JRI Research Journal

Japan Research Institute

https://www.jri.co.jp/english

Vol. 3, No. 2, April 16, 2020

Does recurrent education promote employment of seniors?

Yosuke Yasui[1]

<Summary>

◆ I examine the impact of recurrent education on employment rate of the elderly aged 65 and over (hereafter "seniors") using difference in differences based on propensity score matching. The main results are (1) recurrent education significantly boosts non-working seniors' employment probability by about 5~10 percentage points and suppresses working seniors' unemployment probability by about -15~-9 percentage points. Furthermore, such effects persist for at least three years both for non-working and working seniors. (2) Suppose recurrent education is provided to all seniors who do not currently receive recurrent education, seniors' employment rate in Japan would rise by about 5 percentage points. (3) Comparing cost and benefit of recurrent education, the benefit exceeds the cost by 71 thousand yen for non-working seniors and by 350 thousand yen for working seniors. From this evidence, it is necessary for the government and private firms to make use of recurrent education to promote employment of seniors.

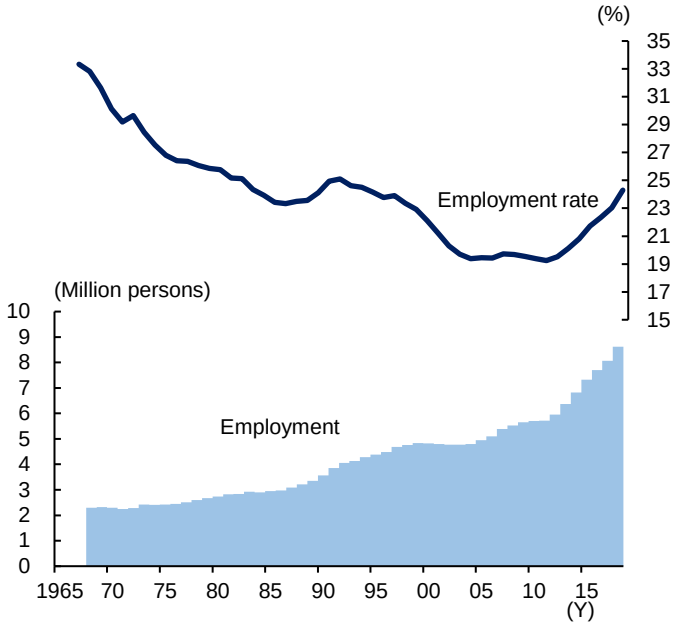
● **This is an English version of "リカレント教育によるシニアの就労促進効果の検証― 傾向スコアマッチングによる差の差の推計 ―" in JRI Review (The original version is available at https://www.jri.co.jp/MediaLibrary/file/report/jrireview/pdf/11116.pdf)**

[1] Senior Economist at Economics Department. Email: yasui.yosuke@jri.co.jp

1. Introduction

Since the start of Abenomics at the end of 2012, the labor participation of older people aged 65 years and over (hereinafter, "seniors") has progressed. Japanese firms' desire to secure a labor force extends from the active-working generation to seniors, faced with contraction of the new graduate market due to a declining population and birthrate in the midst of the economic recovery. As a result, the employment rate of seniors, which had been declining for a long time, turned to a clear upward trend from around 2012 (Figure 1). Employment has also increased by 2.66 million over the past six years from 5.96 million in 2012 to 8.22 million in 2018.

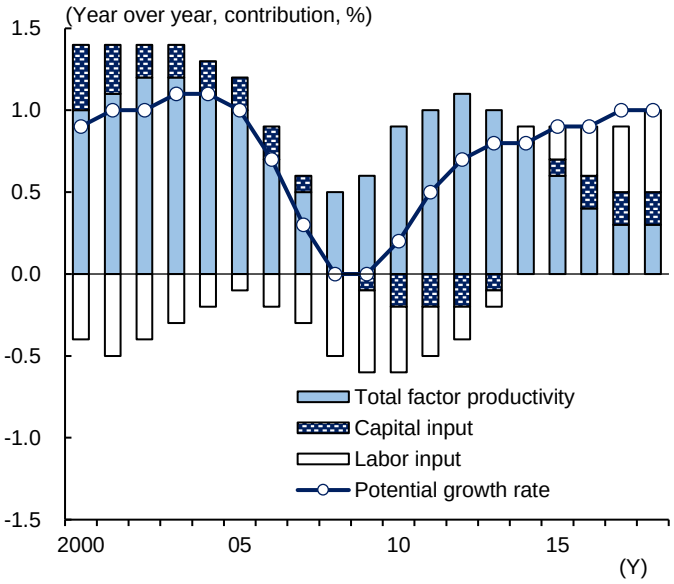
Figure 1. Seniors' employment rate in Japan



Source: Ministry of Internal Affairs and Communications

The increase in seniors' employment also supports the potential growth rate of Japan. Looking at trends in the potential growth rate, the contribution of the labor input had been negative due to the influence of the declining working-age population, which began to decline from the middle of the 1990s. Nevertheless, its impact diminished from around 2010, and its contribution turned positive from 2014 (Figure 2). Behind this, in addition to the rise in labor participation by women in childrearing families, the rapid increase in working seniors has been remarkable.

Figure 2. Potential growth rate in Japan



Source: Cabinet Office, Government of Japan

However, it is misleading to think that all seniors who wish to work are fully able to find their workplaces. According to the Basic Survey on Employment Structure published by the Ministry of Internal Affairs and Communications, which can grasp the status of regular but not temporary employment and unemployment, the number of seniors who wish to work but do not work reached 2.18 million in 2017. By age, such seniors, both men and women, are concentrated in the 65–79 age range. Given the fact that the healthy life span is 72.14 for males and 74.79 for females[2], it can be seen that

[2] Estimated as of 2016. Healthy life expectancy is the average of periods without any restrictions on daily life. Refer to Ministry of Health, Labor and Welfare the 11th Health Japan 21 (second) Promotion Expert Committee document 1-2 (date of March 9, 2018).

there are many unemployed workers who are willing to work and have no health problems.

Based on these facts, an economically important question emerges: what kind of policy measures are required to realize such seniors' willingness to work, faced with the harsh labor shortage in Japan? From the perspective of labor market efficiency, the Japanese government and labor economists propose several policy measures, such as improvement of matching between companies and seniors, performance-based rather than seniority-based wage setting, and recurrent education for seniors as a means of skill building. These are expected to be effective in promoting the employment of seniors. Regarding recurrent education, the Cabinet Office, Government of Japan and labor economists in recent years have found robust evidence of the job boosting effect of recurrent education using causal analysis such as difference in differences (hereinafter, "DID") based on propensity score matching[3] (hereinafter, "PSM").

Existing research, however, does not necessarily focus on seniors, but rather on the active-working generation under 65 years old. Thus, there seems to be a leap of logic based on the evidence and the proposal of policy measures to promote seniors' employment. Factors influencing seniors' tendency to receive recurrent education could be different from those influencing the active-working generation, because seniors generally enjoy pension benefits, have a smaller family size, and have somewhat poorer physical health than the active-working generation, and so on. Therefore, it is necessary to conduct additional research in order to measure the effect of recurrent education on seniors' employment status.

This paper is organized as follows. First, I introduce related literature on recurrent education and employment. Second, I briefly explain the panel data set used here, and define the dependent and independent variables used in probit models to calculate propensity scores and their basic statistics. Third, I estimate probit models and measure the effects of recurrent education on seniors' employment through DID of matched samples. Fourth, I estimate the macroeconomic impact of recurrent education on seniors' employment and conduct cost-benefit analysis. Finally, I draw the conclusion.

