The Effects of the Old-age Pension System for Active Employees on the Labor Supply of Elderly Male Workers

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Summary

This paper analyzes the impact of the old-age pension system for active employees on the employment behavior of elderly persons using the differences-in-differences method and the estimation of dynamic labor supply models. Data comes from "Surveys on Employment of Older Persons." Both the differences-in-differences method and the estimated dynamic labor supply models showed that the old-age pension system for active employees restrains the supply of workers in their early sixties (60 to 65 years of age). Effects of the reform of the system in 1995 were analyzed. The differences-in-differences method revealed that the reform affected the decision to work or not, especially for elderly persons on a small pension, but did not affect working hours. The estimated dynamic labor supply models revealed no significant marginal tax rate effects of the pension system around 1995. The estimated wage elasticities, which were estimated by pooling data for 1988, 1992, and 1996, were relatively high, ranging from 0.2 to 0.6.
1. Introduction

Declining birth rates and an aging population are expected to reduce the labor force in Japan in the early twenty-first century. To mitigate the effects of this decline in the workforce, it is essential to raise the labor force participation rates of women and of elderly persons. Iwamoto (1988) estimates that if there is no change in the labor supply within each age cohort, the labor force in Japan will decline by 6,310,000 between 2000 and 2020. A forecast using a macro-econometric model also suggests a decline in the workforce of six million.

Because a decline in the birth rate results in a decrease in the total population, the non-working population will also decrease. If the dependency rate (which indicates the number of insured persons supporting each pensioner) remains unchanged, the decline in the labor force may well be acceptable. There is also the possibility of changes in industrial structure and the possibility that technical innovation will help support the labor force. Nevertheless, it is worth increasing the workforce by raising the labor force participation rates of women and of elderly people, who are currently under-utilized because of various institutional restrictions. Summarizing the results of recent studies, Iwamoto (1998) forecasts that a doubling of the staff at nursery schools would lead to new jobs for about 300,000 to 600,000 women and that the abolition of the partial pension would result in new jobs for about 300,000 elderly men (between 60 and 64 years).

The partial pension is the remuneration-related component of the pension. In the employee pension system in Japan, the pension comprises two components: a remuneration-related part (the partial pension) and a fixed part (the "basic pension"). The age at which payment of the fixed component begins is to be increased by one year-of-age from (the current) 60 years of age to 65 years of age every three years from 2001 to 2013. Thus, in 2013 those aged between 60 and 64 will receive only the remuneration-related component (the partial pension). The age at which payment of the remuneration-related component commences will also be raised from 60 to 65 during the 2013-2025 period, again by one year-of-age every three years. In 2013, a reduced pension for those aged 60 to 64 will also be introduced.

The labor supply of elderly people has been affected by the old-age pension system for active employees. This system was introduced in 1965; while retirement had formerly been a requirement for pension payment, the system paid a reduced pension to employed persons depending on their wage levels. Prior to 1995, this pension system restrained employment substantially, because reduced pensions for those in their early sixties had the same effect as higher taxes on wages (Abe (1998), Iwamoto (2000)). In 1995 reductions in the active employees' pensions were revised in an attempt to reduce the system's work disincentives. It is important to analyze the impact of the revised pension system on the labor supply of...
elderly persons. This is because, while those in their late sixties (65 to 69 years) currently receive full pensions, from 2002 these persons will be covered by a system that is similar to the old-age pension system for active employees currently applying only to those aged 60 to 64 years.

To date, no studies have analyzed changes in the employment-controlling effect of the pension system for active employees caused by the revision in 1995. This paper analyzes the impact of the 1995 revision of the pension system on labor supply by using data from "Surveys on Employment of Older Persons" and by examining wage elasticities for elderly employees.

The issue addressed by this study is the extent to which the old-age pension system for active employees has controlled the labor supply of those between 60 and 64, who are now eligible for an employee pension. While previous studies have analyzed the impact of the changes in 1986 and 1989, this paper estimates a dynamic model using data from the 1996 "Survey on Employment of Older Persons" to analyze the effects of the 1995 change in the old-age pension system, and does so using pseudo-panel data methods. These are the two novelties of this study.

Section 2 reports on the employment situation of elderly men in Japan and, in particular, looks at recent studies on the relationship between the pension system for active employees and employment rates among those in their early sixties. Section 3 examines the possibility that the pension system discourages the elderly from working by applying the differences-in-differences method, which involves using differences between the pension system for people in their early sixties and the system for those in their late sixties. Section 4 estimates a dynamic labor supply model using pseudo-panel data methods and analyzes the wage elasticity of labor supply for elderly people and the taxation effects of the pension system.
2. Labor force participation rates of elderly men

The labor force participation rate of elderly men in Japan is high by international standards. Figure 1 compares rates of labor force participation and employment for men aged 55 to 64, and shows that Japanese elderly men have high rates of both. The labor force participation rate of Japanese men aged 60 to 64 was 72.6% in 2000. Figure 2 shows the trend for the employment rate of males aged 55 to 59 in Japan. The rate remained at roughly 90% from 1960 to 1990, but began to rise in the 1990s, reaching 94.2% in 2000. The employment rate for those in their early sixties continued to decline from 1970 to the late 1980s, increased thereafter until 1993, and slightly in subsequent years. The figure for those aged over 65 showed a similar trend: the employment rate decreased until the late 1980s, then increased until 1992, since when it has declined.

