The effects of population ageing on public education in Japan : A reinterpretation using micro data.

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The effects of population ageing on public education in Japan: A reinterpretation using micro data[*]

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Abstract:

This study explored the effects of population ageing on public education using Japanese micro data. In recent years, Japan has become the fastest-ageing society among the major countries; the ageing of the population is expected to progress rapidly, such that in 2050, the population of those 65 years of age or older will be about 37% of the total population. Owing to such rapid ageing of the population in Japan, it is important to understand whether the elderly have any preferences regarding public education services. Therefore, through the elderly's reasons for choosing a place of residence, we examined the difference in their preferences for education due to differences in family type and asset conditions. The results of the analysis, like those obtained by Poterba (1998) and Ohtake and Sano (2009), suggest the possibility that elderly people who no longer live with their families do not support education. However as suggested by Hilber and Mayer (2009), elderly people who have more real estate assets can obtain indirect benefits from education; thus, even if they no longer live with their families, such elderly people may support education.

JEL Codes: I22, I28, H75

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1. Introduction

Recently, the topic of what kind of effect an ageing society will have on education spending has been frequently addressed. Poterba (1997, 1998) pointed out that, as it is difficult to obtain a theoretically clear conclusion by relying on how the median voter in an ageing society thinks about compulsory education spending and an ageing society, these challenges are therefore empirical ones.

Poterba (1997, 1998) also indicated that, when increases in spending on compulsory education are thought to hold no benefits for the elderly, this spending may be reduced. Conversely, when the elderly engage in altruistic, long-term decision making, and when the elderly indirectly accrue benefits from spending on compulsory education, the correlation between an ageing society and education spending may be positive.

Performing an analysis based on data from the United States, Hoxby (1998) indicated that, beginning in the 1900s, there has been a positive correlation between the percentage of elderly people in the population and education spending. However, it was also indicated that, as the years have passed, a negative correlation between population ageing and education spending has appeared.[1]

[Insert Figure 1 here]

Today, of the seven major countries (France, United Kingdom, Japan, Germany, Italy, United States, and China), Japan is experiencing the most dramatic population ageing, a phenomenon that will rapidly become more pronounced. In 2050, the percentage of the Japanese population 65 years of age or older is expected to reach 37% (Figure 1). Examples of studies that have performed an empirical analysis of the relationship between an ageing society and spending on compulsory education in Japan include those by Inoue et al. (2007), Ohtake and Sano (2009), Ohtake and Sano (2010), and Miyaki and Kimura (2016). All this research has demonstrated a general negative correlation in recent years between the compulsory education spending effected by regional (that is, municipal and prefectural) governments and the ageing of society. The estimation results obtained by Ohtake and Sano (2009, 2010) indicate the possibility of a positive relationship between compulsory education spending and the rate of population ageing at the prefectural level before 1990. However, on and after 1990, a negative relationship is demonstrated between compulsory education spending and the rate of population ageing.

Ohtake and Sano (2009), in examining the reasons for a change in the relationship between population ageing and compulsory education spending after 1990, stated the possibility that this

[1] Other examples of research that has analysed the relationship between education expenditure and population ageing include that of Harris et al. (2001), Ladd and Murray (2001), Berkman and Plutzer (2004), Grob and Wolter (2007), Figlio and Fletcher (2012), and Kurban et al. (2015).

change was due to either (i) changes to family structure, or (ii) changes to the education fiscal system. Regarding (i) changes to family structure, Poterba (1998) inferred that Hoxby's (1998) research results show a reversal of the coefficient sign due to the effects of elderly people choosing not to live with their families. The analysis results obtained by Ohtake and Sano (2009) regarding the reasons for changes in the relationship between population ageing and compulsory education spending during the 1990s indicates that (i) changes to family structure cannot explain these changes, but it is possible that (ii) a reform of the system of subsidies to regional governments for spending on compulsory education had an effect on this spending.

However, Epple et al. (2012), theoretically speaking, indicated the possibility of intergenerational conflicts with respect to public education, because elderly people who do not live with children have a weaker incentive to support public education services than younger people with children who attend school. That is, it is possible that elderly people who do not live with children are less incentivised to support public education.

Also, as indicated in empirical research by Brunner and Balsdon (2004), although the relationship between population ageing and compulsory education spending can be revealed indirectly from the relationship between the percentage of elderly people in the population and compulsory education spending, determining a causal relationship is difficult. Therefore, in the studies of Brunner and Balsdon (2004) and Cattaneo and Wolter (2009), a survey was distributed to potential voters, and the preferences of the elderly regarding education were clarified on the basis of individual responses.