2. Related literature

Kobayashi and Sato (2013) examines the impact of recurrent education on employment in Japan by estimating DID of propensity-score-matched samples. They analyze the effect of recurrent education (referred to as "self-enlightenment" in their paper) on the employment, unemployment and wages of workers aged 25 and over. They use panel data from 2005 to 2012 of the “Keio Household Panel Survey” (KHPS) conducted by the Panel Data Research Center at Keio University. To calculate the propensity scores, they use a recurrent education dummy as a dependent variable, and dummies such as age, gender, job search, educational attainment, marital status, presence of preschool children, working hours, years of service, household income, and number of children, and so on as independent variables. They report that recurrent education has significant effects of suppressing the unemployment probability of the employed and improving the employment probability of the unemployed.

The Cabinet Office, Government of Japan (2018) also estimates the impact of recurrent education on employment of the unemployed. They use augmented panel data from 2005 to 2016 of the “Japan Household

[3] Rosenbaum and Rubin (1983) develops a theory that enables to remove sample biases by orthogonalization between treatments and outcomes using propensity scores.

Panel Survey" (JHPS/KHPS) conducted by the Panel Data Research Center at Keio University. First, to calculate the propensity scores, they estimate a probit model that is almost the same as that of Kobayashi and Sato (2013), but excluding dummies of the number of children and years of service and including the dummy of the presence of children of six years old or younger as an independent variable. They report that recurrent education has a boost effect on the employment probability of the unemployed. In addition, when recurrent education is divided into three types, namely, distance learning, going to school, and other types of learning, they find no boost effect from distance learning but a significant boost effect from going to school and other types of learning.

Though Kobayashi and Sato (2013) and the Cabinet Office, Government of Japan (2018) conclude that recurrent education indeed has an employment boosting effect, both researches focus on the active-working generation aged 25 years or over, and adopt a presence-of-preschool-children dummy as an independent variables in their probit models. For this reason, it might be inappropriate to consider their estimation results as evidence that recurrent education is also effective for seniors in accumulating work-related skills and boosting employment. Therefore, I focus on seniors based on DID with PSM, as in the previous studies. Accordingly, independent variables should include senior-related factors such as seniors' health status, the number of people living together at home, and working time, in addition to the same variables adopted by the previous studies. I use samples consisting of only seniors because the influence of independent variables on propensity scores is likely to differ between seniors and the active-working generation even if the same variables are adopted in samples including the active-working generation.

3. Data, empirical strategy, and variables

(1) Japan household panel survey

I employ the Japanese household panel data based on the Japan Household Panel Survey conducted by the Panel Data Research Center at Keio University. The center has been tracking the same households from 2004 to the present and has periodically added new cohorts. The panel data has been used in a lot of academic and policy research due to its high quality, large sample size, and a wide range of items such as the age, educational attainment, recurrent education, health status, job search status, employment status, household income, etc. of the head of the household and his/her spouse. Respondents to the survey are men and women aged 20 and over.

(2) Independent and dependent variables for probit models

Here, I describe the definitions of each independent and dependent variable as shown in Table 1.

First, recurrent education is defined as "learning by one's own will to improve one's work-related skills and capabilities" along with the panel survey. Given the definition, recurrent education covers a wide range of types of learning in the survey, including attending lectures at university, going to public or private vocational school, distance learning, attending lectures and seminars, and in-house voluntary study sessions within a firm.

I use a recurrent education dummy value of 1 if a respondent answers that he/she is receiving recurrent education or has done so in the past year, or a value of 0 otherwise. Table 2 shows that the percentage of seniors who are receiving or have received recurrent education is 4.5% for non-working seniors and 11.2% for working seniors. Working seniors are actively engaged in recurrent education on average, reflecting the fact that they

generally have more opportunities to participate in in-house study sessions and seminars in the firm they belong to than non-working seniors. Table 3 shows the development of the share of seniors receiving recurrent education. The share of non-working seniors with recurrent education among all non-working seniors was around 6% in 2005–2006, dropped to around 3% in 2010 after the global financial crisis, but subsequently rose somewhat and then hovered at about 4%. On the other hand, the share of working seniors receiving recurrent education among all working seniors has remained stable at 10 to 12% over the entire period.

Table 1: Definitions of variables

Variables	Definitions	Non-working seniors	Working seniors
Recurrent education	A dummy value of 1 if a respondent answers that he/she is receiving recurrent education or has done so in the past year, or a value of 0 otherwise.	○	○
Gender	A dummy value of 1 if a respondent is male, or a value of 0 otherwise	○	○
Age	Survey year - a respondent's birth year (one lag)	○	○
Educational attainment	A dummy value of 1 if a respondent's final academic background is college and/or graduate school degrees, or a value of 0 otherwise.	○	○
Job search	A dummy variable that is 1 if a respondent's is looking for a job even for a month from January to December of the previous year and is 0 otherwise.	○	○
Health status	A dummy variable of 1 if a respondent's health condition is answered as "not good" or "not very good," or a value of 0 otherwise. (one lag)	○	○
Household income	Natural logarithm of household income including tax in the year before the survey (January to December). (one lag)	○	○
Spouse	A dummy value of 1 if a respondent has a spouse, or a value of 0 otherwise.	○	○
Number of people living together	Number of family members and relatives living together at home. (one lag)	○	○
Urban area	A dummy value of 1 if a residence of a respondent is in a designated city in Hokkaido, Tohoku, Kanto, Chubu, Kinki or Kyushu, or a value of 0 otherwise.	○	○
Year dummy	A dummy value of 1 in a survey year, or a value of 0 otherwise.	○	○
Regular employment	A dummy value of 1 if a respondent is a regular employee, or a value of 0 if he/she is a non-regular employees (e.g., contract workers and part timers)		○
Working time	A respondent's weekly average working hours		○
Firm size	A dummy value of 1 if a firm that a respondent works for has more than 100 people or he/she works for a government office, or a value of 0 otherwise. (one lag)		○
Working	A dummy value of 1 if a respondent "mainly works", "works while attending school" or "works while doing housework" in one month before a survey conducted, or a value of 0 otherwise.	○	
Non-working	1 - Working dummy		○

Note: This table presents definitions of variables used in probit models (Table 5).