Labor force participation rates of those aged 60 and over continued to fall in the 1970s and 1980s due to reinforcement of the public pension system and declines in self-employment and among farmers (Seike (1983)). The second explanation is confirmed by the trend in the employment/population ratios shown in Figure 3: the ratios were at similar levels throughout the 1970s and 1980s.

Abe (1998) gives four possible explanations for increased labor force participation rates during the second half of the 1980s and during the first half of the 1990s: (1) an extended retirement age and the spill-over effects of this on elderly persons; (2) the introduction of subsidies encouraging the employment of older people, and other similar policies; (3) increased labor demand in the period of the "economic bubble" from the late 1980s to the early 1990s; and (4) changes in the old-age pension system for active employees.

(1) Extension of the retirement age

From the 1980s to the 1990s Japanese companies extended their retirement ages.¹ In 1980 the proportion of companies with a retirement age of 60 or over was 39.7%. This figure had increased to 55.4% by 1985, to 63.9% by 1990, to 85.8% by 1995, and to 99.2% by 2000.

The main reason for this trend was that a retirement age of below 60 was prohibited by an amendment to the Law Concerning Stabilization of Employment of Older Persons in 1990. The introduction of the extended retirement age varied considerably according to firm size. Large companies quickly introduced an extended retirement age during the 1980s, and by 1990, 90.6% of them had adopted a retirement age of 60 or over. In small businesses, the extension of retirement ages took place mainly during the 1990s. Even after the retirement age was extended, older employees at most large companies did not

¹ This section owes much to Mitani (2001), which provides a useful summary of developments related to the
always remain at their original workplace: some were offered a preferential system for early retirement, hired out to affiliated firms, or transferred to other sections. However, Chuma's (1997) analysis clearly showed that employees' years of service in their late fifties increased during this period at businesses of all types and sizes, which is thought to have had a considerable impact on the employment behavior of these workers. In fact, Figure 3 shows that the labor force participation rate of employees in their late fifties rose in the 1990s.

(2) Employment promotion systems for older persons

Japan has many subsidies for promoting the employment of older persons. The Law Concerning Stabilization of Employment of Older Persons amendment in 1994 reinforced the obligation on employers to strive to continue hiring employees of up to 65 years of age, and also prohibited a retirement age of less than 60. As part of an employment stabilization project under the Employment Insurance Law, subsidy programs were introduced to increase employment opportunities for elderly people. These subsidies included: 1) a subsidy for continued employment (a subsidy to companies that introduce a continued employment system for workers aged 61 and over); 2) a subsidy for the employment of older workers (a subsidy to companies that hire at least a given number of older persons as a percentage of their total employment); 3) a subsidy for creating an environment for hiring older workers (a subsidy for companies that introduce equipment facilitating the employment of older workers); and 4) a subsidy to support employees' preparations for old-age employment (a subsidy to companies that offer paid holidays to employees who want to learn skills to prepare for employment in old age). These subsidies promoted the employment of older persons. Mitani (2001) confirmed that companies with a better working environment for the elderly hire a larger number of older persons.

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2 This section is based on Abe (1998) and Mitani (2001).
(3) Increase in labor demand

In analyzing the employment behavior of elderly people, Ogawa (1998a, b) developed a new approach to assuming the potential amount of public pension receivable (the "original pension amount"), and thereby eliminated the simultaneity bias that arises between employment and pension payments received due to the measures designed to reduce old-age pensions for active employees. In this analysis, he showed that an increase in the employment rate of older persons between the late 1980s and early 1990s was greatly affected by higher wage incomes. Mitani (2001) also confirmed that employment rates among the elderly react strongly to wage levels and unemployment rates. Since 1998 the aggregate unemployment rate in Japan has increased sharply to about 10%. It is assumed that the reduction in labor force participation rates after 1998 among those in their early sixties has been greatly affected by this reduced labor demand.

(4) Old-age pension system for active employees

The old-age pension system for active employees relaxes the retirement requirement for pension payment and pays reduced pensions to low-wage workers aged 60 to 64. Historical changes to the system are shown in Table 1. The system is intended to increase incentives to work. However, a study has suggested that by having the same effect as imposing high payroll tax rates on wages above a certain level, the system promotes short-hour employment and thereby inhibits the labor supply. More specifically, for workers whose wage income exceeded a given amount, pension cuts were sufficient to leave them worse off than previously. To cope with this problem, in 1989 the wage ("monthly standard remuneration") brackets applied to pension reductions were increased in number from three to seven, and the 1995 reforms treated pension reductions like negative income in order to prevent wage increases from reducing overall take-home pay (see Table 2). Before the 1995 reforms, the brackets applying to pension reductions depended only on monthly earnings. However, in the reformed system the brackets were made dependent on the sum of earnings and pension. These changes to the old-age pension system were expected to have the effect of promoting the labor supply of workers in their early sixties.

