RIETI Discussion Paper Series 11-E-080

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RIETI Discussion Paper Series 11-E-080
**December 2011**

# Retirement Process in Japan: New evidence from Japanese Study on Aging and Retirement (JSTAR)

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Abstract

While the average retirement age is higher in Japan, the retirement process has not been in-depth explored from multiple factors including economic, health and family statuses. We examine the transition of work status and working hours for Japanese males and females using JSTAR (Japanese Study on Aging and Retirement) in 2007 and 2009. We provide some empirical patterns of retirement. First, those who are aged 60 or over and retired stay retired two years later, either male or female, while some portion of those who are aged in 50s come back to work. Second, the probability to retire in 2009 for those who were not retired in 2007 ranges 20-30%. Higher index workers in their 60s are less likely to retire but quickly retire if working hours are reduced. Third, higher index workers seem to keep working at the current working hours than lower index counterparts.

*Keywords*: Retirement, JSTAR, index, nonlinear least squares method.
*JEL classification*: J14, J26.

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* This study was prepared for "Conference on Policy Research and Data Need to Meet the Challenges and Opportunities of Population Aging in Asia" in New Delhi, March 14–15, 2011. We are grateful to the Indian National Science Academy, the host of the conference and other sponsoring organizations. We also thank Asako Jufuku, Hirokazu Matsuyama, Yuta Kikuchi for excellent Research Assistance and Daigo Nakata as well as participants at the conference for their constructive comments. Ichimura thanks the JSPS for its support through the Basic Research Grant.
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# 1 Introduction

One of the most distinct characteristics of the Japanese labor market of the elderly is the "late retirement," compared to the other OECD countries. The data on effective retirement age, which is most frequently quoted for an international comparison, shows that the average effective retirement age for Japanese males is 69.5 years and that for females is 66.5 years. These are the latest ages among developed countries (OECD (2008)).

Clearly this measure is insufficient to capture the retirement decision. At least three limitations are pointed out in the literature. First, the definition of retirement depends on subjective perception which may differ across individuals (Lazear (1986) and Lumsdaine and Mitchell (1999)). For example, several studies have revealed that the timing of retirement does not coincide with that to leave labor force or to receive pension benefits (i.e. Banks and Smith (2006) for U.K. and Shimizutani (2011) for Japan). Second, individuals may not retire at once but gradually and the process of retirement may take some time. In addition, retirement may not be an absorbing state (Banks and Smith (2006)). Third, retirement decision may be a joint decision of a couple (Gustman and Steinmeier (2009)). If this is the case, we need to consider retirement behavior as an outcome of intra-household decision making, in addition to a variety of factors including socio-economic, health, and other circumstances.

In this paper, we will describe the Japanese workers' retirement process using Japanese Study on Aging and Retirement (JSTAR). JSTAR, for the first time, provides a publicly available panel data on individuals who are between 50 and 75 in 2007. To our knowledge, this study is the first to explore the retirement process in Japan using a panel data and thus the contribution of this study is to provide new evidence on the process which is uncovered by JSTAR.

While a series of research on retirement in Japan has been accumulated, the studies are limited in two ways.[1] One is that the studies use cross sectional data, which makes it impossible to uncover retirement "process." The other is that the studies use data sets with a very limited variety of variables. In particular

[1]Research carried out in Japanese workers' retirement behavior is largely limited to two areas: the labor supply effect of social security earnings test and the the effect of mandatory retirement on the transition from the prime job to the secondary job.

the data sets do not contain health information other than self-assessed health status nor do they contain family demographics such as spouses' work status or whether they have elderly or other dependents. [2]

JSTAR, a sister survey of Health and Retirement Study (HRS), English Longitudinal Survey on Ageing (ELSA) and Survey on Health, Aging and Retirement in Europe (SHARE), overcomes those two obstacles. JSTAR contains a variety of variables comparable to those in HRS/ELSA/SHARE and intends to address a variety of socio-economic issues related with aging population with emphasis on both inter-disciplinarity and international comparability. See Ichimura, Hashimoto and Shimizutani (2009).

## 2 Measurement of retirement

Retirement depends on definition. The definitions include an affirmative answer to a question regarding retirement status: "Are you currently retired?" as well as a state that the individual is out of the labor force with the intention of remaining out permanently, and a state the individual receives some of his income as pension benefits (Lazear (1986)).[3] We explore retirement behavior

[2]There are some surveys in Japan which are often used in analysis of aging in Japan. National Survey of Family Income and Expenditure collects data every five year on a wide variety of economic variables and family demographics but less information on health. Comprehensive Survey of People's Living Conditions is implemented every three year with small scale surveys in between years to collect rich information on health, family and some economic variables. Survey on Employment of the Elderly focuses on working conditions and experience of the elderly between 55 and 69 but ended in 2004. Those surveys are large but cross sectional. On the other hand, there are three panel data sets on the elderly people. National Long-run Panel Survey on the Life and Health of the Elderly started in 1987 and collects data every three years, which is a Japanese version of AHEAD. Together with Nihon University Japanese Longitudinal Study of Aging, those surveys provide detail information on health status of the elderly aged 60 (or 65) or over and less information on economic status. Thus retirement process is not captured well. Lastly, Ministry of Health, Labour and Welfare started a panel survey of senior population (Chukonen Jyudan Chosa), tracking individuals in their 50s in 2007 every two year. The sample size is larger than that of JSTAR from a nationwide regions but the information is insufficient to capture precise amount of pension income or medical/long-term care expenses, and lacking in previous working experiences or future expectations. In most cases, micro data are not accessible or only limitedly accessible.

[3]Lazear (1986) includes further definitions such as (1) a state the individual has reduced his hours substantially from some lifetime average and intends to maintain hours at or below

using the three measures by examining the first wave (baseline) of JSTAR in this section. The sample in the baseline is those who are aged 50 to 75 and randomly chosen from household registration after regional stratification in each of the five municipalities in 2007.[4] The sample size is more than 4,000 excluding those who did not provide information on the work status from the total sample size of about 4,200.

Figure 1(1) and (2) illustrate non-working status and its decomposition for male and female separately.[5] For male, the proportion of nonworking very gradually increases from less than 5 percent at age 50 to about 8 percent in age 59 but the share jumps at age 60 to about 17 percent and increases along with age in the 60s. However the nonworking proportion is still only slightly above 60 percent around at age 70. Most of the nonworkers are accounted for by retirement but there are still only slightly above 50 percent who classify themselves as retired at age 70. The result differs from those by Banks and Smith (2006) which reveals that non-working and retirement is identical for 65 or over in the U.K. For female, the proportion of non-working is higher than male and increases with age after 50 as opposed to 60 for male. At a closer look, the proportion starts at about 12 percent at age 50 and increases to about 40 percent at age 60. It continues to increase in the 60s reaching 70 percent at age 70. In contrast to male, a larger fraction of nonworking status is accounted for by housemaking, not by retirement. We should note that this must be women who were once working and now no longer working describing themselves as

the current level, (2) a state that the individual appears on some company's retirement role, and (3) a state that the individual receives a primary social security payment. We will refer to (1) below.

[4]Note that JSTAR do not employ a probabilistic national sampling but with an emphasis on securing a larger number of sample under the same socio-economic environment.

[5]JSTAR asks the respondent, and the spouses if any, about their current working status to choose one among the following choices: (1) currently working, (2) leave of absence, (3) not currently working, (4) don't know and (5) refuse to answer. Respondents who choose (1) or (2) are "working" and those who choose other choices are further asked whether they are searching for a job currently or plan to search in the future. If the answer is affirmative, they are categorized as "unemployed." The respondents who are neither explicitly working nor unemployed are further divided into retired, housekeeping, or medically treated. As explained above, these questions are also asked for the spouses, but we use the data on the respondents only in this paper.

"housemaking" rather than "retired" but they are retired, in the sense of having left the labor force as they reached traditional retirement ages. Those patterns do not differ much across different educational attainment either for male and female (results are omitted to save space).[6]

Figure 2(1) and (2) present the distribution of actual and expected retirement age in the first wave. We use the term "actual retirement age" for those who have already retired to differentiate from "expected retirement age" referring to those who have not retired yet.[7] For male, the left panel shows twin peaks in the histogram of actual retirement age and the mode (25%) is found at age 60, followed by age 65 (15%). In contrast, the right panel shows that age to retire in future is concentrated at age 65, followed by age 70 and age 60. While omitted to save space, the distribution of actual retirement age is homogeneous across different educational attainment while that of expected retirement age is later for lower educational attainment; the largest fraction is observed at age 70 among those who completed junior high school only.

For females, the largest fraction in distribution of actual retirement age (left panel) is observed at age 60, which is also the case for males but the distribution is flatter, implying the distribution has a single peak at age 60. In contrast, the largest fraction in the expected retirement age (right panel) is found at age 65, which is identical with the case for males, but the second peak is found at age 60 in contrast to age 70 for males. When decomposing by educational attainment, expected retirement age is later at age 70 for lower educational attainment.

In sum, the most frequently observed retirement age for those who have already retired is age 60 for both sexes, followed by age 65 for males. The most popular retirement age for those who are expecting to retire is age 65 for both sexes, followed by age 70 for males and by age 60 for females.[8] The distribution

[6]The proportions of nonworking persons from the Labor Force Survey are 6.9% (39.2%) for those aged 55–59, 25.6% (57.8%) for those aged 60–64 and 51.5% (74.2%) for those aged 65–75 for males (females).

[7]A very small portion of the respondents has retired before reaching age 50 and those are omitted in the figures. The sample size is 438 (797) for male and 57 (450) for female for actual (expected) retirement age. Seven respondents answered in a range (i.e., I expect to retire between age A and age B), who are excluded.

[8]Rust (1989) found "twin peaks" in the retirement ages for older Americans who file for social security benefits using the Retirement History Survey (RHS) in the 1970s. The two

of actual retirement age does not differ much across educational attainment for both sexes but the expected retirement age tend to be later for those with lower education.

Of course these patterns may be a reflection of the institutions such as the start year to receive pension benefits. Thus, we turn to examine the distribution of the age to receive pension.

The public pension program in Japan consists of three programs; the Employees' Pension Insurance (EPI; Kosei Nenkin) whose pensioners are private sector employees, the Mutual Aid Insurance (MAI; Kyosai Nenkin) covering employees in the public sector and private schools, and the National Pension Insurance (NPI; Kokumin Nenkin) whose pensioners are not covered by the EPI nor MAI program.[9] NPI has a flat-rate benefit only and the normal eligibility age is 65 for both sexes. The minimum years of contribution is 25 years and the monthly benefit for the fully insured (with 40 years of contribution) is about 66,000 yen per month (about 800 dollars). The NPI program allows a ten-year window in claiming benefits. If an individual claims benefit between age 60 and 64, one undergoes benefit reduction and if an individual claims between 66 and 70, one enjoys benefit rewards. [10] On the other hand, the EPI program consists of flat-rate and wage-proportional components. The flat rate component has the same contribution-benefit structure as NPI and the wage-proportional component depends on age, months of contributions, and the benefit multiplier, which differs across gender and birthday. The normal eligibility ages for both components of EPI are set at age 65 but EPI beneficiaries are also entitled to receive the "special benefit" before age 65 which is close to formal benefit in most cases. The normal eligibility ages of special benefit differs between male and female and between flat-rate and wage-proportional components. As of

peaks are observed at age 62 when the individual is eligible to receive a reduced benefit and at age 65 when the individual is eligible to full social benefits. Lumsdaine and Mitchell (1999) argue that the two marked peaks remain after controlling for pension income available at those ages.

[9]In terms of the number of pensioners, the EPI and the NPI contributed to the total by slightly less than a half respectively, and the MAI occupies the remaining small portion.

[10]For those who were born after April 2nd, 1941, the actuarial reduction rate before age 65 is 0.5 percent per month and the actuarial credit rate after age 65 is 0.7 percent per month (Shimizutani and Oshio (2011)).