Table 2: Summary of statistics

	Non-working seniors					
	N	Mean	Standard deviation	Max	Median	Max
Recurrent education	13,650	0.045	0.208	0	0	1
Gender	15,860	0.479	0.500	0	0	1
Age	15,814	71.5	4.716	65.0	71.0	94.0
Educational attainment	15,860	0.155	0.362	0	0	1
Job search	15,860	0.009	0.093	0	0	1
Health status	15,627	0.241	0.427	0	0	1
Household income	14,206	467	364.4	0	382	9,300
Spouse	15,860	0.866	0.3	0	1	1
Number of people living together at home	15,859	2.6	1.2	1	2	10
Urban area	15,860	0.238	0.426	0	0	1
The first difference of working dummy	15,477	0.040	0.196	0	0	1
The second difference of working dummy	12,445	0.045	0.207	0	0	1
The third difference of working dummy	9,899	0.046	0.210	0	0	1

	Working seniors					
	N	Mean	Standard deviation	Max	Median	Max
Recurrent education	7,342	0.112	0.315	0	0	1
Gender	8,353	0.622	0.485	0	1	1
Age	8,249	69.3	3.982	65.0	68.0	90.0
Educational attainment	8,353	0.179	0.384	0	0	1
Job search	8,353	0.015	0.121	0	0	1
Health status	8,239	0.123	0.328	0	0	1
Household income	7,489	654	604.0	0	500	9,999
Spouse	8,353	0.873	0.3	0	1	1
Number of people living together at home	8,353	2.8	1.4	1	2	10
Regular employment	8,353	0.136	0.3	0	0	1
Working time	7,272	32.295	21.4	1	30	556
Firm size	8,009	0.217	0.412	0	0	1
Urban area	8,353	0.268	0.443	0	0	1
The first difference of non-working dummy	8,327	0.147	0.354	0	0	1
The second difference of non-working dummy	6,775	0.219	0.414	0	0	1
The third difference of non-working dummy	5,469	0.279	0.449	0	0	1

Note: This table presents summary of statistics of variables used in probit models (Table 5). Note that non-working seniors are those aged 65 and over who did not work in the previous year of the survey year. Working seniors are those aged 65 and over who worked in the previous year of the survey year. The unit of household income is 1 million yen. The statistics cover data from 2005 to 2017.

Table 3: Development of mean of the variables

A. Non-working seniors

Year	Recurrent education	Gender	Age	Educational Attainment	Job search	Health status	Household income	Spouse	Number of people living together at home	Urban area
2005	0.062	0.515	68.1	0.124	0.012	0.182	419	0.881	2.8	0.199
2006	0.060	0.515	68.4	0.126	0.020	0.236	483	0.876	2.8	0.210
2007	0.052	0.491	68.6	0.127	0.016	0.233	467	0.880	2.8	0.193
2008	0.057	0.505	69.0	0.147	0.017	0.229	458	0.886	2.6	0.236
2009	0.045	0.510	69.4	0.142	0.005	0.209	455	0.875	2.6	0.229
2010	0.031	0.490	71.0	0.150	0.004	0.250	492	0.876	2.6	0.221
2011	0.043	0.487	71.3	0.149	0.005	0.241	459	0.874	2.6	0.229
2012	0.053	0.481	71.7	0.145	0.006	0.234	473	0.870	2.6	0.232
2013	0.047	0.475	71.7	0.159	0.005	0.238	470	0.867	2.5	0.242
2014	0.040	0.474	72.0	0.161	0.010	0.238	472	0.868	2.5	0.251
2015	0.041	0.462	72.3	0.164	0.011	0.254	455	0.853	2.5	0.253
2016	0.042	0.468	72.7	0.166	0.012	0.243	459	0.854	2.5	0.255
2017	0.043	0.452	73.0	0.175	0.009	0.260	470	0.844	2.4	0.254

B. Working seniors

Year	Recurrent education	Gender	Age	Educational Attainment	Job search	Health status	Household income	Spouse	Number of people living together at home	Regular employment	Working time	Firm size	Urban area
2005	0.125	0.683	68.6	0.153	0.026	0.091	591	0.914	3.1	0.231	38.5	0.284	0.220
2006	0.103	0.700	68.1	0.146	0.016	0.134	712	0.903	3.0	0.158	34.1	0.225	0.271
2007	0.103	0.703	68.4	0.127	0.017	0.124	687	0.886	3.0	0.148	34.1	0.170	0.288
2008	0.125	0.653	68.2	0.145	0.011	0.079	709	0.897	2.9	0.132	34.7	0.197	0.268
2009	0.107	0.648	68.3	0.166	0.008	0.116	736	0.902	2.9	0.156	33.8	0.223	0.274
2010	0.116	0.625	69.2	0.153	0.011	0.11	672	0.875	2.8	0.139	33.4	0.197	0.270
2011	0.105	0.628	69.5	0.164	0.008	0.099	647	0.879	2.8	0.108	31.4	0.194	0.276
2012	0.117	0.615	69.5	0.181	0.008	0.138	701	0.876	2.8	0.123	31.6	0.223	0.264
2013	0.106	0.619	69.3	0.191	0.007	0.106	671	0.868	2.8	0.141	31.2	0.231	0.265
2014	0.114	0.600	69.4	0.19	0.027	0.121	646	0.859	2.8	0.123	30.8	0.221	0.271
2015	0.108	0.612	69.5	0.202	0.02	0.144	613	0.869	2.8	0.129	32.0	0.225	0.282
2016	0.118	0.595	69.7	0.195	0.018	0.147	612	0.856	2.8	0.136	31.7	0.218	0.265
2017	0.107	0.599	69.8	0.205	0.021	0.141	621	0.853	2.7	0.137	32.0	0.222	0.257

Note: This table presents time series of mean of the variables used in probit models (Table 5). Note that non-working seniors are those aged 65 and over who did not work in the previous year of the survey year. Working seniors are those aged 65 and over who worked in the previous year of the survey year. The unit of household income is 1 million yen.

Second, I use independent variables that might affect the probability of receiving recurrent education, referring to the previous research.

As Table 4 describes, each independent variable can be classified into three factors that affect the probability of receiving recurrent education: (1) educational investment cost, (2) spare time, and (3) incentive.

First, (1) the investment cost factor is related to educational attainment, household income, the area where the senior lives, the employment type, and firm size.

Since seniors with higher academic backgrounds, such as college and/or graduate school degrees have already accumulated appropriate skills to some extent, it is possible for them to acquire additional skills with less time and mental effort.

Household income may be related to seniors' latent skills and abilities that their educational attainment cannot fully reflect. Also, if they have a sufficiently high household income, the financial cost of recurrent education may be low enough for them to maintain their usual living standard[4].

As for urban areas, seniors living in large cities such as Tokyo, Osaka, Nagoya, Sendai and Fukuoka are able to attend lectures and seminars more easily than seniors living in rural areas, because such cities have large numbers of universities and vocational schools and many opportunities to take lectures and seminars.

As for type of employment, firms tend to provide regular employees with more recurrent educational opportunities such as off-the-job training and seminars in the workplace than non-regular employees (e.g., contract workers and part timers) involved in sideline work[5]. As for firm size, larger firms are likely to plan in-house seminars, etc. for their employees on the back of their affluent financial margins and savings relative to small or medium-sized firms.

Second, (2) the spare time factor is related to variables such as gender, spouse, number of people living together at home, and working hours. Regarding gender, since seniors in Japan generally persist in the practice of household division of labor, household duties are concentrated on women, which makes it more difficult for female seniors to allocate spare time to receiving recurrent education than male seniors. As for spouse, a senior who has a spouse might have to take into consideration his/her spouse's lifestyle, so it might be difficult to give priority to his/her own convenience, such as attending lectures and seminars. With regard to the number of people living together at home, the more people there are, the more likely seniors are to have to spend time on housework, nursing care, and childcare for grandchildren, hence the remaining time they have for recurrent education decreases considerably. In addition, in contrast to non-working seniors, working seniors cannot generally find time and energy to receive recurrent education if their working hours are long.

Finally, (3) the incentive factor is related to the senior’s age and health status, as well as job searching and macroeconomic labor market conditions. If the senior is relatively young, devoting his/her effort and time to recurrent education for skill improvement would pay well by allowing him/her to continue to work for the rest of his/her life. Regarding health status, a senior with poor health will not want to receive recurrent education to find a job and will not have the desire to work in the first place. As for job search, a senior who is eagerly looking for a job in order to change jobs or find a new job might try to receive recurrent education to acquire job skills in order to fulfill the job requirements and perform well after employment. As for macroeconomic labor market conditions, when labor demand is strong relative to labor supply, seniors become willing to receive recurrent education, expecting it be much easier to find an appropriate job. The opposite situation holds than when labor demand is weak during an economic downturn. Such an effect is assumed to be specific to each year, and thus a time dummy variable can be used to control changes in labor market conditions each year.