Therefore, likewise, in this study, we used individual survey responses to investigate the elderly's preferences regarding education expenditure. The responses used in this study are from the two survey years, 2009 and 2010, of the 'Preferences Parameters Study' conducted by the Global Centers of Excellence program at Osaka University. This survey includes a questionnaire concerning what kinds of reasons individuals had when choosing a place of residence. In this questionnaire, one of the possible choices for choosing to live in a certain area is the educational environment.

Originally, Tiebout (1956) considered 'voting with one's feet' as a way to solve problems of revealed preferences in the supply of public goods. That is, people select their place of residence to maximise utility. Through this act of 'voting with one's feet', in this case, by choosing one's place of residence, it is possible to understand people's preferences. Therefore, in this study, using the reasons that people choose certain places of residence, an analysis was conducted to determine what kinds of factors cause each household to experience satisfaction.

Furthermore, an analysis was conducted that considers whether households that chose their place of residence on the basis of a good educational environment feel satisfied regarding the public education offered in the region in which they live. The analysis in this study, like in the studies of Brunner and Balsdon (2004) and Cattaneo and Wolter (2009), used the results of a questionnaire, which are considered to be stated preferences. However, on this point, the nature of this study differs

somewhat from that of previous research. As the object of the analysis here focuses on the reasons people chose to live in the place they do now, it is highly possible that these preferences reflect the actions of the individual currently living in the place they have chosen. Therefore, in comparison to the results of previous research, we considered the results obtained here to be closer to the actual preferences of the elderly.

First, regarding what kind of preferences the elderly hold concerning education expenditure, we conducted a more direct investigation, using individual responses, of whether, as indicated in the research by Epple et al. (2012) and Poterba (1998), elderly people who do not live with children have a lower incentive to support public education. Therefore, (1) we investigated whether a difference in preferences related to education occurs between elderly people who live with children and elderly people who do not live with children.

Second, Brunner and Balsdon (2004) discussed the possibility that the elderly may agree to public education expenditure on the basis of intergenerational altruism. They also pointed out that intergenerational altruism may occur, for example, if an elderly person's grandchild commutes to a public school, if an elderly person has lived in a certain area for longer than the younger generation, or if an elderly person has formed a close relationship with the people and children of a neighbourhood.

According to the '2015 Annual Report on the Ageing Society', the percentage of the elderly population (persons 65 years of age or older) who lived alone was 4.3% for men and 11.2% for women in 1980. In 2010, however, this ratio had become 11.1% for men and 20.3% for women. The number of elderly living alone has therefore increased significantly in modern Japan.

Furthermore, according to the 2013 'Awareness Survey on the Participation of the Elderly in Regional Society', looking at participation rates for interacting with younger generations, single-person elderly households had a higher percentage of non-participation in comparison to elderly people with other living arrangements.[2] Therefore, the sort of intergenerational altruism studied by Brunner and Balsdon (2004) may be less present among elderly people in single-person households than among those living in elderly-only households (households composed of couples) or other living arrangements. Therefore, (2) we investigated how differences in preferences with respect to education occur between elderly people who do not live with children and those who live in single-person households.

Finally, even for elderly households that do not include anyone young enough to receive direct benefits from education, as discussed by Poterba (1997, 1998), if such households own property, it is possible that support for education may come from indirect benefits that accrue to such households as a result of an increase in property values due to education investments by the local

[2] For example, for households composed only of couples, non-participation in interactions with younger generations stood at 52.8%. For single-person households, this number was 58.1%. Thus, single-person households tend to participate less.

government. Furthermore, Hilber and Mayer (2009) indicated that, on the basis of school district data for 46 US states, even residents who do not live with children themselves may stimulate an increase in education spending, owing to a capitalisation incentive in which education expenditure causes an increase in property values.

According to the 2009 'Nationwide Consumption Survey', for households of two or more people, people in their 40's, when most child-rearing occurs, had average housing and land assets worth 21.9 million yen. For elderly people 65 years of age or older, this number was 30.43 million yen. Therefore, there is a tendency for average household assets (housing and land assets) to increase as the age of the household increases, and the elderly may therefore be more sensitive to increases in property values. Therefore, we investigated (3) whether there is a difference in preferences regarding education between elderly households that do not live with children and have considerable real estate assets and elderly households that lack such assets.