2011, the eligibility age for the wage-proportional component is 60 for both sexes, not allowing earlier or later claiming. Meanwhile, the eligibility age for the flat-rate component has gradually raised since 2001, and it was 63 for male and 61 for female in 2007. EPI beneficiaries were able to enjoy earlier claiming of the flat-rate component of special benefit for males aged 60 to 62 and females aged 60 in 2007. One can delay either flat-rate or wage-proportional component (See the detail formula for Shimizutani and Oshio (2011)). Contrasting to some European countries that have high take up rates, the disability program participation is still low and the effect on labor force participation is very limited in Japan. The main reason is the strict eligibility rules, though major revisions to the disability program have slightly expanded the eligibility for DI programs (Oshio and Shimizutani (2011)).

Together with social security program, the employment policies for the elderly have been reformed, focusing on extension of mandatory retirement age. In 2004, the Employment Measures Law was revised to include an obligatory clause that requires firms to raise the mandatory retirement age to 65 or above by 2013 or to completely abolish it. The proportion of firms with mandatory retirement steadily increased to above 90 percent in the mid-1990s and the most dominant retirement age is now 60, and some firms have indeed started extending it further to 65 (Oshio, Oishi and Shimizutani (2010)).

Figure 2(3) depicts the distribution of age to start receiving any types of public pension benefits. The sample is confined to those who have received any benefits. For both sexes, close to a half of the respondents has started to receive pension benefits at age 60. The second largest fraction is found at age 65; a quarter for males and more than 30 percent for females. This observation reflects the eligible ages to receive public pension benefits.

That the proportion of those who started to receive pension benefits at age 65 is larger for female reflects the fact that a larger fraction than males are the NPI pensioners. By educational attainment, females who are junior high school graduates have the largest proportion at age 65, followed by age 60, which also an reflection that the larger proportion are on the NPI pensioners for females than for males. The distribution of males is not changed across educational level.

The observation in this section shows that age 60 is a specific age in Japan to retire probably because it is the age at which people become eligible to receive pension benefits. Since the eligible age for the EPI pension benefits is now in transition from 60 to 65, it is natural that the expected retirement age is changing to age 65 for yet to be retired group. However, we should keep in mind that the proportion of working exceeds more than 30 percent at age 70 and some portion of elderly keeps working in their later age. In other words, the institutional reason is an important factor to account for retirement behavior but cannot completely explain labor supply behavior of the elderly.[11] This is what we examine in the next section.

# 3 Transition in working status between first and second waves

This section focuses on the transition of work status using both first and second waves in JSTAR. By doing so, we capture retirement "process" which has been unexplored in Japan. The sample is confined to the respondents who were interviewed both in the waves in the five municipalities.

Before a formal investigation, we preview retirement process transition between two years in terms of the change of work status and hours worked before retirement. The work status and hours worked are measured at time of interview. First, Table 1 shows the change in work status between the first and the second wave in three definitions (working/non-working, employed/self-employed and full time/part time status) in three age ranges (60–64, 65–69 and 70 and over as of the first wave). In what follows, we call those who are wage earners and not self-employed "employed" and those who are working on a regular basis "full time" worker. The upper panel shows that the transition probability into "not working" from "working" for males increases after age 65 from about 20% to 25%. For males, the transition probability into "working" from "not working" drops sharply after age 65 from 17% to 5% and remains the same for

[11] Banks and Smith (2006) provides an evidence that the proportion of non-working and retirement jumps to 100% at age 65 in the U.K. because of an institutional reason; the pension benefits depends on the last salary.

the age group 70–75. For females, the transition probability into "not working" from "working" increases after age 70 from less than 20% to about 30% while the transition probability into "working" from "not working" gradually drops from about 8% to 3% from age 60 to age 75. The middle panel shows that there is very little transition between self-employment and employment status during age 60 to age 75 for both sexes.

The lower panel shows the transition probability between full time and part time work. The information on the full time/part time status is available only for the respondents who were employed or high-ranked managers and the sample size is reduced. As stated, the full time status is defined on whether one works on a regular basis or not. For males, the transition probability into "part time" from "full time" is more than 70% and 60% in their 60s and increases to more than 80% after age 70. The transition probability into "full time" from "part time" is low at about 5% for the first half of the 60s and lower for the more aged group. For females, the transition into part-time from full-time remains at around 40% to 50% throughout. The transition probability into "full time" from "part time" for female is low at 2% for the first half of the 60s and lower for the more aged group.

Second, we examine changes in working hours before retirement. Figure 3 presents evidence on working hours in the first wave (2007) for those who have retired in the second wave (2009). The working hours are converted into annual basis using hours worked per week and weeks worked, i.e. 52 weeks minus non working weeks. Figure 3 (1) reports the mean of annual working hours in three age groups (60–64, 65–69 and 70 or over ) in the first wave for males and females, respectively. For males, the average annual working hours are 1,890 hours for age 60 to 64 and declines to 1,390 for age 65 to 69 and keeps the same level for age 70 and over (1,380 hours). Males who retire at 60–64 seem to retire from close to full time work but this tendency is weakened at older age group. For females, the average working hours is 1,620 hours for age 60 to 64 and decreased to 940 hours for age 65 to 69. Surprisingly, the average working hours jumps up to 1,870 hours, which corresponds to working hours for full time workers, probably because only full time workers keep working after 70 or over.

Figure 3 (2) verifies this further by examining 25 percentile, 50 percentile and

75 percentile of hours worked per year for those who retired in the age categories we examined. For male, individuals below 65 seem to retire directly from full time. For older age categories, however, majority of males seem to retire after reducing some work hours. For female, individuals below 65 although majority seem to retire from full time, there are more than 25 percent who retire via reduced working hours. For female who retire in 65–69 category, most seem to retire via reduced work hours. Female who retire above 70, seems to retire directly from full time.

# 4 Empirical framework

We empirically examine the retirement process above using the regression framework. Our emphasis is on fact finding taking advantage of the first opportunity to explore the retirement process by JSTAR. Thus, we employ a reduced-form specification to examine how specific pre-determined variables are associated with endogenous variables.

We first examine the retirement decision in 2009, $R_{2009}$, given the work status (working or not working) in 2007, $W_{2007}$, and other variables.

We employ the linear probability model for the ease of interpretation of the coefficients where we conduct the empirical analysis separately for males and females with different working status in 2007. For those who were working in 2007, we introduce dummy variables indicating different hours of work statuses; less than 30 hours per week, between 30 to 40 hours per week, and above 40 hours a week. These dummy variables are denoted by $d_{HW}$.

We also include age (in 2007) dummy variables; 50 to 59, 60 to 64, 65 to 69, and 70 and over. These dummy variables are denoted by $d_A$. Age and hours-worked dummy variables are interacted completely. By fully interacting the dummy variables we intend to capture the effects of age and working hours on the outcome variables flexibly. The interaction terms are denoted by $d_A \cdot d_{HW}$.

There are host of other variables we wish to control for. We gather these variables in three categories: health related variables (denoted $x_H$), socio-economic related variables (denoted $x_{SE}$), and family related variables (denoted $x_F$).

Health related variables include word recall measuring the memory in 2007

and its change between 2007 and 2009, grip strength in 2007 and its change, Activities of Daily Living (ADL) limitation and its change, and a measure of depression and its change. The socio-economic variables include net asset over life-time in 2007, educational attainment, and whether he or she was working as an employee or self-employed. Family related variables include marital status as well as its change between 2007 and 2009, the youngest child's age and the number of the parents he or she provides the care.

In order to conserve the number of parameters we assume that these variables affect an outcome only via three linear indices ($x_H'\theta_H$, $x_{SE}'\theta_{SE}$, and $x_F'\theta_F$) representing each of the three categories using the variables discussed above. We then interact each of these three indices completely with the age and hours-worked dummy variables and also with the interaction terms of age and hours-worked dummy variables to allow for flexible ways these variables affect the outcome. We keep the index structure to conserve the number of parameters.

The estimated model is:

$$\begin{aligned} R_{2009} = \beta_0 + d_A'\beta_A + d_{HW}'\beta_{HW} + (d_A \cdot d_{HW})'\beta_{A\cdot HW} \\ + \beta_H(x_H'\theta_H) + \beta_{SE}(x_{SE}'\theta_{SE}) + \beta_F(x_F'\theta_F) \\ + (d_A(x_H'\theta_H))'\beta_{A\cdot H} + (d_A(x_{SE}'\theta_{SE}))'\beta_{A\cdot SE} + (d_A(x_F'\theta_F))'\beta_{A\cdot F} \\ + (d_{HW}(x_H'\theta_H))'\beta_{HW\cdot H} + (d_{HW}(x_{SE}'\theta_{SE}))'\beta_{HW\cdot SE} + (d_{HW}(x_F'\theta_F))'\beta_{HW\cdot F} \\ + (d_{HW} \cdot d_A(x_H'\theta_H))'\beta_{HW\cdot A\cdot H} + (d_{HW} \cdot d_A(x_{SE}'\theta_{SE}))'\beta_{HW\cdot A\cdot SE} \\ + (d_{HW} \cdot d_A(x_F'\theta_F))'\beta_{HW\cdot A\cdot F} + u. \end{aligned}$$

Note that the resulting model is a non-linear in parameter model. We normalize the coefficients defining the three indices by setting one of the coefficients to one; for the health index the variable corresponding to the normalized coefficient is the CES-D scale depression measure, for the socio-economic index it is the dummy variable indicating high education level (more than 2 year college), and for the family index it is whether the person is married or not in 2007.

We refer to the males and females regression results for 2007 workers as Regression 1 and results for 2007 non-workers as Regression 2. Note that for non-workers, there is no conditioning on the hours-worked dummy variables. We also conduct the same regression analysis for the working hours given the same set of regressors for males and females who worked in 2007. We refer to

the results as Regression 3.

# 5 Estimation Method

We estimate all models Regressions 1–3 by the non-linear least squares method using the model specified.

In carrying out the estimation, we faced some difficulty due to item non-response in certain regressors. In order to keep as many sample as possible in the estimation, we "impute" the missing data for three variables; total assets, grip strength and word recall before estimating each specification. We apply the method of Arellano and Meghir (1992) in our context of missing regressors assuming that the non-response occur randomly.

First, we regress total asset on all the regressors in the estimation as well as additional variables (information on the job at age 54) for those whose asset data is available. Then, we obtain "total asset hat" using the actual values if not missing and the estimated values if missing. Second, we perform the similar procedure for word recall using "total asset hat" and obtain "word recall hat". Third, we again perform the similar procedure for grip strength using "total asset hat" and "word recall hat" and obtain "grip strength hat". Finally, we estimate "total asset hat hat" using "word recall hat" and "grip strength hat". We use those three estimated variables in the estimation. We perform those steps separately for each estimation.

# 6 Empirical Results

Table 2 presents the summary statistics of the variable used in the regressions. The sample size of those whose work status is available in 2009 and are age between 50 and 74 in 2007 are 1,481 for males and 1,430 for females, respectively, but the numbers are reduced to 672 and 709 in the table mainly for the lack of information on net asset.

We review the statistics below comparing males and females. First, the proportion of retired respondents in 2009 is 36% for males and 58% for females. The averages of weekly working hours are reduced from 30.1 hours to 25.4

hours for males, and from 13.3 hours to 12.1 hours for females between two years. Second, the age structure is similar for both sexes; about 40% in their fifties and the proportion is slightly higher for male. Third, the proportion of the depressed, which is measured in the Center for Epidemiological Studies Depression Scale (CES-D Scale), or the number of word recalled are slightly higher for female while grip strength is higher for male. A smaller proportion of both sexes has Activities of Daily Living (ADL) limitation in terms of six basic activities. Forth, the proportion of having a spouse is close to 90% for male and three quarter for female while that of having a working spouse is more than 50% for male and 60% for female. About 10% is engaged in family care of their own or spousal parents. The proportion of those who do not have a child is less than 10% and the age of the youngest child is higher for female. Fifth, the educational attainment is higher for males, which is observed in the higher proportion of graduates of two-year colleges or more (including university graduates). The share of EPI (Employee Pension Insurance) or MAI (Mutual Aid Insurance) beneficiaries is higher for male. The amount of net assets is also larger for male. The amount is defined as the sum of current stock of assets either financial or real minus any debts either mortgage or non-mortgage, labor income before retirement (expected retirement age is available if not yet retired), social security benefits between retirement and the timing of death (expected survival age is available) and expected (or realized) bequests, subtracting expected expenditure (including imputed rents) between now to death. In the regression analysis, four categorical dummy variables are created by dividing the asset level into four groups depending on thresholds of net assets; 1 million, 15 million, and 35 million yen.