[4] On the other hand, if the income level is high enough, there may be cases where the incentive to work becomes weak. In such case, the household income can be regarded as the incentive factor.
[5] See Hara (2007).

Table 4: Factors that affect the probability of receiving recurrent education

	Independent variables	Expected implication of independent variables on probability of recurrent education (Hypothesis)	Sign conditions
Investment cost factors	Educational attainment	Since seniors with higher academic backgrounds, such as college and/or graduate school degrees have already accumulated appropriate skills to some extent, it is possible for them to acquire additional skills with less time and mental effort.	+
	Household income	Household income may be related to seniors' latent skills and abilities that their educational attainment cannot fully reflect. Also, if they have a sufficiently high household income, the financial cost of recurrent education may be low enough for them to maintain their usual living standard.	+
	Urban area	seniors living in large cities such as Tokyo, Osaka, Nagoya, Sendai and Fukuoka are able to attend lectures and seminars more easily than seniors living in rural areas, because such cities have large numbers of universities and vocational schools and many opportunities to take lectures and seminars.	+
	Regular employment	Firms tend to provide regular employees with more recurrent educational opportunities such as off-the-job training and seminars in the workplace than non-regular employees (e.g., contract workers and part timers) involved in sideline work.	+
	Firm size	Larger firms are likely to plan in-house seminars, etc. for their employees on the back of their affluent financial margins and savings relative to small or medium-sized firms.	+
Spare time factors	Gender	Since seniors in Japan generally persist in the practice of household division of labor, household duties are concentrated on women, which makes it more difficult for female seniors to allocate spare time to receiving recurrent education than male seniors.	+
	Spouse	A senior who has a spouse might have to take into consideration his/her spouse's lifestyle, so it might be difficult to give priority to his/her own convenience, such as attending lectures and seminars.	−
	Number of people living together at home	The more people there are, the more likely seniors are to have to spend time on housework, nursing care, and childcare for grandchildren, hence the remaining time they have for recurrent education decreases considerably.	−
	Working time	In contrast to non-working seniors, working seniors cannot generally find time and energy to receive recurrent education if their working hours are long.	−
Incentive factors	Age	If the senior is relatively young, devoting his/her effort and time to recurrent education for skill improvement would pay well by allowing him/her to continue to work for the rest of his/her life.	−
	Job search	A senior who is eagerly looking for a job in order to change jobs or find a new job might try to receive recurrent education to acquire job skills in order to fulfill the job requirements and perform well after employment.	+
	Health status	A senior with poor health will not want to receive recurrent education to find a job, and will not have the desire to work in the first place.	−
	Yearly fixed effect	When labor demand is strong relative to labor supply, seniors become willing to receive recurrent education, expecting it be much easier to find an appropriate job. The opposite situation holds than when labor demand is weak during an economic downturn. Such an effect is assumed to be specific to each year, and thus a time dummy variable can be used to control changes in labor market conditions each year.	+/−

Note: This table explains implication of coefficients of the independent variables used in probit models (Table 5) and each expected sign conditions.

(3) Outcome variable measuring the impact of recurrent education

In order to measure the effect of recurrent education on employment, I set an outcome variable that indicates the employment status. The outcome variable for non-working seniors is set as the first (or second or third) difference of the working dummy, which is 1 if a senior who was unemployed in the previous year starts to work this year, and is 0 if he/she remains unemployed this year. The reason for taking the first difference of the working dummy is to eliminate the influence of the macroeconomic situation on the employment status of both working and non-working seniors (see Heckman, Ichimura, and Todd, 1998). Therefore, comparing the first difference of the working dummy of a senior who has received recurrent education with that of a senior who has almost the same tendency to receive recurrent education but has not done so in reality would lead to a causal effect of recurrent education toward seniors' employment. Similarly, I set an outcome variable that indicates non-working status as 1 minus the working dummy.

(4) Summary of statistics

This section summarizes several characteristics of the statistics. First, the mean values of gender, age, health status, and household income differ significantly between working seniors and non-working seniors (see Table 2).

The share of men among working seniors (62%) is 14 percentage points higher than among non-working seniors, at 48%. This suggests that the majority of senior households maintain a familial division of labor, with men working outside and women working at home taking care of household chores. Nevertheless, year by year, the share of men among working seniors has been declining. Although the share was around 70% from 2005 to 2007, since then it has been decreasing steadily and reached around 60% in 2017.

The average age of working seniors (mean: 69.3, median: 68) is about 2 years less than that of non-working seniors (mean: 71.5, median: 71). Considering the standard deviation of age, seniors near or below the average healthy life span tend to work, that is, working seniors are concentrated between 65.32 and 73.28 years of age and non-working seniors between 66.78 and 76.22 years of age. However, the average age of working seniors has been rising from around 68.3 in 2005 to around 69.8 in 2017 as elderly labor participation has increased.

In terms of health status, the share of seniors with poor health among working seniors (12.3%) is less than 10 percentage points lower than that among non-working seniors (24.1%). This implies that healthy seniors are more likely to work.

As for household yearly income, the mean and median household incomes of working seniors (mean: 6.54 million yen, median: 5.00 million yen) are larger than those of non-working seniors (mean: 4.67 million yen, median: 3.82 million yen), by about 2.00 million yen for mean income and around 1.20 million yen for median income. Working seniors' wage income is likely to support their household income to some extent, though it should be noted that a household income also includes pensions, rent and financial income, as well as spouses and children's income from work.

4. Econometric analysis

(1) Propensity score for receiving recurrent education

The propensity scores are calculated by estimating probit models where the dependent variable is a recurrent education dummy and the independent variables affecting seniors' tendency to receive recurrent education are as described above.

A. Non-working seniors

When estimating a propensity score for non-working seniors, I adopt as independent variables the dummies of gender, age, educational attainment, job search status, health status, spouse, urban area, natural logarithms of household income, number of people living together at home, and year (controlling for yearly fixed effect). The theoretically and logically expected sign conditions of each coefficient of independent variables are summarized in the rightmost column of Table 4.

The estimation results in Table 5 show that each of the coefficients of educational attainment, number of people living together at home, age, job search status, and health status is statistically significant, and the sign conditions are satisfied. From this, the probability of receiving recurrent education among non-working seniors is roughly explained by (1) investment cost, (2) spare time used for education, and (3) incentive factors. In particular, investment cost and incentive factors seem to be important because the marginal effects of educational attainment and job searching on the probability are both 5 percentage points.

Note that the household income coefficient is positive and statistically significant. This result approves the hypothesis that the household income is related to a senior's latent skills and ability. On the other hand, the following hypotheses are rejected—that if a senior's household income is higher, his/her desire for recurrent education for work would diminish.

The estimated coefficients of gender, spouse and residence area differ from the expected sign conditions. The coefficient of residential area was expected to be positive because larger cities have more recurrent education opportunities, but it is negative and statistically significant. This could be understood as meaning that the plentiful opportunities for recurrent education in large cities are mainly available for the active-working generation, and it may be difficult for seniors to participate in them. Also, in local cities with fewer opportunities to take lectures and seminars, since there are not many active-working generation members in the first place, there may be more opportunities per capita for seniors.