2. Data and Basic Summary of Results

The data used in this paper were taken from the 2009 and 2010 'Preferences Parameters Study' conducted by the Global Centers of Excellence program at Osaka University. The data from these two survey years were pooled and analysed. The subjects of this survey for each year were 6,134 men and women over 20 years of age from all over Japan who were selected through a two-stage random sampling method. The data used in this study came from responses to questionnaire items that existed in both years of the above survey. The questionnaire number for each questionnaire item recorded below describes the question number used in the 2010 survey.

First, to limit the subjects of the analysis to the elderly, age was calculated. We defined 'elderly' as being anyone 65 years of age or older, and used the resulting sample of those 65 and older for the analysis.

The sample of those who answered 2, 'I would like to stay', in response to Q23, 'If you could move to another prefecture in Japan, would you like to do so?', was used for the explained variable, and the value of the variable was decided on the basis of their answer to Q24, 'Why would you like to live in the prefecture recorded above?' This variable was assigned a value of 1 for those who cited 'A good educational environment', and a 0 for all other responses.

Here, of all elderly people surveyed, those who answered 1, 'I would like to move', to Q23 were classified as 'wish to move', and those who answered 2, 'I would like to stay', were classified as 'wish to stay'. Looking at Table 1, which shows the respective percentages for these responses, it can be seen that more than 90 percent of the elderly hope to stay, which indicates a high possibility that many elderly people are satisfied with their area of residence.

[Insert Table 1 here]

Also, ‘wish to move’ and ‘wish to stay’ are both stated preferences, but their quality is somewhat different. ‘Wish to stay’ is a stated preference, but there is a high possibility that this preference reflects the behaviour of those currently living in an area. However, ‘wish to move’ deals with a place where the respondent is not currently living, and may therefore be considered to not align with the individual actions of the respondent. In this study, we used only those responses that were highly likely to reflect individual actions and therefore restricted our analysis to the sample of those who responded that they ‘wish to stay’.

Next, Table 2 shows, of those persons who were both elderly and also selected ‘wish to stay’, the percentage of respondents who, in response to Q24, chose ‘3 A good educational environment’ as their reason for choosing their area of residence. Looking at this table, the percentage of all elderly people who chose education as a reason for selecting their place of residence was about 4.6%. Therefore, for a portion of elderly people, education may be considered a causal factor in selecting their place of residence.

[Insert Table 2 here]

Also, respondents may hold different interpretations of what the term ‘educational environment’ means. In this case, as the category refers to a reason for choosing an area of residence, the definition certainly may be limited to ‘education’ that is characterised as a local, public resource with a limited scope of beneficiaries. In Japan, for primary and secondary levels of education, which are aimed at the young, and for education provided by public schools, a household that does not live in the area where a public school is located is unable to enjoy the benefits of that school. Conversely, whether a household can enjoy the benefits of education provided by universities and private schools is not fundamentally connected to the area where the household is located.

However, education may also include education that does not target the young, such as ‘social education’, from which the elderly are able to directly benefit. Social education refers primarily to continue learning for the purpose of one’s own hobby, entertainment, or to support one’s life’s work, even for elderly people who have stepped away from the forefront of society. In Japan, this kind of social education primarily takes the form of ‘public lectures’ offered by the government, which often take place at cultural institutions such as community halls or libraries.

The value of education may therefore differ depending on whether it is ‘education for the younger generations’, which does not directly benefit the elderly, or ‘social education’, which directly benefits the elderly. Consequently, for the data used in this study, we have examined which of these types of education is indicated by the phrase ‘a good educational environment’.

As it was possible to make four different choices simultaneously in response to Q24, Table 3 shows which of the remaining three choices were also selected by respondents who chose education. Similarly, Table 3 shows what other choices were selected by respondents who chose a

good cultural environment or a good environment for raising children.

For example, it is possible that respondents who have an affinity for social education, from which they can directly benefit, are those who chose both 'cultural' and 'educational environment'. As the public lectures that characterise this social education are primarily offered at cultural institutions such as libraries and community halls, it is possible that respondents favouring this type of education would also choose 'a good cultural environment'. Also, it is possible that those respondents who chose 'a good environment for raising children' prefer the type of education targeted at younger generations. Respondents who favour this type of education may choose both 'a good environment for raising children' and 'a good educational environment'.[3]

Respondents who actually chose 'a good cultural environment' were more likely to also choose 'a good educational environment'. They were also likely to select 'there are many hospitals or medical institutions', 'the area is convenient because of the availability of supermarkets and department stores', and 'transportation is convenient' as other choices. However, no respondents who chose 'a good cultural environment' also chose 'a good environment for raising children'. Examining trends in these selections, as they are all factors that make one's life more convenient, there may be a tendency for respondents who chose 'a good cultural environment' to make choices that directly benefit them comparatively often.