Table 3 reports the estimated coefficients in Regressions 1–3 for males. The third column reports the result of Regression 2 which explores the factors affecting probability of retirement in 2009 given the respondent reported being retired in 2007. The result indicates that most males are continued to be retired with probability close to 1 except for those in their 50s who have a point estimate of being in the retired status with probability 46.8% when health, family, and socio-economic indices are held at 0. None of these indices are statistically significant for any age group although point estimates are sometimes non-trivial.

For males who worked in 2007, we examine the retirement decision depending on different hours worked in 2007; less than 30 hours per week, greater or equal to 30 but less than 40 hours per week, and greater or equal to 40 hour per week, for each of four age groups, males in their 50s, 60–64, 65–69, 70 or older. The results are reported in Table 3 column 2 and Figure 4 summarizes the results holding the three indices at the respective mean values. Figure 4 also reports the results for those who declared retired in 2007 (hours=0 in Figure 4). As described in Table 1, those who retired in 2007 remain retired with high probability if they are 60 or above. When males work at all, the probability of retiring in two years is significantly less; it is less than 25% and there is not much difference across different age groups when they are working less than 30 hours per week. The probability of retirement in 2009 is around 20% to 25%. For males who worked 30 to 40 hours per week, there are differences across age groups. Those who are in their 50s have low probability (5% or less) of retirement in 2009 once they worked at least 30 hours. Interestingly, those who are in their 70s also have low probability of retirement in 2009 (about 0%) once they worked 30 hours but below 40 hours per week. While the point estimate of the retirement probability in 2009 goes up for this age group who worked 40 hours or more per week, the coefficient is not statistically significant. On the other hand, the retirement probability does not seem to differ depending on the working hours once they worked for males in their 60s; the retirement probability remains around 20%.

This suggests that those who retire in their 60s about two thirds retire via reduced hours, whereas people who are working in their 70s retire mostly after reducing working hours.

Figures 6 and 7 examine the effect of health, socio-economic, and family factors on the retirement probability for males. Figure 6 is for males whose indices are all above the median values and Figure 7 is for males whose indices are all below the median values. In our construction, the health index is normalized by the CES-D measure so that the health index takes on higher value when health variables move in the direction indicated by the coefficients in the way analogous to lower the CES-D measure. Similarly, the family index takes on higher value when a variable in the index times its coefficient moves in the same direction

as to being married, and the socio-economic index takes on higher value when a variable in the index times its coefficient moves in the same direction as to having longer years of education.

For those who retired in 2007, there is no statistically significant difference between the two Figures as we discussed earlier although visually there are some differences. But there is a large and statistically significant difference between Figures 6 and 7 across age groups when they worked in 2007. First, males in their 50s who work less than 30 hours per week retire with higher probability when they are in higher index value group (about 23% versus 10%). This is due to the statistically significant positive family index coefficient. Family index is higher when one is married, have no child, and when the minimum age of the dependent child is higher. The difference between Figures 6 and 7 for those who are in their 50s decline when they work more than 30 hours and they retire with lower probability. Males in their 70s have a similar tendency, but there is no statistically significant coefficients that drive the difference. Second, the largest difference is observed for males who are 65–69 category. Males in this age category who have higher index value retire with much lower probability compared to those who have lower index value (17% versus 40% when they work less than 30 hours and about 0% versus 20% when they work more than 40 hours). The effect of higher family index is opposite for this age group compared to males in their 50s. Overall, the only index that affect the retirement decision in 2009 is family index. The health and the socio-economic indices do not seem to affect the retirement decision with statistical significance.

On the other hand, the health index affect the working hours decision in 2009. CES-D measure and the grip strength are statistically significant variables in the health index. This can be seen in the second column of Table 3. It reports results from Regression 3 and Figure 10 summarizes the results by describing the predicted working hours using the hours results from Regression 3 for males evaluating the indices at their mean values. First, one can see a clear difference between the age groups, the only group which seems to be on or above the 45 degree line is males in their 50s. Other groups seem to be below the 45 degree line, so on average working hours seem to be declining. Second, males in their 50s' working hours rebound from 0 to about 10 hours but males above 60 seem

to stay put at around 0.

The effect of health index values can be seen clearly in Figures 12 and 13. These figures are analogously constructed with Figures 6 and 7 except that the vertical axis is the predicted hours worked instead of the predicted retirement probability. For males in their 50s the predicted working hours for those with the low index values and worked less than 30 hours per week is about 10 hours per week, whereas for those with high index values, it is more than 40 hours per week, which does not differ much with those who worked longer hours per week in 2007. Analogous result holds for those in their 70s. Those with lower index values are predicted to work less hours in the 2009 compared to working hours in 2007 but those with higher index values are predicted to keep working around the same hours per week with the hours worked per week in 2007.

Table 4 reports the estimated coefficients for females in Regressions 1–3. The third column reports the result of Regression 2 which explores the factors affecting probability of retirement in 2009 given the respondent reported being retired in 2007. The result indicates that those in the 50s with higher health index (lower CES-D measure, less ADL-limitation) and higher family index (married, no child) retire with higher probability. The effect of the indices are opposite for females above 70. Those who have higher health index value and higher family index value retire with lower probability. However, the effect is not so large as almost everyone stays retired with high probability in any case as one can see in Figures 8 and 9 for working hours set at 0.

For females who worked in 2007, we examine the retirement decision in the same way we did for males using Regression 1. The results are reported in Table 4 column 1 and Figure 5 summarizes the results along with the results for those who declared retired in 2009 (hours=0 in Figures 5, 8, and 9). Examining Figure 5, when females work at all, the probability of retiring in two years is significantly less; it is less than 28% (slightly higher than males' 25%) and there is not much difference across different age groups when they are working less than 30 hours per week. This is analogous to the males' result. The probability of retirement in 2009 is around 20% to 25%, which is the same with male's result. However, there is a significant difference across index values. For females, socio-economic variables as well as health and family indices all affect the retirement

decision in the statistically significant way.

Comparing Figures 8 and 9, females in their 50s on average are not affected much by the index value. Regardless of the index value, they retire with about 20% probability when they work less than 30 hours per week but retire with about 10% probability when they work more. Those who are above 70 retire with much higher probability, about 45%, when they work less than 30 hours and have higher indices values but retire with probability 0% when the indices values are low. For those with higher indices values, the probability of retirement declines to around 25% when females who are in their 70s work between 30 hours and 40 hours per week compared to near 0 for the same age group with lower indices values. There is not much difference for those who work more than 40 hours. On the other hand, females in their 60s who work less than 30 hours per week retire with less probability when their indices values are high (around 10%) compared to those who have lower indices values; around (40 to 50%). The difference is still large for 60–64 age group when females work between 30 to 40 hours per week (about 10% versus 25%) but the difference disappears for different groups.

While the health index affect the working hours decision in 2009 for males, for females it is the family index that affect the working hours decision. Marital status variable and the minimum child's age (higher age implies less index value) are the statistically significant variables in the family index. This can be seen in the second column of Table 4. It reports results from Regression 3 and Figure 11 summarizes the results by describing the predicted working hours using the hours results from Regression 3 for females evaluating the indices at their mean values. First, unlike males, one cannot see a clear difference between the age groups, except that those in their 70s who worked more than 40 hours per week in 2007 are predicted to work significantly less hours in 2007 compared to other age groups. Second, all groups except for those in their 70s (up to less than 40 hours per week) seem to be predicted to work less in 2009 than the hours worked per week in 2007.

The effect of family index values can be seen clearly in Figures 14 and 15. First, it is observed that females with higher indices values work more hours if they are in their 50s or 60s but opposite is the case for females in their 70s. The

overall effect is the largest for those in their 70s. While once retired, females in their 70s do not come back to work, but those with lower index values do not seem to change the working hours very much over the two years period, whereas those with higher indices values rapidly reduce the working hours over the two years period to less than 30 hours per week.

# 7 Conclusion

We have examined the transition of work status and working hours for Japanese males and females who are between 50 and 75 in 2007 using the JSTAR data. Here we summarize our findings.

For males and females, we find that there is strong evidence that those who retire stay retired two years later once they are 60 or over for males and for females in general. This decision does not seem to be affected much by the health, family, and socio-economic indices, although there are statistically significant indices for females. Males in their 50s on the other hand does seem to come back to work to some extent. Interestingly, among this age group it is the unhealthy, who is predicted to work longer hours 2 years later (15 hours per week versus 10 hours per week).

For males and females who are not retired in 2007, retirement probabilities are predicted to be between 20% to 28% when the three indices are evaluated at the mean values. However the retirement decisions of males and females seem to be affected by different factors. The important index affecting males' retirement decision seem to be the family index whereas all three indices affect in statistically significant way the retirement decision for females. Although the sources and the magnitude of the effect of the indices are different, the direction of the effects are the same across males and females. For both males and females, those who are in their 50s and above 70 retire with higher probability when they have higher index values whereas those who are in their 60s retire with lower probability when they have higher index. Largest effects are observed among males who are 65 or above when they work less than 30 hours and females who are 60 or above when they work less than 30 hours and females who are 60–64 or above 70 who work between 30 hours and 40 hours per week. This implies

that males and females with higher index values retire with lower probability during their sixties but once they reduce working hours to less than 30 hours, retire relatively quickly compared to those with lower index values who keep working with reduced hours.

In terms of hours worked, the Regression 3 results for males and females show that males and females with lower index tend to reduce hours worked more quickly than those with higher index except for females in their 70s who work more than 40 hours. For this group, higher index females reduce hours worked more quickly.

Overall, higher index males and females seem to keep working at the current working hours longer than those with lower index values counterparts. If their working hours are reduced to 30 hours or less per week when they are in their 50s or above 70, higher index value persons retire with higher probability than those with lower index values and if they reach 30 hours or less per week working hours when they are in their 60s, they tend to stay in the labor market longer if they have lower index values. An exception to this pattern is the females who work in their 70s with high index values. This group of females tend to reduce working hours quickly to less than 30 hours per week and then tend to retire with higher probability once the working hours per week become less than 30 hours.

The pattern we have described above is of course tentative to the extent we have assumed stationarity of behavior across different cohorts. To what extent this assumption holds up needs to be examined using longer panel data.

We also need to examine to what extent the pattern described depends on current institutional arrangements. In order to examine this we need to find some variations in data that can be regarded equivalent to institutional changes.

# References

[1] Banks, James and Sarah Smith (2006). "Retirement in the UK," Oxford Review of Economic Policy, vol.22, no.1, pp. 40–56.

[2] Gustman, Alan, Olivia Mitchell and Thomas Steinmeier (1995). "Retirement Measures in the Health and Retirement Study," Journal of Human

Resources, vol. 30 (supplement), S. 57–83.

[3] Gustman, Alan and Thomas Steinmeier (2009). "Integrating Retirement Models," NBER Working Paper No. 15607.

[4] Ichimura, Hidehiko, Hideki Hashimoto, and Satoshi Shimizutani (2009). "JSTAR First Results: 2009 Report," RIETI Discussion Paper Series 09-E-047. Research Institute on Economy, Trade and Industry. Project on Intergenerational Equity and Center for Intergenerational Studies (CIS), Hitotsubashi University, Discussion paper, no. 443–447.

[5] Lazear, Edward (1986). "Retirement from the Labor Force," in Orley C. Ashenfelter and Richard Layard eds. Handbook of Labor Economics, volume 1 (Chapter 5), pp. 305–355, North-Holland.

[6] Lumsdaine, Robin and Olivia S. Mitchell (1999). "New Developments in the Economic Analysis of Retirement," Orley C. Ashenfelter and David Card eds. Handbook of Labor Economics, volume 3C (Chapter 49), pp.305–355. pp. 3261–3307, North-Holland.

[7] OECD (2008). Ageing and Employment Policies—Statistics on Average Effective Age of Retirement.