Figures 4A and 4B illustrate the improved pension reduction scheme of the old-age pension system. The horizontal axis represents the monthly wage ("monthly standard remuneration") and the vertical axis represents the sum of pension received and the monthly wage. Figure 4A supposes that the amount of pension that retired workers could receive (the original pension benefit) is ¥200,000 per month. The diagram compares the three stages of the pension system for active employees: from 1986 to 1989; from

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3 Seike (1993) made the first attempt to analyze the effect on work disincentives of the old-age pension for active employees.
1989 to 1994; and following the 1995 change. As noted above, the change in 1989 increased the number of wage groups for cutting pensions from three to seven. Before the 1995 reform, there was a convex kink in the income schedule at ¥95,000 per month. The 1995 reforms eliminated reductions in overall take-home pay (the sum of pension and wages), unless monthly wages exceeded ¥340,000. Figure 4B shows that the convex kink in the 1995 reform moves to the right as the original pension benefit decreases. For the person with an original pension benefit above ¥156,250, the 1995 reform changed the location of the convex kink to a point below ¥95,000, the point at which the convex kink was located prior to 1995. For the person with an original pension benefit of less than ¥156,250, the convex kink was moved to the right by the 1995 reform.

Previous studies have revealed that the old-age pension system for active employees restrains the labor force participation rate and the working hours of employees in their early sixties (Seike (1993), Ogawa (1998a, b), Abe (1998), Iwamoto (2000), and Mitani (2001)). The studies of Abe (1998), Iwamoto (2000), and Mitani (2001) also found that the increase in the number of wage brackets for pension reduction from three to seven in 1989 had little effect on the labor supply of workers aged 60 to 64.

Abe (1998) argued that while those in their early sixties suffered large pension reductions as a result of wage increases under the old-age pension system for active employees, those in their late sixties receive pensions regardless of wage levels. Treating the 1989 reforms applied to workers aged 60 to 64 as a "natural experiment," she analyzed the change by using the differences-in-differences method. If the 1989 change had the effect of increasing the incentive to work, in the case of persons eligible for an employee pension, the increase in the labor force participation rate of those in their early sixties following the change should have been larger than that of those in their late sixties. However, having analyzed data from "Surveys on Employment of Older Persons," Abe (1998) found no evidence of such an effect.

Iwamoto (2000) estimated a dynamic labor supply model by using pseudo-panel methods on survey data from "Basic Study on People's Life," treated the old-age pension system for active employees as a payroll tax system, and estimated the rate of this tax. He found that the effect of the old-age pension for active employees is equivalent to a payroll tax rate of 80% or more, and that the tax rate did not change after the reforms of 1989.

Mitani (2001) used a multinomial logit model for the choice of employment status between three alternatives—employment, self-employment, and not working—to analyze the effects of the old age pension system on the employment behavior of active employees. Like Ogawa (1998), he treated the pension as an

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4 The change in 2000 eliminated reductions in overall take-home pay for a monthly wage of ¥340,000.
income subsidy for those choosing the employment option. Those choosing the option of not working are assumed to receive a full pension. Because those electing employment cannot choose their working hours, the starting wage is used and monthly income is assumed fixed. Having built the model to explain employment behavior, Mitani (2001) analyzed the impact of changes to the pension system on employment/not working ratios. As with other studies, Mitani (2001) found that the 1989 reforms had little effect on employment behavior. However, Mitani (2001) found that the 1995 changes did increase employment/not working ratios. The results of Mitani (2001) are questionable if the assumption that employees cannot choose their working hours is incorrect. Some of the mechanisms for cutting the old-age pension for active employees are likely to create distortions that promote short-hour employment, but this effect cannot be analyzed.

3. Effects of the old-age pension for active employees estimated by the differences-in-differences method

This section treats the changes in the old-age pension system for active employees as a "natural experiment", exploiting the fact that the system treats those aged 60 to 64 and those aged 65 to 69 differently, to investigate whether or not the reforms affected the employment behavior of the elderly. This technique is similar to methods used by Abe (1998), Friedberg (2000), and Gruber and Orszag (2000). First, the history of changes to the pension system is outlined. Since the system for those aged 65 to 69 was not one in which wage increases triggered pension reductions, graphs are used to investigate whether or not reform of the pension system for those aged 60 to 64 brought about increases in labor force participation rates among those aged 60 to 64 that differed from those aged 65 to 69. Data from "Surveys on Employment of Older Persons" at the three points in time referred to above are then examined using the differences-in-differences method to see if there were variations in labor supply behavior.

Friedberg (2000) applies differences-in-differences and structural model estimation to U.S. data to analyze the impact of earnings tests for pensions on the labor supply of older workers. The earnings test in the U.S. public pension system resembles the test that has been in place in Japan's old-age pension system for active employees since 1995. Friedberg (2000) examines the effect on the distribution of earnings of changes induced by pension reforms in the exempt amount for pension payments. He finds that earnings cluster near the exempt amount, and that a change in the exempt amount generates a corresponding change in the location at which earnings cluster. He also carries out policy simulations based on the estimation of a structural model. The simulations show that the abolition of earnings tests would raise aggregate labor supply hours by 5.3%. By contrast, an increase in the exempt amount of earnings would lower labor supply.
Gruber and Orszag (2000) analyze the effects of the exempt amount in earnings tests on labor supply and on the behavior of pensioners. They find that the exempt amount does not affect the labor supply of men but does affect that of women, and that more lenient earnings tests raise the rate at which those eligible take up pensions but also reduce the average amount of pensions. Hence the abolition of earnings tests at young ages may lower the living standards of the elderly, and so the authors urge caution with regard to discontinuing tests.

Exploiting differences between the treatment of those aged 60 to 64 years and those aged 65 to 69 by Japan's old-age pension system for active employees, Abe (1998) showed that earnings tests control the labor supply of older persons and that the change in the pension system for active employees in 1989 had no impact on the labor supply of those in their early sixties.