The coefficient of gender is negative and statistically significant, and the negative marginal effect implied by this estimate indicates that the probability of receiving recurrent education is about 0.7 percentage points smaller for men than for women. This result may be influenced by the fact that women aged 65 and over in Japan generally have less work experience than men, so they fail to accumulate work-related skills. Therefore, women may be more motivated to acquire new skills through recurrent education.

Note also that the coefficient of spouse is not statistically significant, which indicates that the presence of a spouse for a senior is neither a positive nor a negative factor in the receiving of recurrent education.

Table 5: Estimation results for probit models

	Dependent variable : Recurrent education	
＜Independent variables＞	Non-working seniors	Working seniors
Educational attainment	0.0530 ***	0.0878 ***
	(0.0074)	(0.0132)
Household income	0.0174 ***	0.0387 ***
	(0.0035)	(0.0065)
Urban area	-0.0108 ***	-0.0277 ***
	(0.0038)	(0.0084)
Regular employment		0.0237 **
		(0.0125)
Firm size		-0.0088
		(0.0093)
Gender	-0.0071 *	-0.0328 ***
	(0.0039)	(0.0098)
Spouse	-0.0033	0.0201
	(0.0062)	(0.0116)
Number of people living together at home	-0.0047 ***	-0.0224 ***
	(0.0018)	(0.0036)
Working time		-0.0006 ***
		(0.0002)
Age	-0.0016 ***	0.0006
	(0.0004)	(0.0011)
Job search	0.0507 **	0.0274
	(0.0266)	(0.0348)
Health status	-0.0177 ***	-0.0212 *
	(0.0038)	(0.0113)
Yearly fixed effect	Yes	Yes
Sample size	12,050	5,571
Pseudo R-squared	0.0429	0.0504

Note: This table presents the estimation results of the probability of receiving recurrent education among non-working seniors explained by (1) investment cost, (2) spare time used for education, and (3) incentive factors. ***, **, * indicate significance at the 1, 5, and 10% level, respectively. The upper figures are coefficients for independent variables, meaning marginal effects. The lower figures in parentheses are standard errors.

B. Working seniors

Regarding the estimation results for working seniors in Table 5, the coefficients for educational attainment, spouse and health status are almost the same as for non-working seniors, but regarding those for gender, age, number of people living together at home, and job search, each magnitude and statistically significant level of the coefficients differs from those for non-working seniors.

First, the coefficient of gender for working seniors is negative and statistically significant, but its absolute value is four times larger than that for non-working seniors. This implies that female seniors are more likely to implement recurrent education than male seniors, which might reflect that it is difficult for female seniors to maintain employment without improving their skills. Alternatively, it might tell us that there are many female seniors engaging in medical- and welfare-related industries that require them to deepen their understanding of advancing medical technology, nursing care and welfare systems that are revised year by year[6].

Second, the coefficient of age is statistically insignificant. It can be interpreted that seniors at work have already performed well, and that they do not lose their motivation to learn necessary skills due to their age alone.

Third, the coefficient of number of people living together at home is negative and statistically significant as for non-working seniors, but its absolute value is five times larger. Unlike non-working seniors, working seniors spend a lot of time working and in work-related activities. Therefore, as the number of people living together increases, such seniors must devote more time to housework, childcare and nursing, and it is more difficult for them to secure time for recurrent education.

The coefficient of job search is statistically insignificant. The share of job searching persons among working seniors (1.5%) is slightly higher than that among non-working seniors (0.9%), but it turns out that whether or not working seniors are looking for a different job is unrelated to their motivation to receive recurrent education.

Regarding independent variables added only to the probit model for working seniors, the coefficients of employment status and working hours satisfy the sign conditions and are statistically significant, but the coefficient of firm size does not. First, the result is consistent with regular employees having more opportunities for recurrent education such as in-house study sessions than non-regular employees. Second, the coefficient of working hours implies that the busier the business that seniors are involved in becomes, the more difficult it is for them to receive recurrent education including in-house study sessions. Third, the coefficient of firm size indicates that even if large companies generally have more financial resources than small and medium-sized enterprises, persistent pressure for cost reduction narrows down opportunities for training even in large firms.

From the above consideration, the estimate results of the probit models both for working seniors and non-working seniors can be interpreted economically and logically, and thus I judged that reasonable estimates have been obtained.

(2) DID based on PSM

Based on the propensity score of seniors calculated by the probit models described above, seniors who conducted recurrent education are matched with seniors who had a similar tendency to implement recurrent

[6] In the 2017 survey, the share of working female seniors in the medical and welfare industries (12.5%) is second only to wholesale and retail (23.4%) and other services (23.4%).
On the other hand, the share of working male seniors in the medical and welfare industry is as small as 6%. By the way, among males, the shares of other services (25.1%), wholesale and retail (23.4%), and construction (10.1%) are high.

education but did not do so. I also compare the first difference of the working dummy for seniors taking recurrent education and for those not taking recurrent education to examine whether there is a causal effect on employment. Note that I focus on the average treatment effect (ATE) instead of the average treatment effect on the treated (ATT), because there is interest in to what degree the probability of employment (or unemployment) would be raised (or depressed) when typical seniors receive recurrent education[7].

A. Non-working seniors

For non-working seniors, recurrent education increases the probability of employment one year later by + 4.7 percentage points (see Table 6). After two years, the impact is +9.6 percentage points. Even after three years, the impact remains at +7.0 percentage points. Note that all estimates are statistically significant at a significance level of less than 5 percentage points.

Compared to the results of the Cabinet Office, Government of Japan (2018) focusing on non-working people aged 30 years and over, the impact of recurrent education on working seniors seems to be somewhat less than that on the active-working generation. They report that the ATT on boosting employment probability is 11 percentage points one year after recurrent education, 10 percentage points two years later, and 14 percentage points three years later. On the other hand, the ATT for seniors in this paper is approximately 40% to 70% of that estimated by the Cabinet Office, Government of Japan (2018), which is +6.7 percentage points one year later, +6.9 percentage points two years later, and +5.7 percentage points three years later.

Table 6: Difference in differences estimators for the impact of recurrent education on seniors' employment probability

	Impact on probability of employment		Impact on probability of unemployment	
After receiving recurrent education	Non-working seniors		Working seniors	
	ATE	ATT	ATE	ATT
One year later	0.0470 ***	0.0668 ***	-0.0893 ***	-0.0967 ***
	(0.0171)	(0.0152)	(0.0137)	(0.0204)
Two years later	0.0962 ***	0.0692 ***	-0.1294 ***	-0.1556 ***
	(0.0206)	(0.0169)	(0.0210)	(0.0269)
Three years later	0.0696 **	0.0574 ***	-0.1505 ***	-0.1233 ***
	(0.0323)	(0.0177)	(0.0214)	(0.0316)

Note: This table presents difference in differences estimators indicating the impact of recurrent education on seniors' employment probability. Samples are matched in accordance with the propensity scores based on the probit models (Table 5). ATE indicates average treatment effect. ATT indicates average treatment effect on the treated. The upper figures are difference in differences estimators. The lower figures are Abadie-Imbens Standard errors (See Abadie and Imbens, 2016). ***, ** indicate significance at the 1, and 5% level, respectively. Caliper is set to be 0.03. Overlap conditions and balance check over matched samples are done (See appendices Figure A-1, A-2). Estimation periods are 2005-2017.