[8] Ohtake, Fumio and Hisaki Yamaga (2003). "Zaishoku Rourei Nenkin Seido to Dansei Koureisha no Roudou Kyoukyu" (Social Security Earnings Test and the Labor Supply of Elderly Males) [in Japanese], National Institute of Population and Social Security Research ed. Sentaku no Jidai no Shakai Hosho, University of Tokyo Press.

[9] Oishi, Akiko Sato and Takashi Oshio (2004), "Social security and retirement in Japan: an evaluation using micro-data," in Social Security and Programs and Retirement around the World: Micro-estimation ed.by J. Gruber and D. Wise, The University of Chicago Press, pp.399–460.

[10] Oshio, Takashi, Akiko Oishi and Satoshi Shimizutani (2011). "Social Security Reforms and Labor Force Participation of the Elderly in Japan," Japanese Economic Review, vol. 62, no.2, pp. 248–271.

[11] Oshio, Takashi, Satoshi Shimizutani and Akiko Sato Oishi (2010). "Does Social Security Induce Withdrawal of the Old from the Labor Force and Create Jobs for the Young? The Case of Japan," in Jonathan Gruber and David Wise eds. Social Security Programs and Retirement around the World: The Relationship to Youth Employment, pp. 217–241.

[12] Oshio, Takashi and Satoshi Shimizutani (2011). "Disability Pension Program and Labor Force Participation in Japan:A Historical Perspective," NBER Working Paper 17052.

[13] Ministry of Health, Labour and Welfare. Survey on Employment Management (Koyo Kanri Chosa). Various years.

[14] Rebick, Marcus (1995). "Rewards in the Afterlife: Late Career Job Placements as Incentives in the Japanese Firms," Journal of the Japanese and International Economies, vol. 9, no. 1, pp. 1–28.

[15] Rust, John (1989). "A Dynamic Programming Model of Retirement Behavior," in David Wise eds. The Economics of Aging, pp.359–398, University of Chicago Press.

[16] Shimizutani, Satoshi (2011). "A New Anatomy of the Retirement Process in Japan," Japan and the World Economy, vol.23, no.3, August 2011, pp. 141–152.

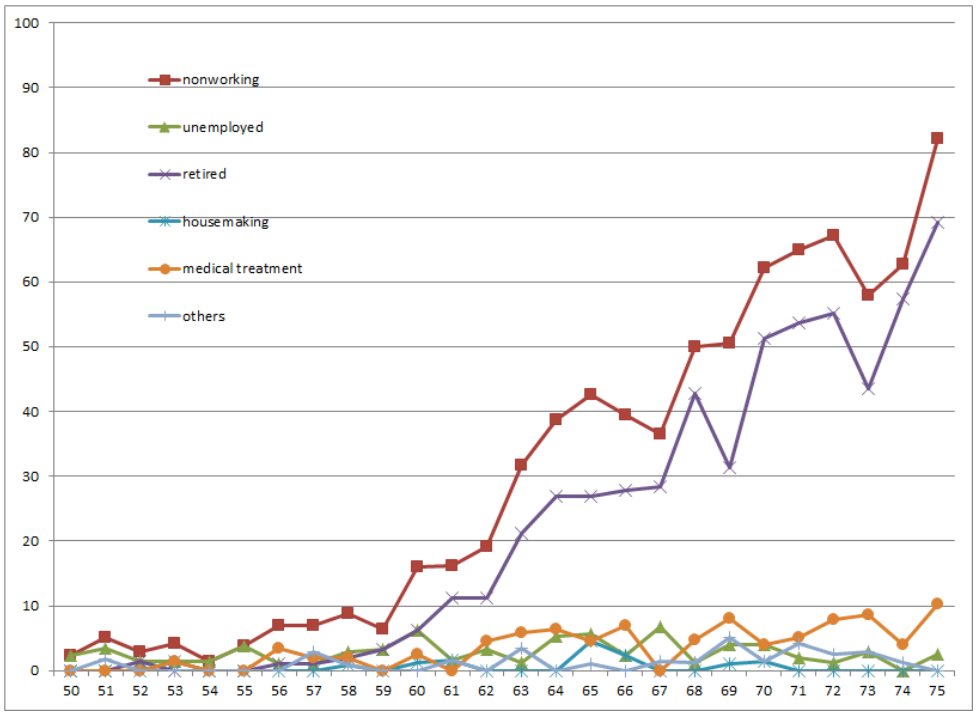
[17] Shimizutani, Satoshi and Takashi Oshio (2010). "New Evidence on Initial Transition from Career Job to Retirement in Japan," Industrial Relations, vol.49, no.2, pp. 248–274.

[18] Shimizutani, Satoshi and Takashi Oshio (2011). "Claiming Behavior of Public Pension Benefits:New Evidence from Japanese Study on Aging and Retirement (JSTAR)," mimeograph.

[19] Shimizutani, Satoshi and Izumi Yokoyama (2009). "Has Japan's Long-Term Employment Practice Survived? Developments since the 1990s," Industrial and Labor Relations Review, vol. 62, no. 3, April 2009, pp. 311–324.

**Figure 1. The proportion of nonworking for male and female**

(1) Male




(2) Female

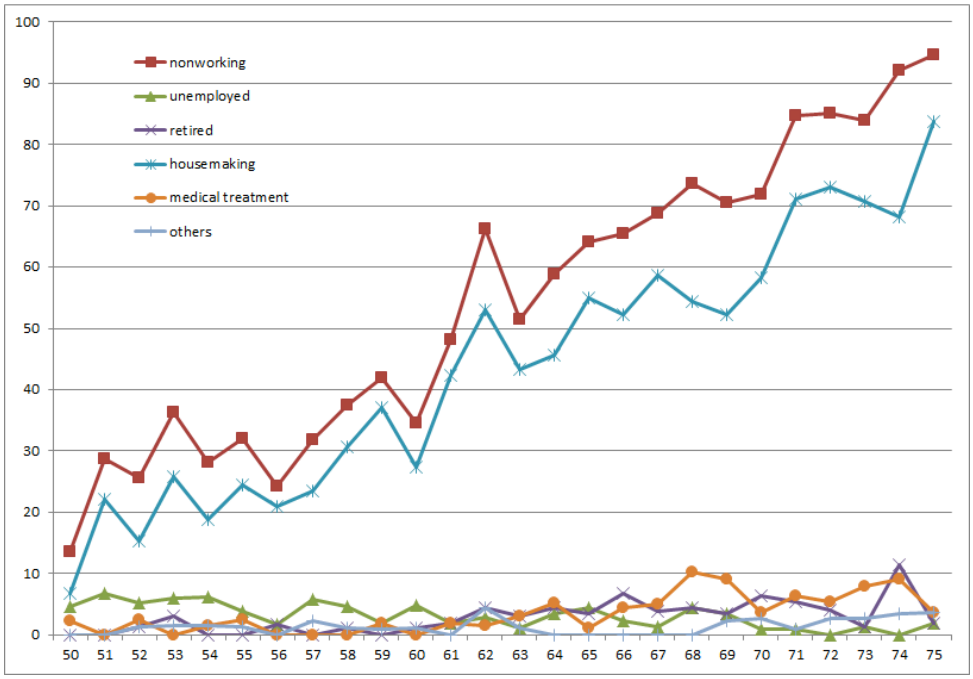
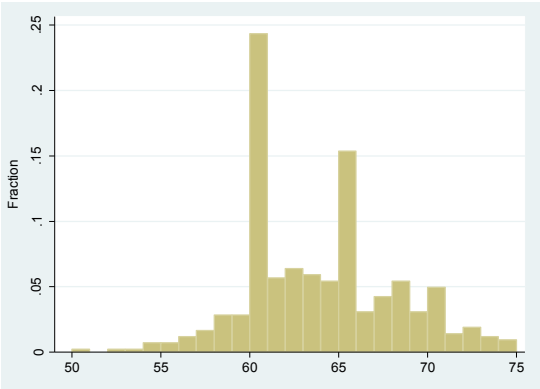


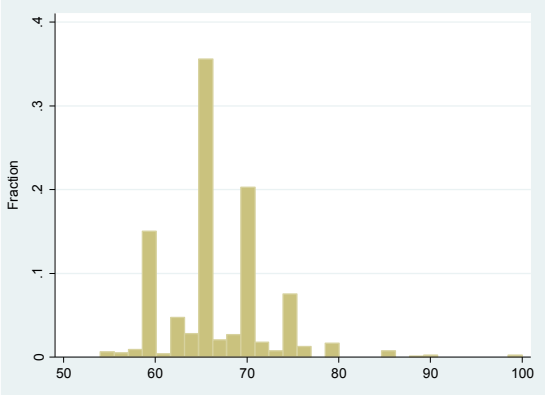
**Figure 2. The distribution of retirement age**

(1) Male

(A) Actual

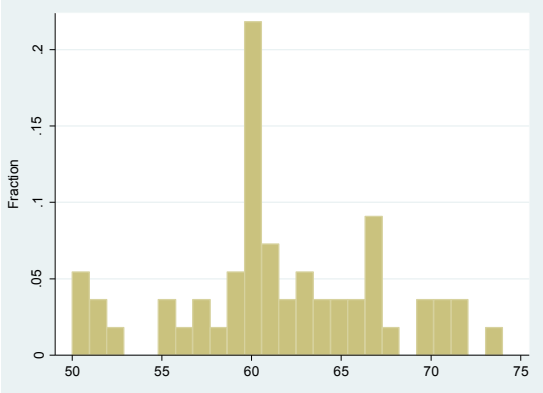



(B) Expected

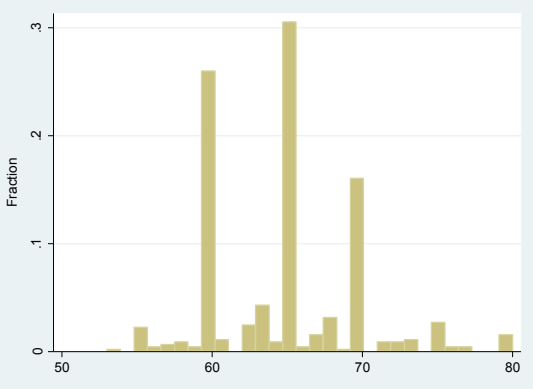



(2) Female

(A) Actual

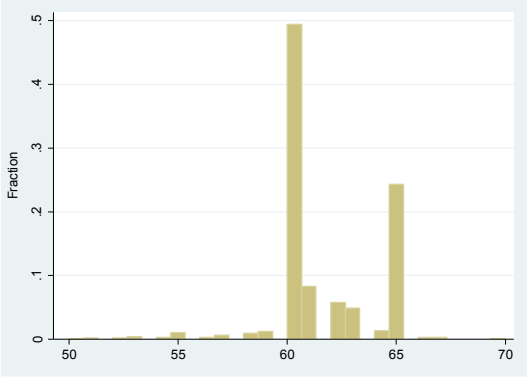



(B) Expected




(3) The distribution of starting age of receiving benefits

(A) Male




(B) Female

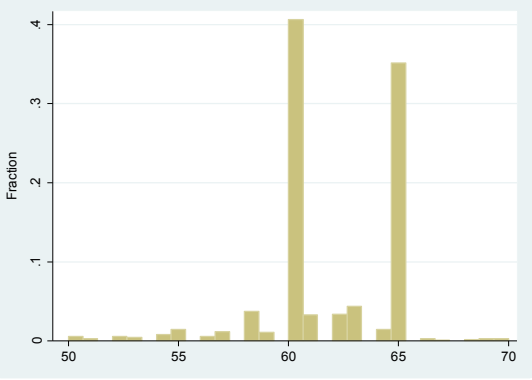
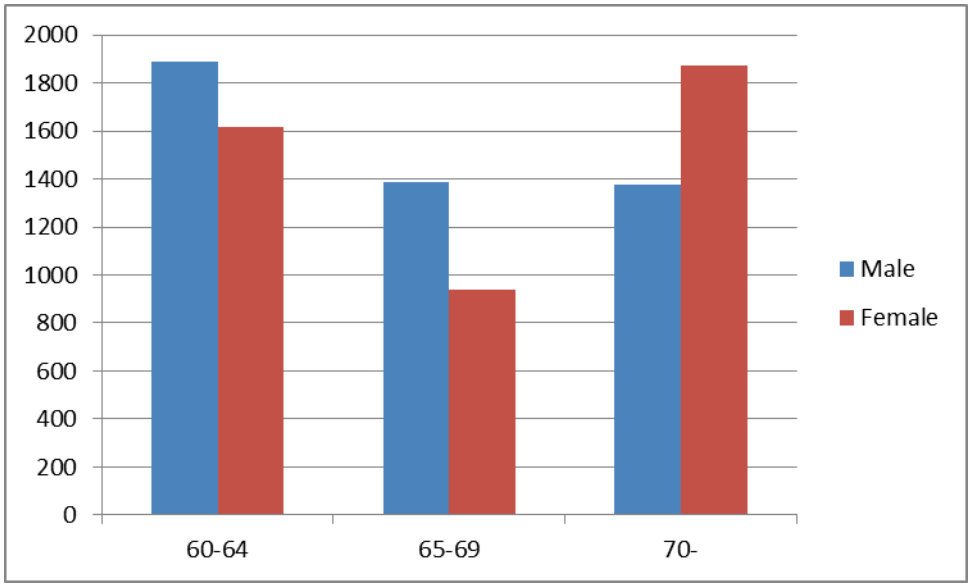