3.1 Major changes in the old-age pension system for active employees

Table 1 shows the major changes in the old-age pension system for active employees in Japan. When this system began in 1965, 80% of the original pension amount (the amount to be paid when fully retired) was paid to people of at least 65 years of age provided their income from employment had reached a certain level. In 1969 a new system was introduced in which working people of between 60 and 64 years of age received a pension that was reduced according to employment income. In this system, four levels of pension benefit reduction according to employment income were established: 80%, 60%, 40%, and 20% of the full pension payable on retirement. No pension was paid to those whose earnings exceeded a particular threshold. This system of reductions tended to reduce the overall incomes (pension plus wage income) of employees aged 60 to 64 as their employment income levels rose to enter the next highest income bracket (see Figure 4A and 4B). The upper limit on wage income for pension payments was increased to keep pace with inflation. However, the problematic issue of wage increases leading to lower total income (wages plus pension) was not settled until the introduction of the 1995 reforms. The reform in 1985 stopped pension reductions for those aged 65 and over.

3.2 Graphical evidence

Figure 5 shows differences between the labor force participation rates of those aged 60 to 64 and those aged 65 to 69. Those aged 65 and over are not affected by earnings tests and can therefore be regarded as a control group for checking the effect of changes in the old-age pension for active employees on those aged between 60 and 64. The points in time at which changes in the system occurred (shown by vertical lines) and the labor force participation rate differences between the two age groups do not seem to be
correlated. Differences in employment ratios are shown in Figure 6 and differences in working hours are shown in Figure 7. No obvious correlations are apparent here either.

Differences in labor supply changes between those aged 60 to 64 years and those aged 65 and over are then examined using the method of differences-in-differences. Using $x_{60,t}$ for the labor force participation rate of those aged 60 to 64 years in year $t$ and using $x_{65,t}$ for the rate of those aged 65 and over in year $t$, differences-in-differences are calculated from the differences in changes in the two groups' labor force participation rates by using the following equation:

$$\Delta\Delta x_t = (x_{60,t+1} - x_{60,t-1}) - (x_{65,t+1} - x_{65,t-1})$$

Figure 8 graphs the values obtained from this equation. The figure appears to show that in 1965 when the old-age pension for active employees was introduced for those aged 65 and over, differences between increases in labor force participation rates for those aged 60 to 64 and those aged 65 and over are below trend. In other words, the introduction of the old-age pension system for active employees for those aged 65 and over may have had the effect of raising the labor force participation rate. However, with the exception of 1975 when the exempt amount was revised, no correlations are apparent between changes in the system and changes in labor force participation rates. Figure 9 graphs employment ratios and Figure 10 graphs working hours. These figures show that at the time of the change in 1995, employment ratios and working hours increased. However, these increases do not differ greatly from changes in 1999 when there was no revision of the system.

In summary, it seems that changes over time in the pension reduction arrangements in the old-age pension for active employees had only minor effects on labor supply. However, this system is not the only factor affecting labor supply behavior. Labor supply is also influenced by household characteristics, income from assets, previous experience of retirement, and other factors. A more detailed analysis is therefore needed.

### 3.3 Regression evidence

As in Abe (1998), this section uses regression analysis on micro data from "Surveys on Employment of Older Persons" carried out by the former Ministry of Labour to investigate the effects of changes in, and the employment control of, the old-age pension system for active employees. Previous studies have used data from these surveys to analyze the labor supply of elderly people. For example,

3.3.1 Descriptive statistics

In this section, the descriptive statistics from the three "Surveys on Employment of Older Persons" are compared and examined. First, Table 3 compares employment ratios for men for each age bracket.

The employment ratios for those aged 60 and under increased between 1988 and 1996. The ratios for those aged 65 and over rose between 1988 and 1992, but declined in 1996. The employment ratios of those aged 60 to 64, who received old-age (employee) pensions, increased. Regardless of age, those who did not receive a pension had higher employment ratios. Table 4 summarizes the average working hours per week of employees.

According to Table 4, the working hours of those aged 64 and under increased, while those of pension beneficiaries aged 65 and over hardly changed.

Figures 11 and 12 present histograms for each survey year of working hours both for male employees who are eligible for the employee pension and for those who are not.

For each survey year, the distribution of working hours is concentrated on full-time employment (44 hours/week) and no employment. This is true whether or not persons are eligible for the employee pension. The employment situation of older persons was also affected by the policy of reducing working hours through, for example, amendments to the Labor Standards Law in the 1980s and 1990s. The figures show that in 1996 the percentage of elderly people working 40 hours a week surpassed that of those working 44 hours a week.

3.3.2 Changes in labor supply behavior and original pension benefit level

Before the 1995 reform, there was a convex kink in the income schedule at ¥95,000 per month. The convex kink in the 1995 reform moves to the right as the person’s original pension benefit decreases, as shown in Figure 4B. For persons with a potential benefit of more than ¥156,250, the 1995 reform changed the location of the convex kink to a point below ¥95,000, at which point the convex kink was located under the system in place before 1995. For persons with an original pension benefit of less than ¥156,250, the

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5 Mitani (2001) uses the same data sets as those used in this paper.
convex kink was moved to the right by the 1995 reform.

If people react to the earnings test, we expect to observe a cluster at the kink. Since the 1995 reform reduced the effective marginal tax rate for the worker with earnings above the convex kink point, the spike at the kink should be smaller in 1996 than in both 1988 and 1992.