Furthermore, respondents who chose 'a good environment for raising children' were also more likely to choose 'a good educational environment'. However, they tended not to choose 'a good cultural environment' and 'the area is convenient because of the availability of supermarkets and department stores'. In particular, none of these respondents chose 'a good cultural environment'. Therefore, based on an examination of selection trends, respondents who chose 'a good environment for raising children' had a low likelihood to choose factors that would make their own life more convenient, and were comparatively unlikely to make choices that directly benefitted themselves.

Furthermore, respondents who chose 'a good educational environment' tended not to choose 'transportation is convenient' and 'the area is convenient because of the availability of supermarkets and department stores', and should therefore be considered, as with respondents who chose 'a good environment for raising to children', to be comparatively unlikely to make choices that will directly benefit themselves.

[Insert Table 3 here]

There was therefore a tendency for similar decision-making behaviour for both respondents who chose 'a good educational environment' and 'a good environment for raising

[3] Certainly, the possibility that respondents who did not choose either 'a good cultural environment' or 'a good environment for raising children' also desired 'education for younger generations' and 'social education' cannot be discounted.

children' in which, comparatively, both groups made selections that do not directly benefit themselves. However, respondents who chose 'a good cultural environment', unlike those who chose either 'a good educational environment' or 'a good environment for raising children', were comparatively more likely to make choices that benefitted themselves.

The purpose of this study was to conduct an analysis of differences in preferences among the elderly regarding education for younger generations. From the trends described above, we assumed that respondents who chose 'a cultural environment' had a preference for 'social education', which can produce direct benefits for the respondents themselves. By doing so, and by conducting an analysis using two simultaneous equations for the factors of either 'education' or 'cultural environment' that influenced where respondents chose to live, it was possible to analyse factors that determine support among the elderly for the education of younger generations.[4] Factors that deal with both education and social education were also taken into account, and to this end, a bivariate probit model was used, in which correlations that occur between the error terms of each function were considered.

3. Model

The interests of this study were as follows. We investigated the following three points: (1) whether differences in preferences regarding education occur between households in which the elderly live with children and households in which they do not, (2) whether differences in preferences regarding education occur between households in which the elderly do not live with children and single-person households in which the elderly live alone, and (3) whether differences in preferences regarding education occur between households in which the elderly do not live with children and hold substantial real estate assets and households in which the elderly do not hold such assets.

Therefore, to investigate (1) whether differences in preferences regarding education occur between households in which the elderly live with children and households in which they do not, in Model 1, elderly households that do not include children (expressed below as 'old') were used as the explanatory variable. Also, the amount of real estate assets owned by the household, age of the questionnaire respondent, household income, academic record, and respondent's gender were all controlled for.

[4]Another simultaneous equation for 'a good environment for raising children' may also be used, but as described above, respondents who chose 'a good educational environment' and those who chose 'a good environment for raising children' may have had similar decision-making behaviour. Furthermore, as there were only 24 respondents in this sample who chose 'a good environment for raising children', the number of respondents was deemed insufficient, and this type of approach was not taken.

Estimation Model (Model 1):

$$educ_i = \alpha + \beta_1 old_i + \beta_2 asset_i + \beta_4 age_i + \beta_5 income_i + \beta_6 educback_i + \beta_7 female_i + u_i$$

$$culture_i = \delta + \gamma_1 old_i + \gamma_2 asset_i + \gamma_4 age_i + \gamma_5 income_i + \gamma_6 educback_i + \gamma_7 female_i + v_i$$

$$E[u_i] = E[v_i] = 0$$

$$Var[u_i] = Var[v_i] = 1$$

$$Cov[u_i, v_i] = \rho$$

Here, let us consider β_1 and γ_1. For example, let us examine fields from the 2013 'Awareness Survey on the Participation of the Elderly in Regional Society' that concern policies pertaining to the elderly. Regarding places for learning, which is a focus of policies aimed at providing satisfaction of the elderly contained in this survey, households composed exclusively of married couples expressed a 5.4% satisfaction rate, and two-generation households (those that live with children) expressed a 5.0% satisfaction rate. That is, there was no significance difference in the satisfaction rate between elderly households that live with children and those that do not. Also, in the same survey, regarding policies that respondents wanted strengthened, 5.5% of households composed exclusively of married couples wanted policies dealing with places of learning to be expanded, whereas 4.5% of two-generation households (those that live with children) wanted such policies to be expanded. Again, there was no significance difference in preferences between elderly households that live with children and those that do not. In light of these survey results, there was a low likelihood of differences in preferences regarding social education policies between elderly people who live with children and those who do not. If there were no such differences in preferences, the γ_1 contained in the models may be regarded as insignificant.