[7] Angrist and Pischke (2008) explains the statistical difference between ATE and ATT.

B. Working seniors

For working seniors, recurrent education reduces non-employment probability by 8.9 percentage points one year later, continues to decrease by 12.9 percentage points two years later, and by 15.0 percentage points three years later. Note that DID estimators are statistically significant at a significance level of less than 1% (see Table 6).

Compared with the results of Kobayashi and Sato (2013) focusing on working persons aged 25 and over, the recurrent educational effect on seniors' employment is much larger than that on the active-working generation. They report that the ATT on unemployment probability is -1.1 to -0.5 percentage points one year after the recurrent education. In this paper, the ATT of working seniors' recurrent education one year later is estimated as -9.7 percentage points. Such a larger depressing effect on seniors' unemployment probability rate might come from their motivation to continue to work, raised by acquiring skills. In general, seniors receiving a pension and holding enough savings do not necessarily have to work for financial reasons. Therefore, once their skills and performances are acknowledged by their coworkers, seniors would like to postpone their retirement.

To summarize, first, recurrent education is confirmed to have the effect of boosting non-working seniors' employment as well as maintaining working seniors' employment. Second, it turns out that these effects persist for at least three years. Third, it is confirmed that the declining impacts of recurrent education on working seniors' unemployment are larger than the boosting impacts on non-working seniors' employment.

5. Implications

(1) Macroeconomic impact

In this section, I estimate the macroeconomic impact of recurrent education on boosting seniors' employment.

Suppose all seniors who currently do not receive recurrent education were in fact to do so. The share of non-working seniors without recurrent education among all non-working seniors is about 96%, and that of working seniors among all working seniors is about 90% as of 2017. Based on the previous result, the impact can be estimated to be about +5 percentage-points in seniors' employment rate one year later. It can be said that this improvement effect has a large macroeconomic impact, considering seniors' employment rate in 2017 is 23%.

Macroeconomic impact of recurrent education on boosting promotion of seniors' employment
= [ATE one year later for non-working seniors
*Share of the non-working seniors without recurrent education
*Number of non-working seniors in 2017
+ATE one year later for working seniors
*Share of the working seniors without recurrent education
*Number of working seniors in 2017]
/Population of seniors in 2017
= (0.0470*0.96*26.97 million + 0.0893*0.90*8.07 million)/35.04 million
= 5.32 percentage points

(2) Cost-benefit analysis

Also, it is important to compare the cost and benefit of carrying out recurrent education when the government and/or private firms encourage seniors to receive recurrent education. To do so, I define "cost" as the opportunity cost required for recurrent education, and "benefit" as the expected income obtained when they work upon having received recurrent education.

A. Non-working seniors

According to the panel survey, the average cost of recurrent education for non-working seniors was 122,000 yen annually in 2017. The expected income is estimated to be the discounted present value of wage incomes obtained over one to three years after the recurrent education, given that the effect of recurrent education on employment lasts for at least three years. According to the panel survey, the average of annual wage income is 96,400 yen when seniors who were not employed in the previous year start to work this year. In addition, supposing the subjective discount rate is 3% among seniors[8], the "benefit" can be calculated as 193,000 yen. Therefore, the cost-effectiveness is positive, at 71 (=193–122) thousand yen.

Expected income for non-working seniors taking recurrent education
= ATE one year later*Wage income/Discount factor
+ATE two years later*Wage income/ (Discount factor)^2
+ATE three years later*Wage income/ (Discount factor)^3
= 0.0470*964 thousand yen / 1.03
+0.0962*964 thousand yen / (1.03)^2
+0.0696*964 thousand yen / (1.03)^3
= 193 thousand yen

B. Working seniors

In the case of working seniors, the "cost" spent on recurrent education needs to include costs incurred by recurrent education paid by firms, in addition to the costs paid by seniors themselves. According to the panel survey, the amount paid by working seniors was 121 thousand yen a year in 2017. However, since it is difficult to determine the costs of recurrent education received in the workplace, I instead recognize such cost as the time required to have the seniors attend the recurrent education in the firm. The panel survey also has information on the time spent by working seniors in receiving recurrent education, which is 205 hours a year. Taking the average of the wage income for working seniors as 1,532 yen per hour (= annual wage income of 2.26 million yen divided by annual work time of 1,480.6 hours), the cost incurred to firms is estimated to be 314 thousand yen a year.

Expected income, as in the case of non-working seniors, can be calculated to be 786 thousand yen. As a result, the cost-effectiveness is positive, at 350 (= 786– 435) thousand yen. The excess benefit for working seniors

[8] The discount rate is set to 3%, referring to Shiraiwa et al. (2012).

exceeds that for non-working seniors by about 300 thousand yen[9].

Expected income for working seniors taking recurrent education
= ATE a year later*Wage income/Discount factor
+ATE two years later*Wage income/ (Discount factor)^2
+ATE three years later*Wage income/ (Discount factor)^3
= 0.0893*2269 thousand yen / 1.03
+0.1294*2269 thousand yen / $(1.03)^2$
+0.1505*2269 thousand yen / $(1.03)^3$
= 786 thousand yen

6. Concluding remarks

In this paper, I examine the impact of recurrent education on seniors' employment using DID based on PSM. The main results are as follows.

First, recurrent education significantly boosts non-working seniors' employment probability by about 5~10 percentage points and suppresses working seniors' non-employment probability by about -15~-9 percentage points. Furthermore, such effects persist for at least three years both for non-working and working seniors.

Second, suppose recurrent education is provided to all seniors who do not currently receive recurrent education, seniors' employment rate in Japan would rise by about 5 percentage points.

Third, comparing cost and benefit of recurrent education, the benefit exceeds the cost by 71 thousand yen for non-working seniors and by 350 thousand yen for working seniors.

From this evidence, it is necessary for the government and private firms to enhance recurrent education to promote seniors' employment. To make recurrent education more effective, the first policy priority should be placed on working seniors.

Further research on the effect of recurrent education should be conducted to incorporate the quality of recurrent education. In this paper I am not able to take this into account due to the limits of the data.

References

Abadie, A. and G. W. Imbens (2016). “Matching on the Estimated Propensity Score.” *Econometrica*. Vol. 84, Issue2. pp. 781-807.

Angrist, J. J. and J. Pischke (2008). *Mostly Harmless Econometrics*. Princeton University Press.

The Cabinet Office, Government of Japan. (2018). *Annual Report on the Japanese Economy and Public Finance 2018*. (in Japanese)

Hara, H. (2007). “Skill development of Japanese firms - from the experiences of the early 70's and the early 2000's. (in Japanese)” *Nippon Roudou Kenkyu Zasshi*. June. 2007.(No.563).

Heckman, J. J., H. Ichimura, J. Smith and P. Todd (1998). “Characterizing Selection Bias Using Experimental

[9] For not only seniors but firms, their providing education opportunities to seniors would be beneficial because they can make money by letting seniors continue to work.

Data.” *Econometrica*. Vol. 66, No. 5. pp.1017–1098.

Kobayashi, T. and K. Sato. (2013). “Implementation of self-development and reemployment, unemployment, and wages. (in Japanese)” in Seko. M., H. Teruyama, I. Yamamoto, Y. Higuchi. *Dynamism of Japanese household behavior* IX. pp85-116.