Figures 13A-C show the earnings distributions for those aged 60 to 64 relative to the first convex kink in 1988, 1992, and 1996. Figure 13A illustrates the earnings distribution for persons whose original pension benefit is less than ¥56,250, and Figure 13B illustrates the distribution for persons whose original pension benefit is more than ¥156,250. As expected, the spike at the kink is smaller in 1996 than in 1988 and 1992. In both figures we observe spikes in 1988 and 1992. However, in 1996 the situation changed dramatically. We observe a sharp drop in the 1996 earnings distribution at the kink point in Figure 13A. However, in Figure 13B we do not observe a cluster of points around the kink in the 1996 earnings distribution. For workers with an original pension benefit of less than ¥156,250 (poor pensioners), the kink point increased following the 1995 reform. Thus, the earnings of poor pensioners increased as the kink increased or remained at its original point. For workers with an original pension benefit of more than ¥156,250 (rich pensioners), the kink point decreased following the 1995 reform. A rich pensioner at the kink in the pre-1995 system might not have selected the new kink point in the post-1995 system. In fact, according to Figure 14B, most rich pensioners stayed at the original kink, at ¥95,000, after the 1995 reform. Rather than showing the new kink point in 1996, Figure 14B shows the distribution of earnings from which ¥95,000 has been subtracted.

The positive effect of the 1995 reform on the labor supply of elderly people was limited to those with an original pension benefit of less than ¥156,250. Since the reform reduced the kink for rich pensioners, these people were hardly affected by the 1995 reform.

3.3.3 Estimation results

Abe (1998) uses data from 1983, 1988, and 1992 to estimate reduced form equations for labor supply. She also estimates the effects of the changes to the system in 1989 by adding a dummy variable for employee pension eligibility, a 60 to 64 years of age dummy variable, and a dummy variable for 1992. She also uses interaction terms between these dummy variables and the explanatory variables. This paper uses Abe's (1998) method and data from 1988, 1992, and 1996 to examine the impact of the changes in 1992 and

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6 Using 1983 data, Seike (1993) found that there was a cluster at the kink for eligible pensioners but not for non-eligible elderly persons.
The econometric models used follow.

\[
\text{Prob(work = 1)} = \alpha_1 (\text{year dummy}) + \alpha_2 (\text{year dummy} \times \text{age 60 - 64}) + \alpha_3 (\text{pension eligibility}) \\
+ \alpha_4 (\text{pension eligibility} \times \text{age 60 - 64}) + \alpha_5 (\text{pension eligibility} \times \text{age 60 - 64 year dummy}) \\
+ \alpha_6 (\text{pension eligibility} \times \text{age 60 over} \times \text{year dummy}) + X\alpha + \epsilon
\] 

\[
(\text{Weekly working hours}) = \beta_1 (\text{year dummy}) + \beta_2 (\text{year dummy} \times \text{age 60 - 64}) \\
+ \beta_3 (\text{pension eligibility}) + \beta_4 (\text{pension eligibility} \times \text{age 60 - 64}) \\
+ \beta_5 (\text{pension eligibility} \times \text{age 60 - 64} \times \text{year dummy}) \\
+ \beta_6 (\text{pension eligibility} \times \text{age 60 over} \times \text{year dummy}) + X\beta + \epsilon
\]

The dummies for pension eligibility and for 60 to 64 years of age, and the year dummy are included to estimate the impact of the old-age pension for active employees on labor supply. Because the old-age pension system for active employees was not changed for those aged 65 and over, this age group can be considered a control group. Hence, persons aged 60 to 64 eligible for a pension can be regarded as a treatment group. Therefore, the coefficients of the interaction terms involving the pension eligibility, year, and age group dummy variables reveal the effects of changes to the pension system by the differences-in-differences method. As already noted, during the sample period the system was reformed twice: in 1989 and again in 1995. In particular, the changes in 1995 were intended to limit some of the labor-supply controlling effects of previous systems.

Other explanatory variables used are household characteristics, experience of retirement at retirement age, health conditions, amount of pension, and mutual aid pension received. The samples are of men aged 60 to 69 years.

Table 5 summarizes the estimation results of a probit model that uses "whether employed or not" as the dependent variable. Table 5 (Table 6) summarizes the results of a model in which the dependent variable is the working hours (log of working hours) of those in the sample that are employed.

First, pension eligibility has a significant disincentive effect on both the employment and working hours of those aged 60 to 64. However, there was no negative effect of pension eligibility on the probability of being in employment in 1996.

Second, according to Table 8, which compares changes in the impact of pension eligibility on labor supply between age groups over time, while the change in 1989 had positive effects on both employment and
working hours, the 1995 reform did not affect working hours but did affect employment.

The estimation results in this section show that the old-age pension system for active employees adversely affected the motivation of those aged 60 to 64 years to work, and that this effect decreased slightly following the changes made in 1995 especially for elderly people with small original pension benefits.

4. Estimation of employment-decision models using pseudo-panel data methods

The econometric models used in the differences-in-differences analysis in the previous section are static labor supply models. Thus, these models may preclude the possibility that differences between the labor supply behavior of those aged 60 to 64 and those aged 65 to 69 are due to differences in the employment behavior of each age group, which are not captured by the explanatory variables used in these models. To overcome this problem and verify results, panel data at the level of the individual is required. However, no such data are available for Japan. Iwamoto (2000) used econometric analysis on data from repeated cross-sections to estimate dynamic employment-decision models in order to investigate the employment controlling effects of the old-age pension system for active employees. The analysis in this section applies the method of Iwamoto (2000) to the pseudo-panel data from the three "Surveys on Employment of Older Persons."