**Figure 3. Hours worked before retirement**

(1) Annual average of hours worked (mean)




(2) Annual average of hours worked (25%-tile, median, 75%-tile)

(a) 25 percentile (b) 50 percentile (c) 75 percentile

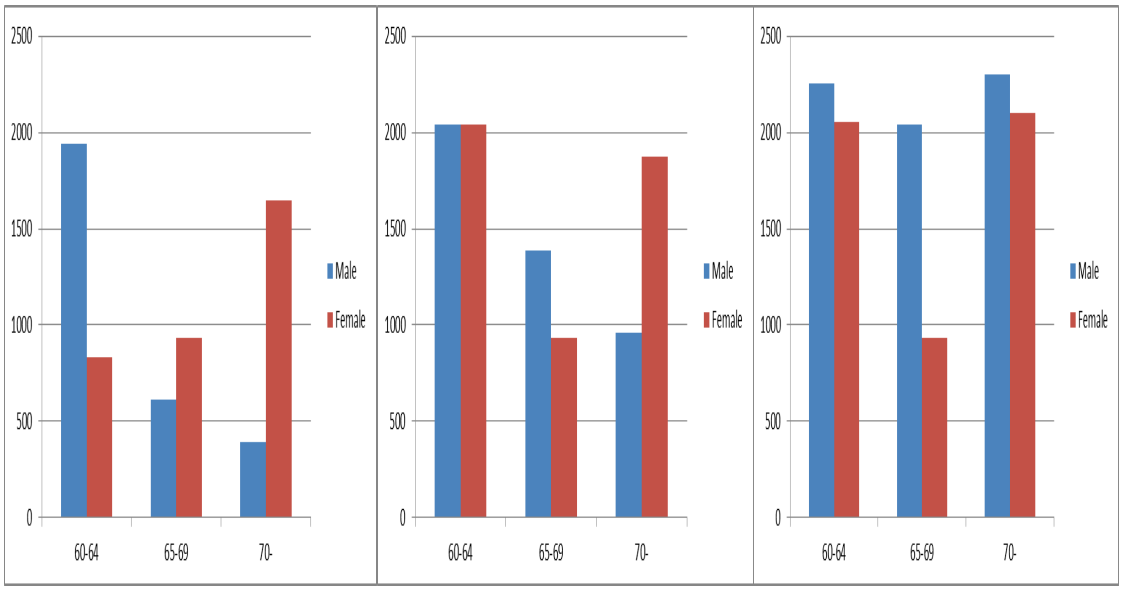


Figure 4

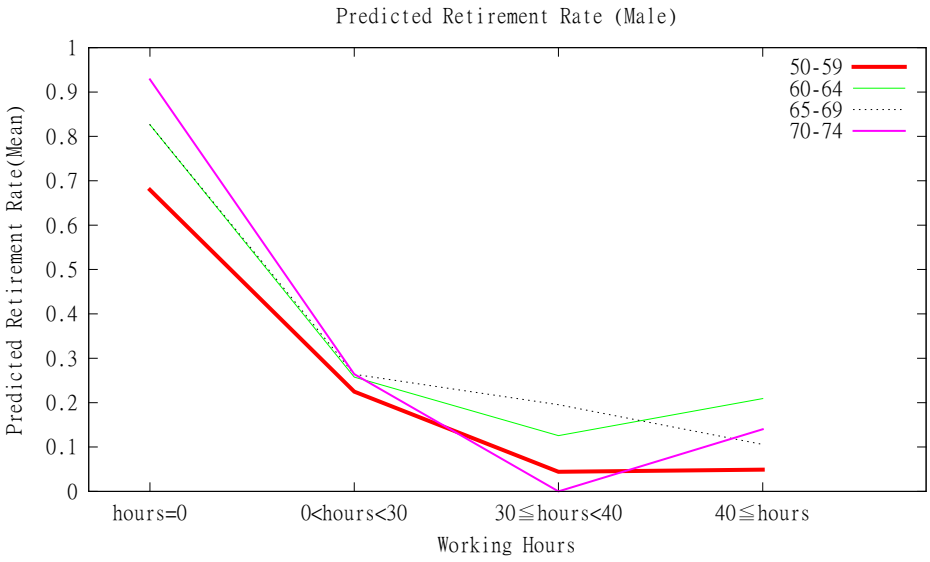



Figure 5

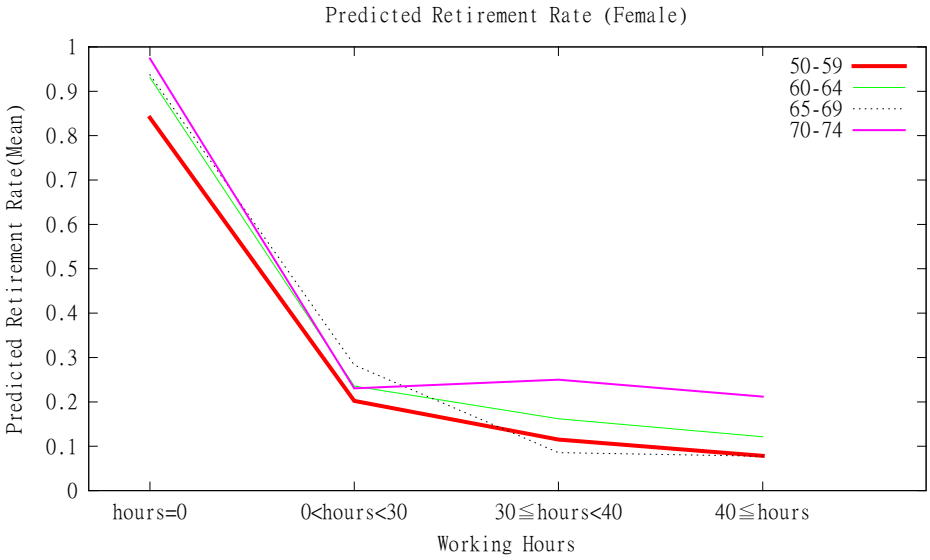


Figure 6

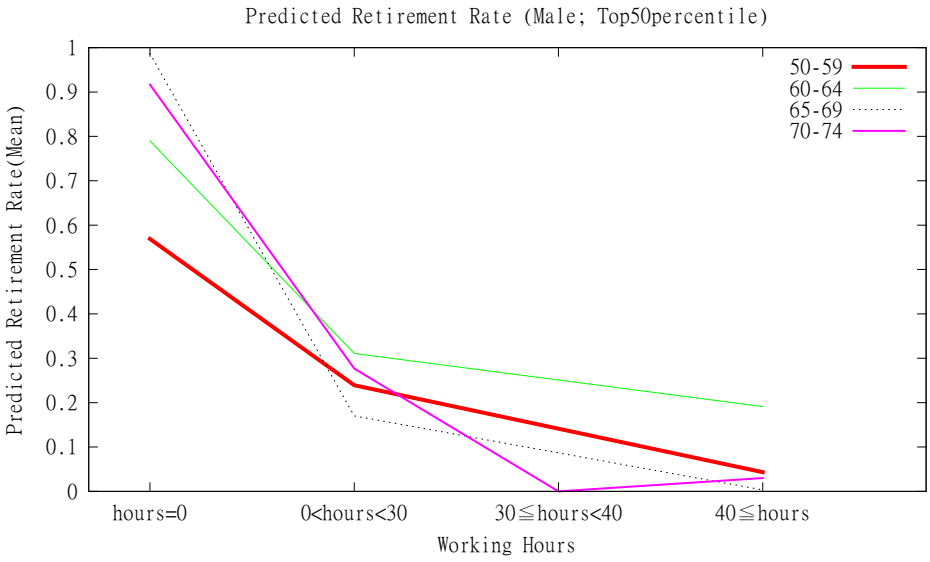



Figure 7