Conversely, as β_1 expresses the effect on education for children, if there are differences in preferences regarding education between elderly households living with children in comparison to those not living with children, β_1 will be significant. We therefore verified this variable's significance.

Next, to investigate (2) whether differences in preferences regarding education occur between households in which the elderly do not live with children and single-person households in which the elderly live alone, in Model 2, single-person, elderly households (expressed below as 'single') was used as the explanatory variable. Also, the same variables used in Model 1 were used as control variables.

Estimation Model (Model 2):

$$\mathrm{educ}_i = \alpha + \beta_1 single_i + \beta_2 \mathrm{asset}_i + \beta_4 age_i + \beta_5 \mathrm{income}_i + \beta_6 \mathrm{educback}_i + \beta_7 female_i + u_i$$

$$culture_i = \delta + \gamma_1 single_i + \gamma_2 \mathrm{asset}_i + \gamma_4 age_i + \gamma_5 \mathrm{income}_i + \gamma_6 \mathrm{educback}_i + \gamma_7 female_i + v_i$$

$$E[u_i] = E[v_i] = 0$$

$$Var[u_i] = Var[v_i] = 1$$

$$Cov[u_i, v_i] = \rho$$

Finally, to investigate (3) whether differences in preferences regarding education occur between elderly households that do not live with children and that hold substantial real estate assets and households that do not hold such assets, in Model 3, the cross term for the single-person elderly household variable from Model 2 (single) and a variable for the amount of a household's real estate assets (expressed below as 'asset') was used as the explanatory variable (expressed below as asset × single). Therefore, Model 3[5] is Model 2 with the (asset × single) explanatory variable added to it.

Estimation Model (Model 3):

$$\mathrm{educ_i} = \alpha + \beta_1 single_i + \beta_2 \mathrm{asset_i} + \beta_3(\mathrm{asset_i} \times single_i) + \beta_4 age_i + \beta_5 \mathrm{income_i} + \beta_6 \mathrm{educback_i} + \beta_7 female_i + \mathrm{u_i}$$

$$culture_i = \delta + \gamma_1 single_i + \gamma_2 \mathrm{asset_i} + \gamma_3(\mathrm{asset_i} \times single_i) + \gamma_4 age_i + \gamma_5 \mathrm{income_i} + \gamma_6 \mathrm{educback_i} + \gamma_7 female_i + v_i$$

$$\mathrm{E[u_i]} = \mathrm{E}[v_i] = 0$$

$$\mathrm{Var[u_i]} = \mathrm{Var}[v_i] = 1$$

$$\mathrm{Cov[u_i,\ } v_i] = \rho$$

The variables in the model are defined as follows.

educ: If education was selected as a reason for choosing the area of residence, then educ = 1. If it was not, then educ = 0.

$culture$: If culture was selected as a reason for choosing the area of residence, then $culture = 1$. If it was not, then $culture = 0$.

old: A variable that expresses whether a household included children. If a household was composed only of elderly people (not living with children), then old = 1. If a household included children, then old = 0.

$single$: A variable that expresses whether a household was a single-person household. If a household was single person, then $single = 1$. For all other households, $single = 0$.

asset: Current assessed value of household assets (that is, residences and land). This is a category variable that can hold values from 1 to 10.

age: Respondent's age.

income: A variable that expresses household income (total annual pre-tax income). This variable is a category variable that can hold values from 1 to 12.

educback: A variable that expresses academic background. This is a category variable that can hold values from 1 to 9.

Female: A dummy variable for whether the respondent was female. If a respondent was female, then female = 1. If a respondent was male, then female = 0.

[5]In models that used a variable for elderly households that do not live with children (old), the coefficient of correlation between the elderly household dummy and the cross term of the elderly household dummy and real estate assets was high at 0.8340. Therefore, due to the possibility of multiple collinearity, only the results for single-person households (single) are shown.

u_i, v_i : Error terms.
$\alpha, \beta, \delta, \gamma$: Estimated parameters.
ρ: The correlation between the error terms of the two equations.
Subscript i: Represents the individual.