4.1 Theoretical model

The following utility function of older persons is used:

\[ U = \sum_{t=0}^{T} \frac{1}{(1+\rho)^t} u(c_t, l_t) \]  

(1)

It is supposed that older persons live from Term 0 to Term T. \( \rho \) is a discount rate. The following equation is the budget constraint for these persons:

\[ a_{t+1} = (1+r)a_t + (1-\tau_t)w_t(l_t-l_e) - c_t \]  

(2)

where \( w \) is the wage rate and \( \tau \) is the payroll tax rate, and the time endowment of the elderly is standardized at unity. Since working hours cannot be negative, the following constraint is imposed:
Desired working hours are as follows:

\[ h_i^* = 1 - l_i \]  \hspace{1cm} (4)

Denting the vector of characteristics of older persons by X, the utility function is further specified as:

\[
 u(c_i, l_i) = u_l(c_i) + \left( \frac{\frac{l_i - 1}{\beta_1}}{1 - \beta_l} \right) e^{\frac{\rho_2 X_i}{\beta_1}}
\]  \hspace{1cm} (5)

Hence, employment choice is expressed by the following probit models:

\[
 -\ln(1 - h_i^*) = \beta_1 l_n\lambda_0 + \beta_1 (\rho - r) + \beta_1 l_n(1 - \tau_i) + \beta_l l_n w_i + \beta_2 X_i + \varepsilon_i
\]  \hspace{1cm} (6)

\[
 h_i = 1 \quad (h_i^* > 0)
\]  \hspace{1cm} (7)

\[
 h_i = 0 \quad (h_i^* \leq 0)
\]  \hspace{1cm} (8)

where \( \lambda \) is a Lagrange multiplier and \( h \) is a binary variable equal to unity for employees and zero otherwise.

The "Surveys on Employment of Older Persons" have no individual-level panel data. However, it is possible to use panel data methods on data from repeated cross-sections. These data represent continuous events, but not for the same set of individuals.

According to Moffitt (1993), the following equations can be formulated:

\[
 -\ln(1 - h_{i(t)}^*) = \beta_1 l_n\lambda_{0(t)} + \beta_1 (\rho - r) + \beta_1 l_n(1 - \tau_{i(t)}) + \beta_l l_n w_{i(t)} + \beta_2 X_{i(t)} + \varepsilon_{i(t)}
\]  \hspace{1cm} (9)

\[
 l_n\lambda_{0(t)} = \beta_3 Z_{i(t)} + \varepsilon_{3(t)}
\]  \hspace{1cm} (10)

\[
 l_n w_{i(t)} = \alpha_1 W_{i(t)} + \alpha_2 Z_{i(t)} + \varepsilon_{4(t)}
\]  \hspace{1cm} (11)

\[
 X_{i(t)} = \gamma_1 W_{2(t)} + \gamma_2 Z_{i(t)} + \varepsilon_{4(t)}
\]  \hspace{1cm} (12)

where \( Z \) denotes time-invariant individual characteristics such as year of birth, gender, and \( W_1 \) and \( W_2 \)
denote variables that are uncorrelated with the fixed effects. In this context, Iwamoto (2000) advances hypotheses related to model building and data. Based on his hypotheses, the following restrictions are imposed.

**Hypothesis 1: Z-variables time-invariant (uncorrelated with the passage of time)**

First, the only Z-variable used by Iwamoto (2000) is a dummy for the year of birth, which does not change with the passage of time. Because the "Surveys on Employment of Older Persons" asked how many aged 55 years and over were in the company workforce at the time of the survey, we also used a dummy variable for each of the older-age employment size bands,\(^7\) which may proxy an academic career. Thus, our analysis uses two Z-variables: a year of birth dummy and the number (in bands) of those aged 55 years and over in the labor force (hereafter, "older-age workforce size").

**Hypothesis 2: \( \rho = r \) (from equation (11))**

\( W_1 \) and \( W_2 \) variables are not correlated with the fixed effects and include the age dummy variable. Because the age dummy variable may be the deciding factor in employment, this variable was in \( X \), the vector of characteristics of older persons. Since the time dummy cannot be used as an explanatory variable, it is assumed that \( \rho = r \) in equation (9).

**Hypothesis 3: No instrumental variables required for \( X \)**

As noted in Hypothesis 2, the age dummy variable was included in \( X \). This made it difficult to find instrumental variables for other explanatory variables. Thus we assumed that \( X \) is not correlated with the disparate portion from the cohort average of the fixed effects (\( \hat{\epsilon}_{3i(t)} \) of equation (10)) and hence did not use instrumental variables for \( X \).

**Hypothesis 4: \( \alpha_2 = 0 \) (from equation (11))**

Different variables should be used for the wage and employment equations for identification purposes. Hence, we followed Iwamoto (2000) and assumed that there is no cohort effect on wages (that is, \( \alpha_2 = 0 \) in equation (11)).\(^8\)

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\(^7\) The surveys divided workforce sizes of companies into the following six brackets: 1-4 persons, 5-29 persons, 30-99 persons, 100-299 persons, 300-999 persons, and 1,000 or more persons.