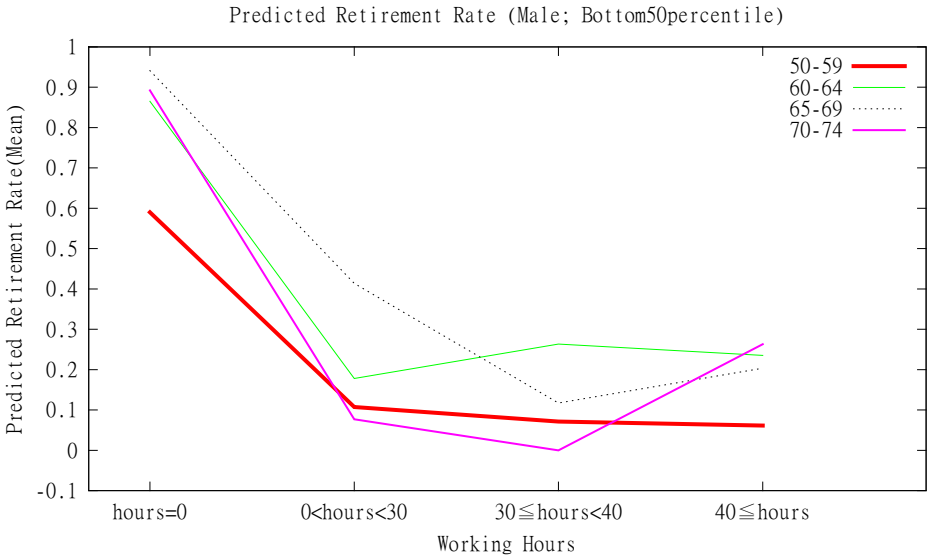


Figure 8

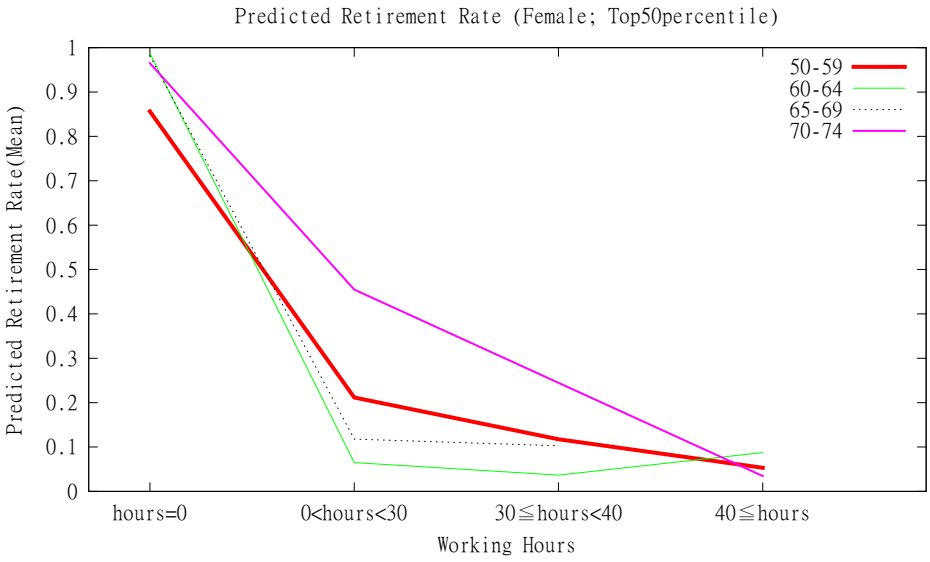



Figure 9

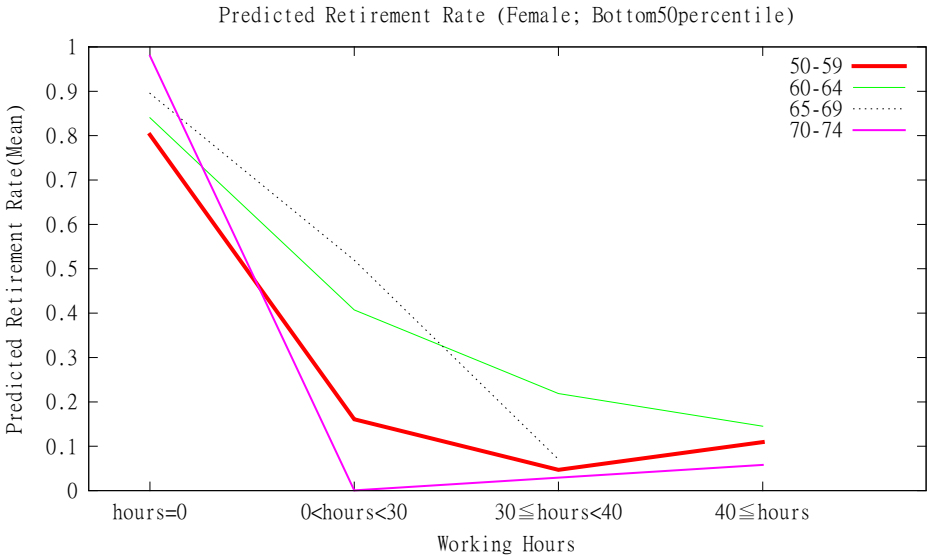


Figure 10

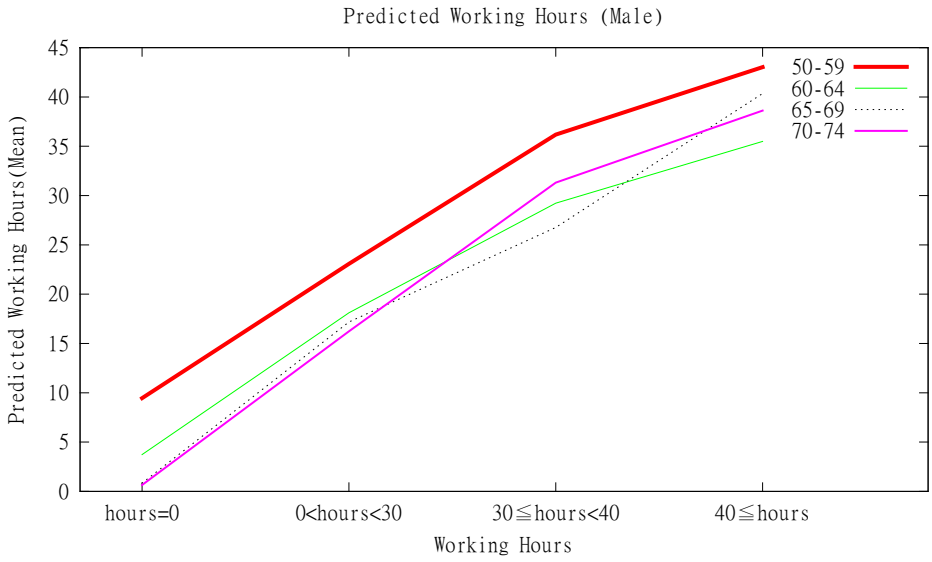



Figure 11

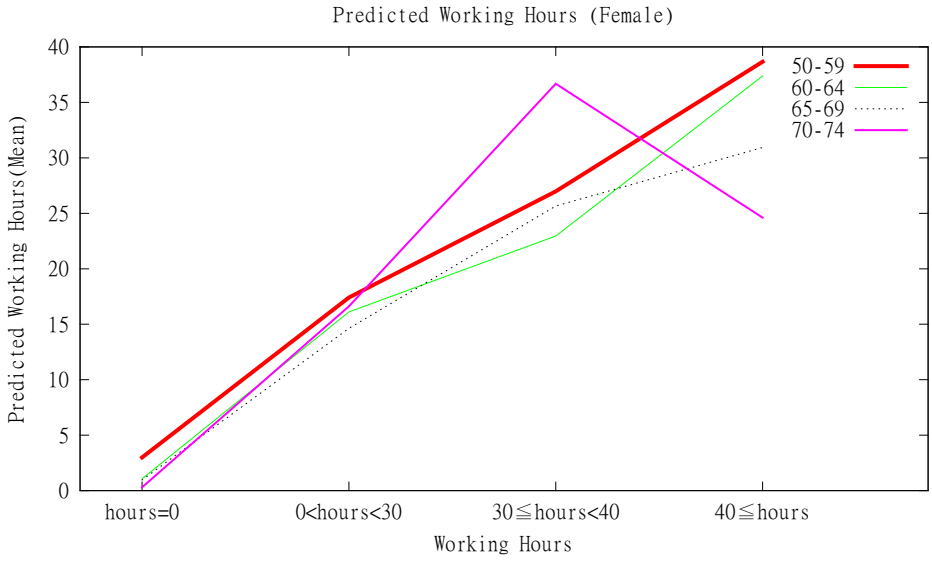


Figure 12

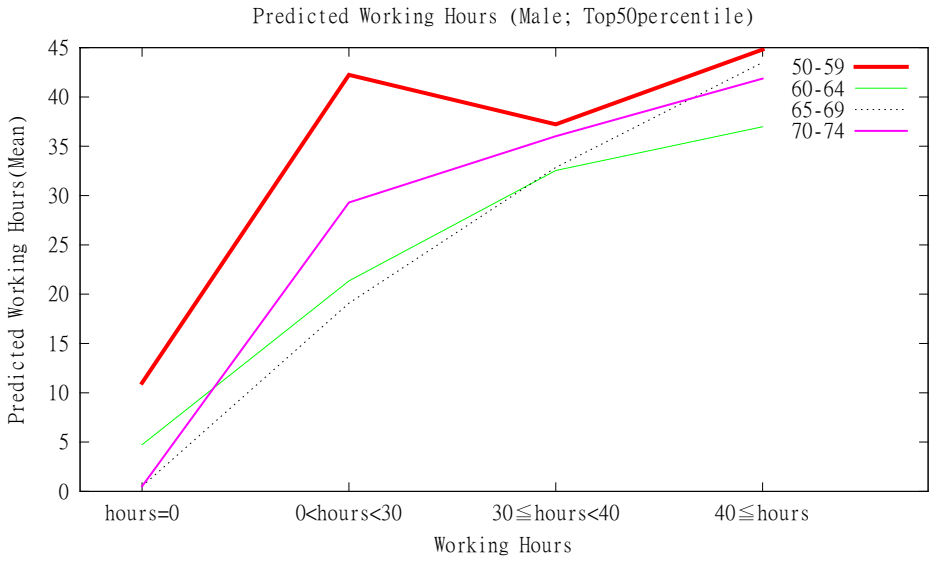



Figure 13

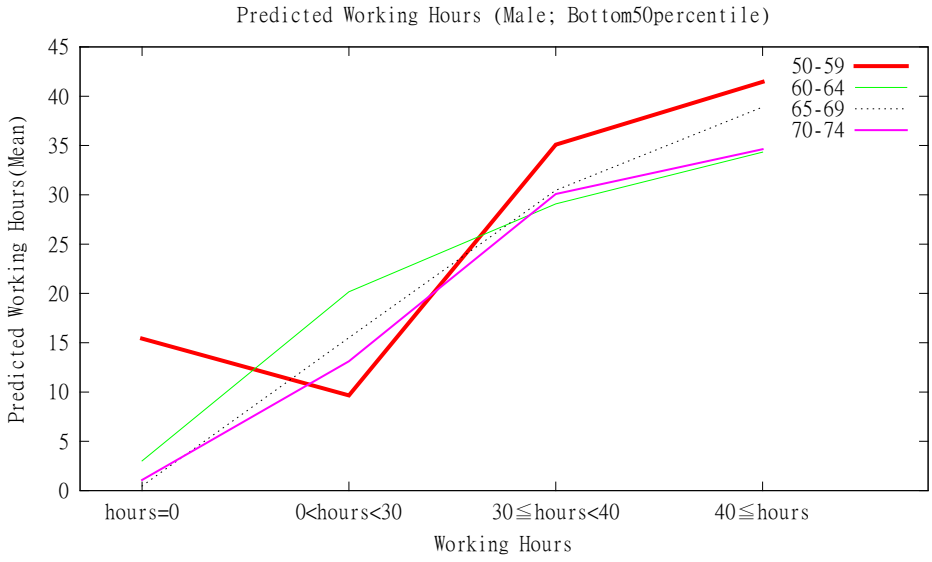


Figure 14

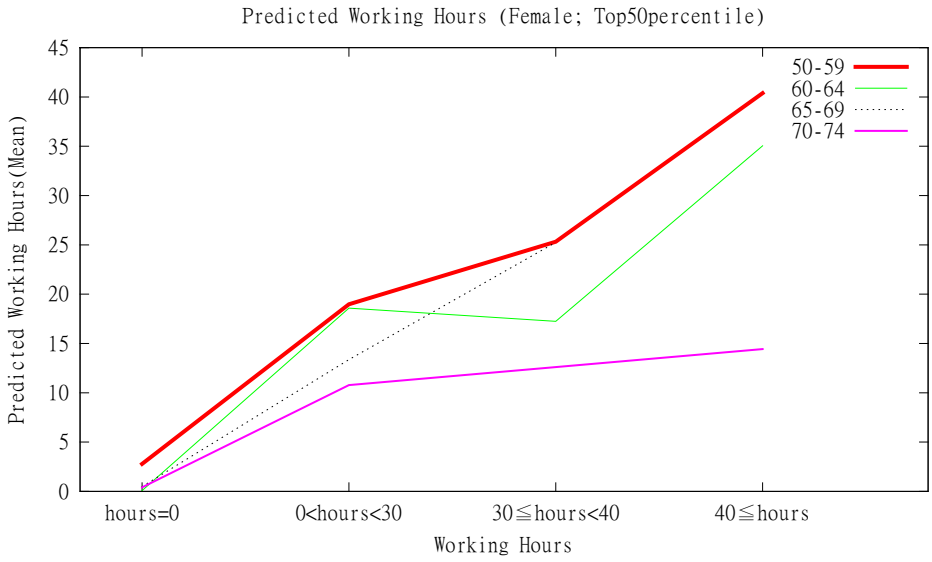
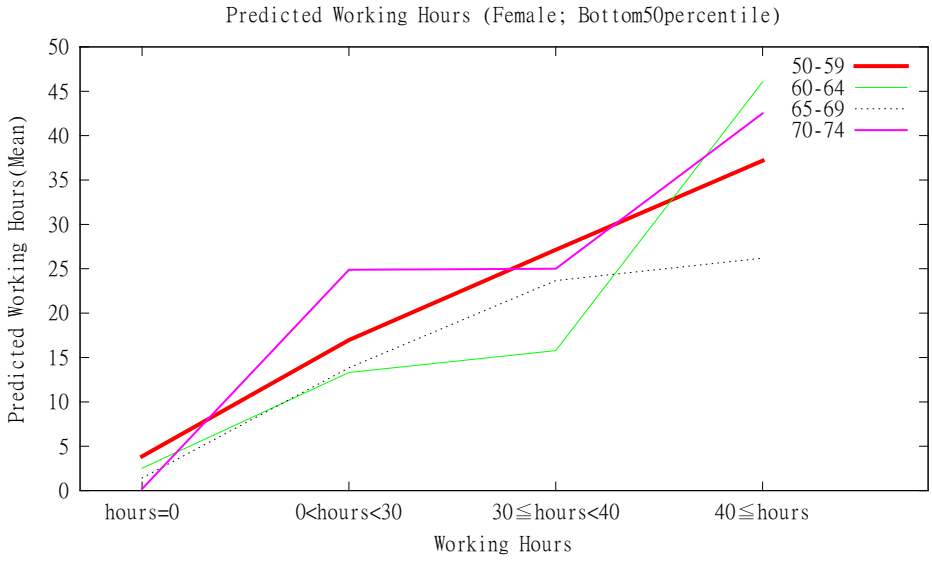