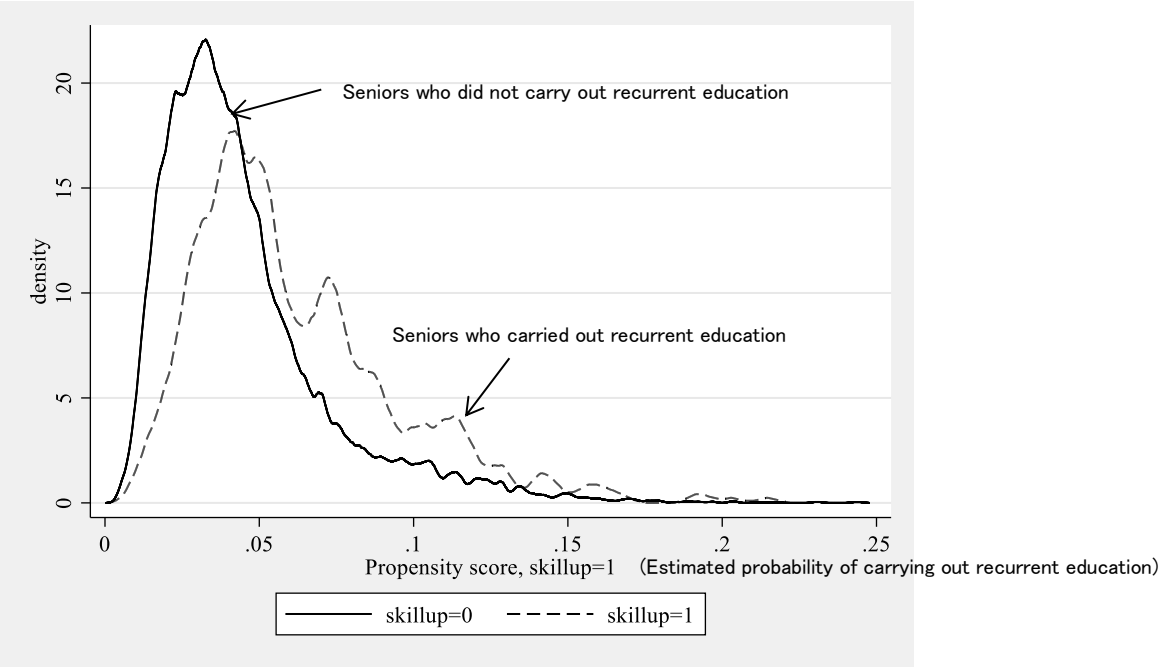
Rosenbaum, P. R., and D. B. Rubin (1983). “The Central Role of the Propensity Score in Observational Studies for Causal Effects.” *Biometrika*. Vol.70, No.1. pp.41–55.

Shiraishi, K., Y. Kasai, T. Ikeda, K. Shimoduma. (2012). “How should the discount rate in medical economic evaluation be set? (in Japanese)” *Jpn J Pharmacoepidemiol*, 17(1) June 2012：33.