\(^8\) Therefore, the wage function includes no \( Z \)-variables. As noted in Hypothesis 1, we used two \( Z \)-variables: a dummy variable for the year of birth and older-age workforce size. To identify the effects of both factors,
The estimating equations below are obtained by substituting equations (10), (11), and (12) for equation (9) in order to represent the above hypotheses.

\[
\ln w_{it(i,r)} = \alpha_i W_{it(i,r)} + \varepsilon_{it(i,r)} \quad (13)
\]

\[
-\ln(1 - h^*_t) = \beta_1 \beta_3 Z_{it(i,r)} + \beta_1 \ln(1 - \tau_{it(i,r)}) + \beta_1 \ln w_{it(i,r)} + \beta_2 X_{it(i,r)} + \varepsilon_{it(i,r)} \quad (14)
\]

These equations were estimated as follows.

First, using the two-step procedure of Heckman (1976), a probit model was estimated for the reduced form equation obtained by substituting the wage income equation (13) into the employment equation (14). The inverse Mills ratio obtained from the reduced estimates was used as an explanatory variable in the wage income equation (equation (13)), which was estimated using only the sample of employees. This estimated equation was used to forecast the (implied) wage income of the non-employees in the sample. The wage income of those employed and not employed was used to construct the wage income variable in equation (14). This employment equation was estimated on the whole sample (employed and non-employed).

The observations used for estimation are those on the thirteen cohorts born between 1924 and 1936 and are men aged 60 to 64 years.

First, a probit model is estimated for the reduced form equation obtained by substituting the wage income equation into the employment equation. The explanatory variables in this model are: a year of birth dummy variable, older-age workforce size, an age dummy variable, a health dummy variable (unity for healthy, zero otherwise), experience at mandatory retirement (unity for those with experience, zero otherwise), number of persons living together (logarithmic values), and variables for household categories.\(^9\)

we may omit either one of the variables. We found the estimation results to be virtually the same, whichever factor was omitted. Therefore, we used the year of birth dummy variable as the identifying variable.

\(^9\) Based on Ogawa (1998), households were distinguished into the following five categories: 1. Single-person household; 2. Husband and wife household; 3. Household containing parent(s) and a child (children), type A (case where parent(s) is (are) the main income earner(s)); 4. Household containing parent(s) and a child (children), type B (case where a child (children) is (are) the main income earner(s)); and 5. Household other than 1 to 4. The "Surveys on Employment of Older Persons" include questions about the "number of persons who live together" and "Whose income mainly supports you?" The answers to these two questions were used to distinguish the five household categories mentioned above. The household in which the "number of persons who live together" is one is regarded as a single-person household; the household in which the "number of persons who live together" is two and the "main income earner" is the respondent or spouse, is a husband and wife household; the household in which the "number of persons who live together" is three or more and the "main income earner" is the respondent or spouse, is a household containing parent(s) and a child (children), type A; the household in which the "number of persons who live together" is three or more and the "main income earner(s)" is (are) a child (children), is a household containing parent(s)
We characterized the dummy variable for year of birth and older-age workforce size as Z-variables (time-invariant individual characteristics) and the age variables as ones not correlated with the fixed effects.

As for the marginal tax rate \( \tau \), the following equation is used in the context of equation (14) to include as an additional explanatory variable a dummy variable, \( D \), that takes a value of unity for individuals in receipt of an employee pension if aged 60 to 64 and a value of zero otherwise:

\[
\beta_0 = \beta_1 \ln \frac{1 - \tau_1}{1 - \tau_0}
\]

(15)

where \( \beta_0 \) is the dummy variable's coefficient, \( \tau_1 \) is the marginal tax rate of the recipient of an old-age pension for active employees, and \( \tau_0 \) is the tax rate for other individuals.

4.2 Estimation and results

The inverse Mills ratio is obtained from the estimated employment function and then added as an explanatory variable to the wage income equation for employed persons. In the wage income equation, the dependent variable is the hourly wage rate, and the explanatory variables are: the age dummy variable, older-age workforce size, the health dummy variable, experience at retirement age, the number of persons living together, household category variables, a prefecture dummy variable, and the inverse Mills ratio. Because the "Surveys on Employment of Older Persons" also investigated working hours, it is possible to calculate hourly wage rates. Individuals who reported working 70 hours or more a week are omitted.

Estimated wage rates for employed and non-employed individuals obtained from the estimated wage income equation are used as the explanatory wage variable in the estimation of the employment equation (equation (14)). The explanatory variables used are the same as those for the first stage, except for the addition of the estimated wage rates.

Estimation was as described above. Samples based on four different specifications were used as follows:

Sample A: includes older-age workforce size;
Sample B: excludes older-age workforce size;
Sample C: includes older-age workforce size and original pension amount;
Sample D: excludes older-age workforce size but includes original pension amount.

and a child (children), type B; and any other type of household is a household other than 1 to 4.
Many older-age workforce size values are missing. To see if this affected the estimates, models including and excluding this variable were estimated.

Four different specifications of the effect of self-employment were estimated as follows:

Basic specification: self-employed cases are excluded and a dummy variable for pension recipients is divided by year;

Alternative specification 1: self-employed persons are excluded and a dummy variable for pension recipients is not divided by year;

Alternative specification 2: self-employed persons are included, a dummy variable for self-employment is included, and a dummy variable for pension recipients is divided by year;

Alternative specification 3: self-employed persons are included, but the dummy variable for self-employment is excluded, and a dummy variable for pension recipients is divided by year.