Figure 15



## Table 1. Transition of work status between two years

| Male | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Working | Not working |
| 2007 | Working | 80.3% | 19.7% |
| | Not working | 17.1% | 82.9% |
| | | 2009 | |
| Age65-69 | | Working | Not working |
| 2007 | Working | 75.0% | 25.0% |
| | Not working | 5.4% | 94.6% |
| | | 2009 | |
| Age70-75 | | Working | Not working |
| 2007 | Working | 77.5% | 22.5% |
| | Not working | 5.0% | 95.0% |

| Female | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Working | Not working |
| 2007 | Working | 83.0% | 17.0% |
| | Not working | 8.2% | 91.8% |
| | | 2009 | |
| Age65-69 | | Working | Not working |
| 2007 | Working | 85.1% | 14.9% |
| | Not working | 5.6% | 94.4% |
| | | 2009 | |
| Age70-75 | | Working | Not working |
| 2007 | Working | 73.0% | 27.0% |
| | Not working | 2.6% | 97.4% |

| Male | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Employed | Self-employed |
| 2007 | Employed | 98.0% | 2.0% |
| | self-employed | 0.0% | 100.0% |
| | | 2009 | |
| Age65-69 | | Employed | Self-employed |
| 2007 | Employed | 100.0% | 0.0% |
| | self-employed | 4.1% | 95.9% |
| | | 2009 | |
| Age70-75 | | Employed | Self-employed |
| 2007 | Employed | 100.0% | 0.0% |
| | self-employed | 0.0% | 100.0% |

| Female | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Employed | Self-employed |
| 2007 | Employed | 98.5% | 1.5% |
| | self-employed | 1.8% | 98.2% |
| | | 2009 | |
| Age65-69 | | Employed | Self-employed |
| 2007 | Employed | 97.1% | 2.9% |
| | self-employed | 3.8% | 96.2% |
| | | 2009 | |
| Age70-75 | | Employed | Self-employed |
| 2007 | Employed | 100.0% | 0.0% |
| | self-employed | 0.0% | 100.0% |

| Male | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Full time | Part time |
| 2007 | Full time | 28.6% | 71.4% |
| | Part time | 5.4% | 94.6% |
| | | 2009 | |
| Age65-69 | | Full time | Part time |
| 2007 | Full time | 40.0% | 60.0% |
| | Part time | 2.0% | 98.0% |
| | | 2009 | |
| Age70-75 | | Full time | Part time |
| 2007 | Full time | 16.7% | 83.3% |
| | Part time | 0.2% | 99.8% |

| Female | | | |
|---|---|---|---|
| | | 2009 | |
| Age60-64 | | Full time | Part time |
| 2007 | Full time | 42.1% | 57.9% |
| | Part time | 2.0% | 98.0% |
| | | 2009 | |
| Age65-69 | | Full time | Part time |
| 2007 | Full time | 37.5% | 62.5% |
| | Part time | 0.9% | 99.1% |
| | | 2009 | |
| Age70-75 | | Full time | Part time |
| 2007 | Full time | 50.0% | 50.0% |
| | Part time | 0.1% | 99.9% |

**Table2 Summary Statistics**

| Variables | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | # Obs. | Mean | S.D. | # Obs. | Mean | S.D. |
| Retirement in 2009 | 1481 | 0.36 | 0.48 | 1430 | 0.58 | 0.49 |
| Working hours in 2009 [#] | 1388 | 25.36 | 23.57 | 1363 | 12.06 | 18.4 |
| Working hours in 2007 [#] | 1929 | 30.07 | 24.65 | 1957 | 13.25 | 19.01 |
| Working Hours | 1929 | | | 1957 | | |
| Working hours=0 | | 0.31 | 0.46 | | 0.58 | 0.49 |
| 0<Working hours<=30 | | 0.11 | 0.31 | | 0.18 | 0.38 |
| 30<Working hours<=40 | | 0.06 | 0.23 | | 0.08 | 0.26 |
| 40<Working hours | | 0.52 | 0.5 | | 0.17 | 0.37 |
| Age | 2032 | | | 2031 | | |
| Age50-59 | | 0.39 | 0.49 | | 0.35 | 0.48 |
| Age60-64 | | 0.2 | 0.4 | | 0.2 | 0.4 |
| Age65-69 | | 0.21 | 0.41 | | 0.2 | 0.4 |
| Age70-74 | | 0.19 | 0.39 | | 0.22 | 0.41 |
| Depressed | 1903 | 0.23 | 0.42 | 1905 | 0.27 | 0.44 |
| Memory (word recall) [#] | 1768 | 4.94 | 1.59 | 1860 | 5.33 | 1.58 |
| ADL limitations (any) | 2022 | 0.05 | 0.22 | 2029 | 0.06 | 0.24 |
| Grip strength [#] | 1898 | 35.73 | 6.96 | 1959 | 22.71 | 4.73 |
| Spouse | 2032 | 0.88 | 0.32 | 2031 | 0.75 | 0.44 |
| Working spouse | 1785 | 0.53 | 0.5 | 1516 | 0.6 | 0.49 |
| Providing Care | 2032 | 0.14 | 0.45 | 2031 | 0.11 | 0.37 |
| No child | 2032 | 0.09 | 0.29 | 2030 | 0.08 | 0.28 |
| Minimum child age[#] | 1833 | 30.3 | 8.33 | 1847 | 34.11 | 8.27 |
| Education | 2032 | | | 2031 | | |
| Education_ high | | 0.26 | 0.44 | | 0.15 | 0.36 |
| Education_middle | | 0.41 | 0.49 | | 0.5 | 0.5 |
| Education_low | | 0.33 | 0.47 | | 0.35 | 0.48 |
| EPIMAI | 1878 | 0.75 | 0.43 | 1876 | 0.45 | 0.5 |
| Net asset in million yen | 1468 | | | 1374 | | |
| Asset >=35 | | 0.33 | 0.47 | | 0.26 | 0.44 |
| 15 <= Asset < 35 | | 0.28 | 0.45 | | 0.25 | 0.43 |
| 1<= Asset <15 | | 0.19 | 0.39 | | 0.22 | 0.42 |
| Asset < 1 | | 0.2 | 0.4 | | 0.26 | 0.44 |

Note: [#] refers that the variable is not a dummy variable.

## Table 3 Male estimation

| Column | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Constant | -1.225*** | -78.31 | 0.468 | 33.08 |
| | (0.291) | (55.30) | (0.392) | (18.81) |
| H index | -0.0578 | -21.14* | -0.0689 | 2.635 |
| (health index) | (0.0410) | (9.225) | (0.0863) | (3.346) |
| F index | 0.604*** | 2.123 | -0.230 | 4.028 |
| (Family index) | (0.180) | (4.351) | (0.151) | (5.070) |
| E index | -0.0991 | -0.421 | -0.00554 | 1.656 |
| (Economic index) | (0.0871) | (1.369) | (0.0387) | (3.399) |
| Age6064 | 1.418* | 77.55 | 0.473 | -40.90 |
| (Aged between 60-64) | (0.584) | (55.77) | (0.491) | (21.85) |
| Age6569 | 3.268*** | 50.42 | 0.541 | -35.54 |
| (Aged between 65-69) | (0.765) | (52.54) | (0.464) | (20.99) |
| Age7074 | -0.159 | 48.18 | 0.423 | -32.79 |
| (Aged between 70-74) | (1.454) | (48.12) | (0.404) | (19.33) |
| H3040 | 1.034* | 110.9* | | |
| (30<Working hours<=40) | (0.425) | (56.36) | | |
| Hm40 | 1.354*** | 109.2* | | |
| （40<Working hours） | (0.298) | (53.96) | | |
| Age6064 * H3040 | 0.613 | -96.05 | | |
| | (0.807) | (62.27) | | |
| Age6569 * H3040 | -2.135* | -94.56 | | |
| | (0.985) | (62.18) | | |
| Age7074 * H3040 | 0.350 | -87.01 | | |
| | (1.436) | (58.38) | | |
| Age6064 * Hm40 | -1.304 | -49.50 | | |
| | (0.665) | (53.43) | | |
| Age6569 * Hm40 | -3.005*** | -22.50 | | |
| | (0.806) | (52.73) | | |
| Age7074 * Hm40 | 0.769 | -31.59 | | |
| | (1.638) | (65.60) | | |
| H3040 * H index | 0.222 | 20.84* | | |
| | (0.168) | (9.693) | | |
| Hm40 * H index | 0.0546 | 18.68* | | |
| | (0.0429) | (9.022) | | |
| H3040 * F index | -0.352 | -1.495 | | |
| | (0.249) | (3.350) | | |
| Hm40 * F index | -0.645*** | -1.736 | | |
| | (0.190) | (3.673) | | |
| H3040 * E index | 0.0372 | 0.516 | | |
| | (0.0705) | (1.615) | | |
| Hm40 * E index | 0.104 | 0.654 | | |
| | (0.0908) | (1.627) | | |

| Table 3 Continued | | | | |
|---|---|---|---|---|
| Column | 1 | 2 | 3 | 4 |
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Age6064 *H index | 0.0263 | 15.52 | 0.112 | -5.106 |
| | (0.0662) | (8.911) | (0.130) | (5.709) |
| Age6569 * H index | 0.171 | 15.75 | 0.0846 | -2.742 |
| | (0.0944) | (9.084) | (0.102) | (3.450) |
| Age7074 * H index | -0.178 | 16.28 | 0.0306 | -2.405 |
| | (0.124) | (9.139) | (0.0553) | (3.152) |
| Age6064 * H3040 *H index | -0.150 | -17.98 | | |
| | (0.170) | (9.863) | | |
| Age6569 * H3040 * H index | -0.271 | -22.50* | | |
| | (0.218) | (10.73) | | |
| Age7074 * H3040 * H index | 0.0136 | -26.96* | | |
| | (0.193) | (12.79) | | |
| Age6064 * Hm40 * H index | -0.0752 | -11.69 | | |
| | (0.0788) | (9.067) | | |
| Age6569 * Hm40 * H index | -0.140 | -9.235 | | |
| | (0.0862) | (9.161) | | |
| Age7074 * Hm40 * H index | 0.236 | -13.19 | | |
| | (0.146) | (13.19) | | |
| Age6064 * F index | -0.600* | -3.219 | 0.199 | -3.550 |
| | (0.272) | (6.386) | (0.151) | (4.741) |
| Age6569 * F index | -1.143** | 0.421 | 0.276 | -4.918 |
| | (0.360) | (1.794) | (0.177) | (6.310) |
| Age7074 * F index | -0.210 | 3.084 | 0.275 | -4.411 |
| | (0.428) | (5.324) | (0.179) | (5.580) |
| Age6064 * H3040 * F index | -0.295 | 4.203 | | |
| | (0.350) | (8.384) | | |
| Age6569 * H3040 * F index | 0.661 | -0.420 | | |
| | (0.420) | (2.215) | | |
| Age7074 * H3040 * F index | -0.0420 | -4.413 | | |
| | (0.463) | (7.751) | | |
| Age6064 * Hm40 * F index | 0.589* | 2.045 | | |
| | (0.294) | (4.327) | | |
| Age6569 * Hm40 * F index | 1.097** | 0.221 | | |
| | (0.363) | (2.014) | | |
| Age7074 * Hm40 * F index | 0.0821 | -3.619 | | |
| | (0.465) | (6.437) | | |
| Age6064 * E index | 0.150 | 0.365 | 0.0218 | -3.413 |
| | (0.133) | (1.427) | (0.150) | (6.438) |
| Age6569 * E index | 0.127 | -0.988 | 0.00228 | -1.453 |
| | (0.116) | (2.019) | (0.0166) | (3.048) |
| Age7074*Eindex | 0.0130 | 1.438 | 0.00291 | -1.469 |
| | (0.106) | (2.878) | (0.0207) | (3.050) |