Household income (income), educational background (educback), gender (female), and respondent's age (age) were used as control variables in all models. High-income households may desire a high level of education services. Therefore, the likelihood that a household cites education as a reason for choosing an area to live in may be proportionate to household income. Regarding academic background, a strong academic background produces benefits such as a higher level of income. Respondents may be proactive about putting efforts into education in relation to the extent to which they enjoy the benefits of having a strong academic background. Therefore, the stronger a household's academic background, the more likely the household may cite education as a reason for choosing an area to live in. Furthermore, as preferences regarding education may vary based on differences in the gender and age of respondents, these attributes were used as control variables.

Also, for ρ, which expresses the correlation between the error terms of the two equations, $\rho > 0$ indicates a positive correlation between choosing 'a good educational environment' and 'a good cultural environment'. However, $\rho < 0$ indicates a negative correlation between 'a good educational environment' and 'a good cultural environment', and $\rho = 0$ indicates no correlation between 'a good educational environment' and 'a good cultural environment'. Therefore, if $\rho = 0$, then the two equations may be analysed independently from one another.

4. Variables

In this study, we performed an analysis using a sample of elderly people, whom we defined as those 65 years of age or older. First, regarding the sample of those respondents who answered 'I would like to stay' to Q23, 'If you were able to move to another prefecture, would you like to do so?', we used the answers given by these respondents to Q24, 'Why would you like to live in the prefecture recorded above?' We assigned the educ variable a value of 1 for those who cited 'a good educational environment' in response to Q24, and assigned it a value of 0 for all other responses. At the same time, we assigned the $culture$ variable a value of 1 for those who cited 'there are musical performances, theatres, libraries, and other such institutions, so there is a good cultural environment' in response to Q24, and assigned it a value of 0 for all other responses.

Next, as an explanatory variable, we created a dummy variable for living with children (old) using responses to Q14, 'Regarding the structure of the family you currently live with, which of the following applies? Choose 1 answer that fits best by circling the appropriate number'. We assigned the old variable a value of 1 for households that circled '1 A single person' or '2 A couple

only', and have assigned it a value of 0 for all other responses.[6] Similarly, we used responses to Q14 for the single-person household variable (single), and assigned this variable a value of 1 for '1 A single person' and a value of 0 for all other responses.

We created an explanatory variable for income (income) based on Q29, 'What was the total annual pre-tax income of your household in 2009 including bonuses?' For the household real estate assets variable (asset), we used the response to Q34, 'What is the current assessed value of the residences and land assets owned by your entire household?', as the current assessed value of the household assets (residences and land). For the academic background variable (educback), we used responses to Q6, 'Please indicate the last school you and your spouse graduated from. For those currently enrolled in school, please use the school you are currently attending. Choose 1 answer that fits best and record the number below'. In this study, we were mainly concerned with whether the propensity for respondents to cite education as the reason for choosing to live in a certain area corresponds to the extent to which they have high incomes, hold a large amount of assets, and have a strong academic background. As a result, the size of the coefficient did not pose a major problem, and therefore, we used the results of the questionnaire as is.[7]

For the variable representing the age of the respondent (age), we used the age calculated when partitioning the sample as is. In creating the dummy variable representing whether a respondent was female (female), we used the responses to Q1 'What is your gender?' We assigned this variable a value of 0 for '1 Male' and a value of 1 for '2 Female'. The descriptive statistics of each variable calculated based on the above are shown in Table 4.

[Insert Table 4 here]

5. Estimation Results

Stata 12 was used for the analysis in this study. The estimation results are shown in Tables 5–8. For the explained variables, the analysis results obtained from a bivariate probit model that used two simultaneous equations, an estimation equation for education as the reason for selecting area of residence and an estimation equation for culture as the reason for selecting area of residence, are shown in Tables 5 and 6. Furthermore, the marginal effects obtained using these results are shown in Tables 7 and 8.

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[6] As other possible responses were '3 A couple and child(ren)', '4 A single parent and child(ren)', '5 A couple, child(ren), and parent(s) of the couple', and '6 A couple, child(ren), parent(s) of the couple, and sibling(s) of the couple', households that were assigned a value of 0 will at least be those in which the elderly live with children (people of a younger generation). It was difficult to assess '7 Other', so these responses were excluded from the estimates.

[7] Regarding academic background, options for dropping out and graduating appeared separately in the questionnaire. As a result, it was possible that the values were not monotone. Therefore, estimates were performed in which the final academic level of achievement for drop outs was recounted (specifically, college dropouts were recounted as high school graduates). However, no major difference appeared in the estimation results.