Tables A1 to A4 in the appendix present the results of these four specifications. Employment equations are estimated in the final stage of the estimation. For each specification, dividing the coefficient on the log wage rate variable by the corresponding employment ratio gives the estimated wage elasticity. Equation (14) models the choice of working hours, which can be estimated directly given that the "Surveys on Employment of Older Persons" include a question about working hours. Estimation results for the structural working hours equation are summarized in Tables A5 to A8. In this case, the coefficients on the log wage rate variable are estimated elasticities.

(Wage elasticity)

The estimated wage elasticities for the different specifications are shown in Tables 9 and 10. Elasticities were evaluated at sample means for each specification. In the basic specification and alternative specification 1, which exclude self-employed persons, the wage elasticity from the probit model is 0.47 and that from the tobit model is 0.39. In alternative specifications 2 and 3, which include self-employed persons, the corresponding estimates are slightly smaller: between 0.28 and 0.40 from the probit model and between 0.19 and 0.27 from the tobit model.

Let us compare these estimated wage elasticities with those from previous studies, which vary

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10 The employment ratio for each sample is as follows:
Samples A, C: 0.6571% for the case where "Surveys on Employment of Older Persons" are excluded; 0.6813% for the case where they are included;
Samples B, D: 0.6120% for the case where "Surveys on Employment of Older Persons" are excluded;
considerably. Ohkusa (1998) accounts for sample selection bias in estimating the wages of non-employed persons. He pools questionnaires from the "Basic Study on People's Life" for 1986, 1989, 1992, and 1995 and finds an estimated wage elasticity of 0.28 for older men aged 60 to 64 who need no nursing care. Oishi (1999) uses data from the "Basic Study on People's Life" for 1995 and finds an estimated income elasticity of employment of 0.58 for men between 60 and 69 years of age. From a specification that is equivalent to the basic specification estimated in the present paper, Iwamoto (2000) finds an estimated wage elasticity of 0.13.

The estimation results of the present study are similar to those of previous studies, except that, having accounted for sample selection bias, our estimated elasticities obtained on the basis of excluding self-employed persons are somewhat larger than those of previous studies. However, as argued by Iwamoto (2000), it is possible that older persons choose to start their own business simply to avoid pension reductions. If so, simply excluding self-employed persons from the estimating sample may cause sample selection bias. The estimated elasticities from alternative specifications 2 and 3, in which the self-employed are included, are between 0.33 and 0.38 from the probit model and between 0.21 and 0.30 from the tobit model. These estimates are quite similar to those obtained by previous studies.

(Impact of old-age pension for active employees)

Recall the following equation:

\[ \beta_0 = \beta_1 \ln \frac{1 - \tau_1}{1 - \tau_0} \]  \hspace{1cm} (15)

where \( \beta_0 \) is the coefficient on a dummy variable that takes a value of unity for individuals in receipt of an employee pension if aged 60 to 64 and a value of zero otherwise, \( \beta_1 \) is the coefficient of the wage rate variable, \( \tau_0 \) is the marginal income tax rate for persons other than recipients of an old-age pension for active employees, and \( \tau_1 \) is the real payroll tax effect of the old-age pension for active employees.

If we give an actual value to \( \tau_0 \) in this equation, we can obtain the effective taxation effect of the old-age pension for active employees. Assuming a marginal tax rate for persons aged 60 to 64 who are not in receipt of an old-age pension for active employees of 10% and using the results of the basic specification shown in Table A1, the estimated taxation effect of the pension is 91.2% for 1988, 93.8% for 1992, and 93.1% for 1996. If the results of the basic specification for working hours in Table A5 are used, the corresponding figures are 95.0%, 97.9%, and 97.6%. Results obtained using other specifications are very similar. These dynamic model estimation results suggest that the old-age pension for active employees has

\[ 0.6865\% \] for the case where they are included.
substantial marginal tax rate effects and a controlling effect on labor supply, and that neither the changes of 1989 nor those of 1995 helped lessen these effects.

5. Conclusion

This paper has analyzed the impact of the old-age pension system for active employees on the employment behavior of older persons using the differences-in-differences method and by estimating dynamic labor supply models. The differences-in-differences results and the estimated dynamic labor supply models both showed that the pension system has disincentive effects on the labor supply of those aged 60 to 64. The differences-in-differences results revealed that the changes to the pension system in 1995 affected the choice of whether to work or not but did not affect working hours. These effects were limited to elderly persons with an original pension benefit of less than ¥ 156,250. The estimated dynamic labor supply models indicated that the marginal tax rate effects of the pension system did not have significant effects in the period before and after 1995. The wage rate elasticities of labor supply, which were estimated using the pooled data for 1988, 1992, and 1996, were relatively high, ranging from 0.2 to 0.6.

The results summarized above suggest that any change in the exempt amount of the old-age pension system would only increase the labor supply of older persons to a very limited extent. To achieve greater effects of stimulating labor supply, earnings tests for the payment of public pensions should be abolished. The problem with the old-age pension system for active employees is not that it merely hinders the labor supply of older people, but also that it produces distortions in modes of employment. For instance, to avoid the earnings test, some elderly people will choose to work part-time or become self-employed. An actuarially fairer system for early payment of a reduced pension should be introduced and earnings tests for the old-age pension for active employees should be abolished.
References


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