zero when an individual retires.