| Table 3 Continued | | | | |
|---|---|---|---|---|
| Column | 1 | 2 | 3 | 4 |
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Age6064 * H3040 * E index | -0.0377 | -0.0609 | | |
| | (0.0888) | (1.776) | | |
| Age6569 * H3040 * E index | 0.0521 | -0.203 | | |
| | (0.115) | (1.838) | | |
| Age7074 * H3040 * E index | 0.0490 | -0.921 | | |
| | (0.124) | (2.480) | | |
| Age6064 * Hm40 * E index | -0.224 | 1.866 | | |
| | (0.193) | (3.566) | | |
| Age6569 * Hm40 * E index | -0.180 | 2.879 | | |
| | (0.157) | (4.986) | | |
| Age7074 * Hm40 * E index | -0.0485 | -0.434 | | |
| | (0.120) | (1.971) | | |
| Memory (word recall) | 0.116 | -0.219 | -0.872 | -0.762 |
| | (0.126) | (0.127) | (1.038) | (0.891) |
| ADL limitations (any) | -6.368* | 1.313 | 1.352 | -0.780 |
| | (2.784) | (0.750) | (2.414) | (1.153) |
| Grip strength | -0.0628 | -0.0945* | 0.0481 | -0.0347 |
| | (0.0488) | (0.0438) | (0.102) | (0.0566) |
| Working spouse | -0.106 | 3.823 | 0.927 | 1.370 |
| | (0.121) | (7.255) | (0.920) | (1.986) |
| Providing Care | -0.167 | -2.715 | -0.819 | -1.384 |
| | (0.216) | (5.609) | (0.562) | (1.850) |
| No child | 1.800*** | -4.622 | -0.783 | -3.465 |
| | (0.514) | (10.27) | (1.670) | (6.541) |
| Minimum child age | 0.0571** | 0.114 | -0.0521 | -0.131 |
| | (0.0179) | (0.235) | (0.0499) | (0.200) |
| Education_middle | 2.155 | 2.815 | -16.28 | -2.279 |
| | (1.565) | (4.369) | (117.7) | (5.561) |
| EPI/MAI beneficiaries | -1.119 | -6.111 | -3.620 | -1.572 |
| | (1.071) | (10.14) | (27.15) | (3.138) |
| Asset_m3500 | -0.956 | -3.017 | 14.36 | 2.844 |
| (Asset>=35 million yen) | (1.124) | (5.223) | (104.7) | (6.771) |
| Asset_15003500 | -0.788 | -2.102 | 11.95 | 1.538 |
| (15<=Asset<35 million yen) | (1.070) | (3.930) | (87.75) | (3.804) |
| Asset_1001500 | 0.846 | -2.147 | 0.0979 | -0.763 |
| (1<=Asset<15 million yen) | (1.136) | (4.095) | (8.954) | (2.258) |
| | | | | |
| Number of observations | 847 | 793 | 367 | 361 |
| R-squared | 0.186 | 0.294 | 0.187 | 0.210 |

Note: Robust standard errors in parentheses. *** denotes p<0.01, ** p<0.05, * p<0.1.

Note: H3040 and Hm40 indicate working hours in 2007. Asset_m3000, Asset_15003000, Asset_1001500 are dummy variables of each level of total assets in 2007.

## Table4 Female Estimation

| Column | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Constant | -0.127 | 15.42 | 0.832*** | 1.378 |
| | (0.135) | (11.95) | (0.150) | (3.919) |
| H index | -0.0686 | -0.0300 | -0.152* | 3.800* |
| (health index) | (0.0760) | (0.261) | (0.0692) | (1.804) |
| F index | -0.155 | 0.00117** | 0.0986* | -1.932 |
| (Family index) | (0.0915) | (0.000383) | (0.0494) | (1.473) |
| E index | 0.203* | -0.362 | -0.0264 | 3.213 |
| (Economic index) | (0.0937) | (2.063) | (0.0350) | (1.902) |
| Age6064 | -0.0765 | -19.48 | -0.242 | 6.538 |
| (Aged between 60-64) | (0.226) | (16.85) | (0.227) | (5.137) |
| Age6569 | -0.151 | 2.211 | -0.0950 | 2.894 |
| (Aged between 65-69) | (0.271) | (23.79) | (0.188) | (4.231) |
| Age7074 | 1.090* | 13.35 | 0.194 | -1.931 |
| (Aged between 70-74) | (0.494) | (39.75) | (0.175) | (4.141) |
| H3040 | 0.0699 | 19.43 | | |
| (30<Working hours<=40) | (0.139) | (16.55) | | |
| Hm40 | 0.241 | 41.63** | | |
| （40<Working hours） | (0.163) | (15.45) | | |
| Age6064 * H3040 | 0.680 | -35.55 | | |
| | (0.718) | (24.46) | | |
| Age6569 * H3040 | 0.708 | -0.677 | | |
| | (0.554) | (34.49) | | |
| Age7074 * H3040 | 0.201 | 6.217 | | |
| | (0.520) | (203.9) | | |
| Age6064 * Hm40 | -0.0415 | 40.96 | | |
| | (0.279) | (25.97) | | |
| Age6569 * Hm40 | 0.486 | 124.4* | | |
| | (0.457) | (50.22) | | |
| Age7074 * Hm40 | 2.027 | -0.246 | | |
| | (1.937) | (68.71) | | |
| H3040 * H index | -0.104 | 0.110 | | |
| | (0.0979) | (0.908) | | |
| Hm40 * H index | 0.143 | 0.164 | | |
| | (0.106) | (1.346) | | |
| H3040 * F index | 0.0871 | -0.00206*** | | |
| | (0.0784) | (0.000519) | | |
| Hm40 * F index | 0.164 | -0.000292 | | |
| | (0.0992) | (0.000508) | | |
| H3040 * E index | -0.179 | 2.263 | | |
| | (0.119) | (3.409) | | |
| Hm40 * E index | -0.232* | 6.036 | | |
| | (0.104) | (4.156) | | |

| Table 4 Continued | | | | |
|---|---|---|---|---|
| Column | 1 | 2 | 3 | 4 |
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Age6064 *H index | 0.0880 | -0.146 | 0.0397 | -2.355 |
| | (0.155) | (1.208) | (0.0735) | (1.720) |
| Age6569 * H index | 0.121 | 0.0352 | 0.133 | -3.691* |
| | (0.200) | (0.352) | (0.0731) | (1.868) |
| Age7074 * H index | 0.101 | -0.0228 | 0.160* | -3.880* |
| | (0.274) | (0.298) | (0.0708) | (1.820) |
| Age6064 * H3040 * H index | 0.992*** | -0.191 | | |
| | (0.217) | (1.586) | | |
| Age6569 * H3040 * H index | -0.111 | -0.128 | | |
| | (0.290) | (1.088) | | |
| Age7074 * H3040 * H index | -0.536 | -1.661 | | |
| | (0.916) | (14.32) | | |
| Age6064 * Hm40 * H index | -0.306 | 0.351 | | |
| | (0.183) | (2.895) | | |
| Age6569 * Hm40 * H index | -0.351 | 0.868 | | |
| | (0.250) | (7.111) | | |
| Age7074 * Hm40 * H index | 3.364 | 0.162 | | |
| | (4.901) | (1.421) | | |
| Age6064 * F index | -0.0486 | -0.00118 | 0.107 | -1.967 |
| | (0.0874) | (0.000790) | (0.0809) | (2.063) |
| Age6569 * F index | -0.0666 | -0.000843 | -0.0350 | 0.492 |
| | (0.106) | (0.000607) | (0.0675) | (1.756) |
| Age7074 * F index | 0.412* | 0.000677 | -0.118* | 2.352 |
| | (0.201) | (0.00156) | (0.0591) | (1.541) |
| Age6064 * H3040 * F index | 0.155 | -0.000351 | | |
| | (0.168) | (0.00104) | | |
| Age6569 * H3040 * F index | 0.297 | 0.00322** | | |
| | (0.211) | (0.00107) | | |
| Age7074 * H3040 * F index | 0.101 | 0.0154 | | |
| | (0.139) | (0.00980) | | |
| Age6064 * Hm40 * F index | 0.00244 | 0.000448 | | |
| | (0.107) | (0.00111) | | |
| Age6569 * Hm40 * F index | 0.216 | 0.00557*** | | |
| | (0.175) | (0.00117) | | |
| Age7074 * Hm40 * F index | 0.109 | 0.0000363 | | |
| | (0.229) | (0.00284) | | |
| Age6064 * E index | -0.402** | -0.535 | 0.0130 | -3.557 |
| | (0.143) | (4.415) | (0.0393) | (2.214) |
| Age6569 * E index | -0.486** | -1.098 | 0.0907 | -4.406 |
| | (0.182) | (3.296) | (0.0601) | (2.335) |
| Age7074 * E index | 0.0933 | -2.259 | 0.0138 | -3.152 |
| | (0.225) | (6.260) | (0.0321) | (1.905) |

| Table 4 Continued | | | | |
|---|---|---|---|---|
| Column | 1 | 2 | 3 | 4 |
| | Working hours in 2007>0 | | Working hours in 2007=0 | |
| | Retirement in 2009 | Working hours in 2009 | Retirement in 2009 | Working hours in 2009 |
| Age6064 * H3040 * E index | 0.150 | 5.103 | | |
| | (0.215) | (6.339) | | |
| Age6569 * H3040 * E index | -0.0508 | -0.108 | | |
| | (0.451) | (6.097) | | |
| Age7074 * H3040 * E index | -1.016 | 98.69 | | |
| | (1.169) | . | | |
| Age6064 * Hm40 * E index | 0.318 | 4.908 | | |
| | (0.168) | (6.874) | | |
| Age6569 * Hm40 * E index | 0.507* | 5.825 | | |
| | (0.204) | (8.722) | | |
| Age7074 * Hm40 * E index | -1.645 | -15.97 | | |
| | (1.407) | (11.82) | | |
| Memory (word recall) | -0.0411 | -4.481 | -0.0773 | -0.0970 |
| | (0.0410) | (36.74) | (0.0742) | (0.0797) |
| ADL limitations (any) | 0.372 | 16.65 | -1.339** | -1.505* |
| | (0.347) | (142.0) | (0.412) | (0.584) |
| Grip strength | -0.0111 | -4.062 | 0.0454 | 0.0436 |
| | (0.0106) | (33.36) | (0.0327) | (0.0340) |
| Working spouse | -1.266** | 7283.6 | -0.409 | -0.196 |
| | (0.398) | . | (0.228) | (0.251) |
| Providing Care | 1.131* | 1021.3 | 0.280 | 0.233 |
| | (0.546) | (848.5) | (0.174) | (0.165) |
| No child | -1.706 | -6020.0 | 1.831* | 1.361 |
| | (1.254) | (4603.5) | (0.929) | (1.055) |
| Minimum child age | -0.0749 | -308.3* | 0.0411 | 0.0332 |
| | (0.0402) | (126.2) | (0.0251) | (0.0273) |
| Education_middle | -0.143 | 0.775* | -0.665 | 0.0551 |
| | (0.134) | (0.370) | (0.946) | (0.376) |
| EPI/MAI beneficiaries | -0.220 | -0.145 | 0.133 | 0.552 |
| | (0.194) | (0.368) | (0.608) | (0.463) |
| Asset_m3500 | -0.194 | -0.829 | 1.487 | 0.176 |
| (Asset>=35 million yen) | (0.170) | (0.588) | (1.505) | (0.517) |
| Asset_15003500 | 0.0916 | -1.452 | 1.327 | 0.109 |
| (15<=Asset<35 million yen) | (0.243) | (0.939) | (1.251) | (0.404) |
| Asset_1001500 | 0.196 | 0.543 | 1.635 | 0.370 |
| (1<=Asset<15 million yen) | (0.212) | (0.604) | (1.346) | (0.526) |
| | | | | |
| Number of observations | 526 | 500 | 690 | 680 |
| R-squared | 0.190 | 0.428 | 0.113 | 0.119 |

Note: Robust standard errors in parentheses. *** shows p<0.01, ** p<0.05, * p<0.1.