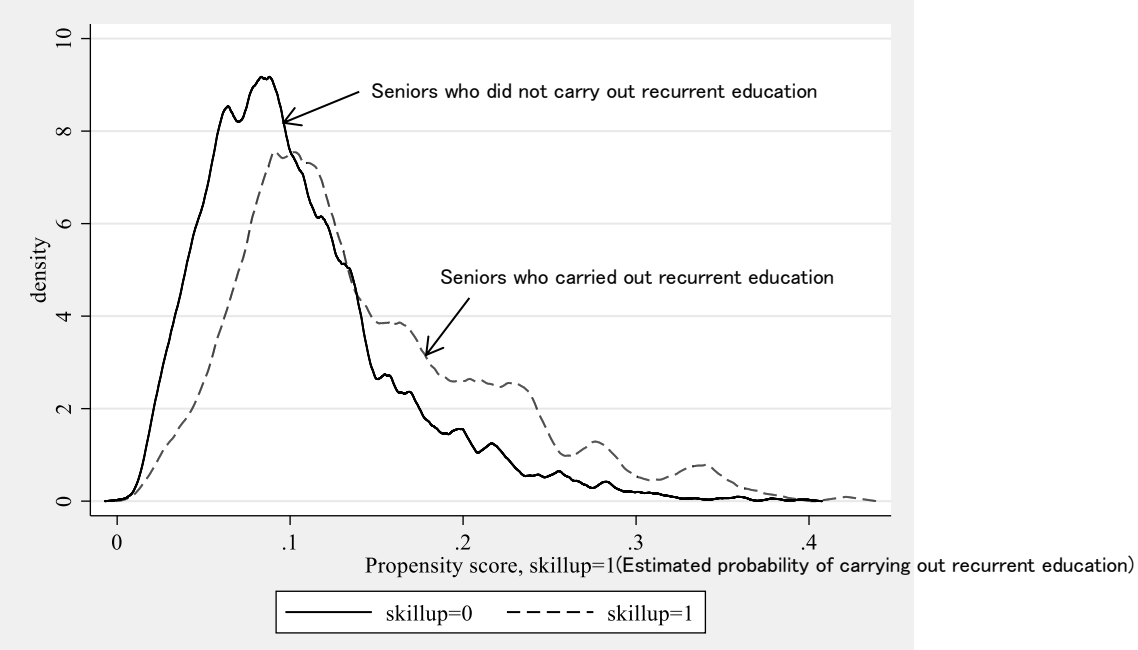
Appendices

Figure A–1: Overlap condition

(1) Non-working seniors



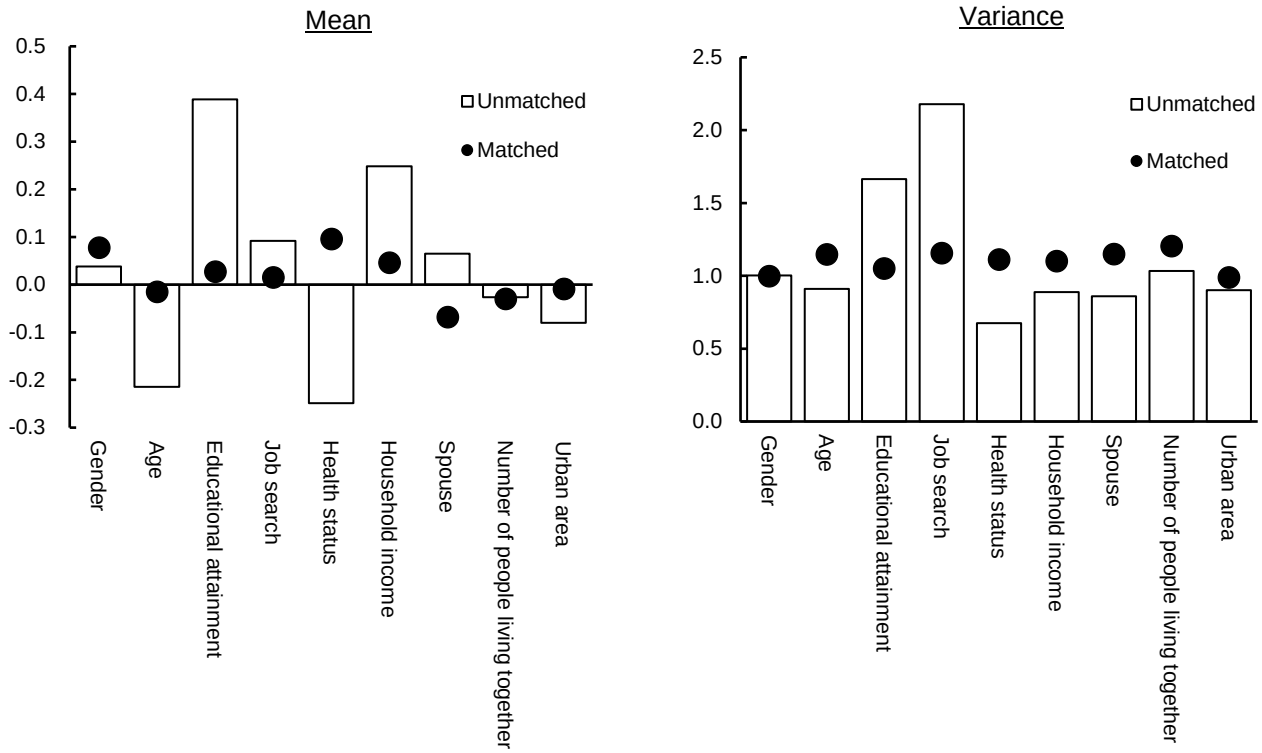
(2) Working seniors



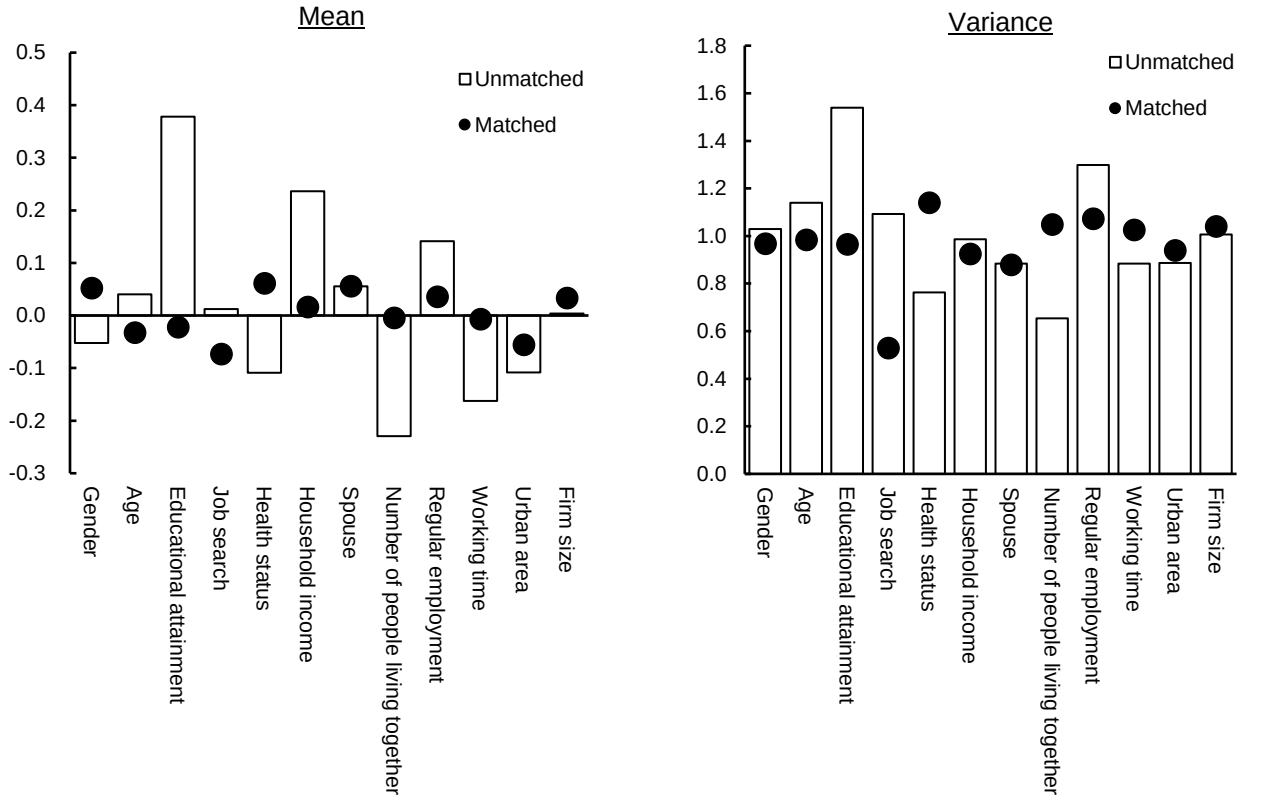
Note: This figure presents distributions of the estimated probability of carrying out recurrent education between seniors who carried out recurrent education and ones who did not. Sufficiently large overlapping area between the two groups indicates that the overlap condition is satisfied.

Figure A–2: Balance check of matched samples

(1) Non-working seniors



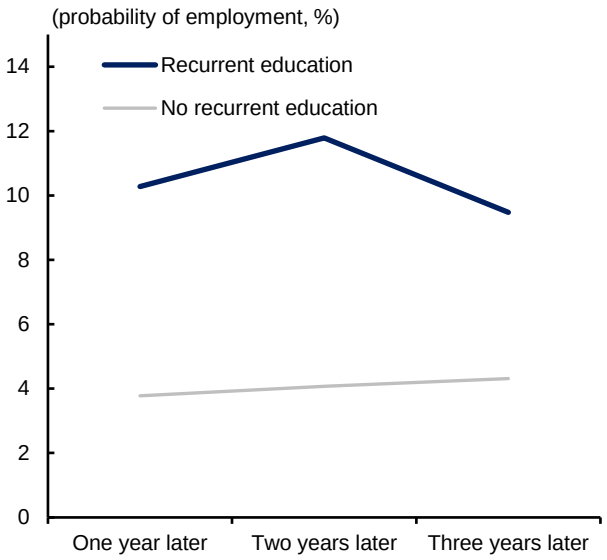
(2) Working seniors



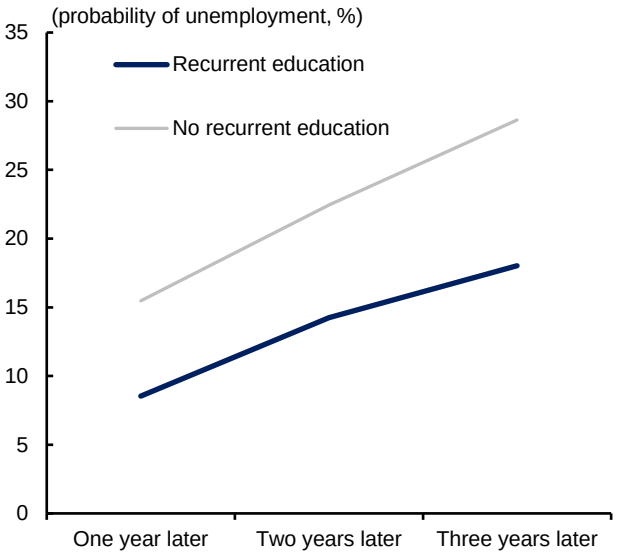
Note: These figures present standardized difference in means and variances of independent variables between seniors who carried out recurrent education and ones who did not. The differences in means among variables generally become small after matching. Also, the variance ratios generally become close to 1 after matching. This confirms that there is no significant bias in the matching data.

Figure A–3: Recurrent education and seniors' probability of employment

(1) Non-working seniors



(2) Working seniors



Note: These figures present developments in seniors' probability of employment without considering sample bias. The difference of the change in the probability of employment (also probability of unemployment) between seniors who carried out recurrent education and ones who did not is statistically significant at a significance level of less than 1%.