[Insert Table 5 here]

[Insert Table 6 here]

It can be seen in Tables 5 and 6 that, in all models, ρ, which expresses the correlation between the error terms of the two equations, had a significantly positive effect. This result indicates that it is better to simultaneously estimate results for 'a good educational environment' and 'a good cultural environment'. It also indicates that choosing education and choosing culture are not independent of one another, and that there may be a positive correlation between these two choices. Therefore, as assumed in this study, respondents who chose 'cultural environment' may have cited 'education' as a reason for choosing an area to live in due to an affinity for 'social education'.

Furthermore, in all models, household real estate assets had a significant positive effect on propensity to choose education. This result indicates that, as discussed by Poterba (1997, 1998), investment in education by local government provides indirect benefits to households that have real estate assets, and that households with significant real estate assets may therefore choose to live in areas that invest in education.

Also, in all models, age had a significantly positive effect on propensity to choose education. However, as the pooled results of two years of the questionnaire were used in this study, it was not possible to discern whether this result was due to age or to a cohort effect.

The variables for family structure (the dummies for living with children and for a single-person household), which were the main variables in this study, had a significantly negative effect on propensity to choose education in all models. Therefore, (1) elderly people living with children cite education as a reason for choosing an area to live in. Also, (3) differences in preferences regarding to education occur between elderly households that do not live with children and that hold considerable real estate assets and households that do not hold such assets, in which the former (i.e. elderly households that do not live with children and that hold considerable real estate assets) cite education as a reason for choosing their area of residence.

However, in the analysis of education, aside from the variables described above, no significant effect was discerned. In the case of income, this result may be because most elderly people in Japan likely receive pensions, and yearly income therefore does not produce a considerable difference in preferences regarding education.[8]

Also, in the analysis of culture, household real estate assets had a significantly positive effect in Models 1 and 2. Individuals with considerable real estate assets may choose 'culture' because areas with substantial cultural institutions see a commensurate increase in property values.

[8] Looking at the income distribution in the data used in this analysis, 46% of respondents chose '3. 2 to less than 4 million yen'. Furthermore, about 77% of respondents fell into one of three levels: '3. 2 to less than 4 million yen', '4. 4 to less than 6 million yen', and '5. 6 to less than 8 million yen'.

Furthermore, in all of the models, academic background had a significantly positive effect on propensity to choose culture. This result may be because respondents with high levels of academic achievement have a strong desire for knowledge and therefore value and demand both 'social education' offered at places like cultural institutions as well as culturally related events and institutions in general.

However, aside from the variables described above, no significant effect was discerned in the analysis of culture. This result includes the fact that γ_1 was not significant, which indicates that, consistent with the results from the 2013 'Awareness Survey on the Participation of the Elderly in Regional Society' described in Section 3, there was no significant difference in preferences for social education between elderly households that live with children and those that do not live with children.

Furthermore, as the constant term in the two equations for education and culture was significantly negative, in situations in which the factors described by the explanatory variables were kept constant, the average elderly person did not select education and culture as reasons for choosing an area of residence.

Based on the analysis results described above, we calculated the marginal effects, specifically, marginal effects for when education was chosen but culture was not chosen. We did so because the main objective of this study was to determine differences in the preferences of the elderly regarding education for young people. As we conducted the analysis under the assumption that respondents who chose 'cultural environment' have an affinity for 'social education', respondents who chose education but not culture may have a preference for education aimed at younger generations. Tables 7 and 8 show the marginal effects calculated for each model.

[Insert Table 7 here]

[Insert Table 8 here]

From Tables 7 and 8, it can be seen that the household dummy variables, which were the important variables in this study, had a significant effect in all models. From Table 7, the marginal effect for β_1 in Model 1 was -0.019 and the marginal effect for β_1 in Model 2 was -0.055. Therefore, the results of the analysis show that the absolute value of the marginal effect of β_1 in Model 2 was greater than that of the marginal effect of β_1 in Model 1. However, the results of the test for whether the difference between these two values was significant (the result of the chi2 test in Table 7), show that there was no statistically significant difference. It is therefore clear that (2) no difference in preferences regarding education occurred between households in which the elderly do not live with children and single-person households in which the elderly live alone.

6. Conclusion

Today, in Japan, where population ageing is the fastest among those of the seven major

countries, it is important to understand what kind of preferences the elderly hold regarding educational services. There is also a high level of interest concerning what kind of effect population ageing will have on education costs in other developed nations when those societies begin to experience the same kind of population ageing currently occurring in Japan. In this setting, as Poterba (1997, 1998) points out, it is difficult to come to a theoretically clear conclusion concerning the relationship between the costs of compulsory education and the ageing of society. This relationship therefore represents a subject for empirical study.

This study began by investigating, based on the works of Epple et al. (2012), Poterba (1998), and Ohtake and Sano (2009), whether differences in preferences concerning education occur between elderly people who live with children and elderly people who do not. The results of the study make it clear that elderly people who live with children are more likely to cite education as a reason for choosing an area of residence. As Epple et al. (2012) pointed out, in comparison to young people who have children who attend school, there is a weaker incentive for elderly people who do not live with children to support investments in public education services. The analysis results of this study also show that it is possible, as inferred by Poterba (1998) and Ohtake and Sano (2009), that as elderly people stop living together with their families, they may stop supporting education.

Furthermore, based on the works of Hilber and Mayer (2009) and Poterba (1997, 1998), an investigation was conducted on whether a difference in preferences regarding education occurs between elderly households that do not live with children but that hold considerable real estate assets and households that do not hold such assets. The results make it clear that, even for elderly households that do not live with children, households that have considerable real estate assets are more likely to cite education as a reason for choosing an area of residence. The results of the analysis in this study show that this result may be because, as pointed out by Poterba (1997, 1998) and Hilber and Mayer (2009), even for residents who do not live with children, having considerable real estate assets makes it possible to obtain indirect benefits from investments in local education, and therefore makes residents more likely to support education.

Finally, although the findings of this study made it clear that preferences regarding education differ depending on whether elderly people live with their own children, who are of a younger generation, it is highly possible that the children described here have already received education. Therefore, it is also highly possible that a more direct analysis could be performed concerning whether such elderly people have grandchildren who attend public school. This subject remains to be addressed.

However, the results of the analysis performed here show that intergenerational exchange is easier for elderly people who live with their children, and that it is possible that the elderly may support local education based on such an exchange. That is, living with younger generations makes a definite contribution to intergenerational altruism.

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Appendix: Questionnaire Items Used

Q1 What is your gender?

1. Male 2. Female

Q4 What year were you and your spouse born? Please circle the era and record your birth year.

You 1. Showa 2. Heisei Year: Your Spouse 1. Taisho 2. Showa 3. Heisei Year:

Q6 Please indicate the last school you and your spouse graduated from. For those currently enrolled in school, please use the school you are currently attending. Choose 1 answer that fits best and record the number below.

You Your Spouse

1. Graduated elementary and middle school (Including primary school and higher-level elementary school)
2. Dropped out of high school (Including middle school under the old system, girl's school, vocational school, and normal school)
3. Graduated high school (Including middle school under the old system, girl's school, vocational school, and normal school) (Including those who expect to graduate)
4. Dropped out of junior college (Including technical college)
5. Graduated junior college (Including technical college) (Including those who expect to graduate)
6. Dropped out of university (Including high school and technical college under the old system)
7. Graduated from university (Including high school and technical college under the old system) (Including those who expect to graduate)
8. Dropped out of a master's course at graduate school
9. Finished a master's course at graduate school (Including those who expect to finish)
10. Dropped out of a doctoral program at graduate school
11. Finished a doctoral program at graduate school (Including those who expect to finish)

Q14 Regarding the structure of the family you are currently living with, which of the following applies? Choose 1 answer that fits best by circling the appropriate number.

1. A single person
2. Only a couple
3. A couple and child(ren)
4. A single parent and child(ren)
5. A couple, child(ren), and parent(s) of the couple
6. A couple, child(ren), parent(s) of the couple, and sibling(s) of the couple
7. Other, specifically ( )

Q23 If you could move to another prefecture in Japan, would you like to do so? If you wish to move, please circle 1 and list the prefecture you wish to move to. If you would like to continue living in your current prefecture, please circle 2, 'I would like to stay', and record the prefecture where you currently live.

1. I would like to move to ( )
2. I would like to stay in ( )

Q24 Why would you like to live in the prefecture recorded above? Please circle four important reasons from the ones listed below. Please rank the four reasons you select from the most important to the least by recording a number from 1 to 4 in the brackets.

1. ( ) To obtain a higher income than I currently have
2. ( ) A good cultural environment
3. ( ) A good educational environment
4. ( ) A good environment for raising children
5. ( ) A good climate and natural environment
6. ( ) It is possible to find a job I am suited for
7. ( ) I can live with my family
8. ( ) This is where I grew up
9. ( ) It would be expensive to move to another prefecture
10. ( ) Local taxes are low
11. ( ) The welfare system is robust
12. ( ) There are many hospitals or medical institutions
13. ( ) The area is convenient because of the availability of supermarkets and department stores
14. ( ) Prices are low
15. ( ) Transportation is convenient
16. ( ) It is easy to find a job
17. ( ) Other, specifically ( )

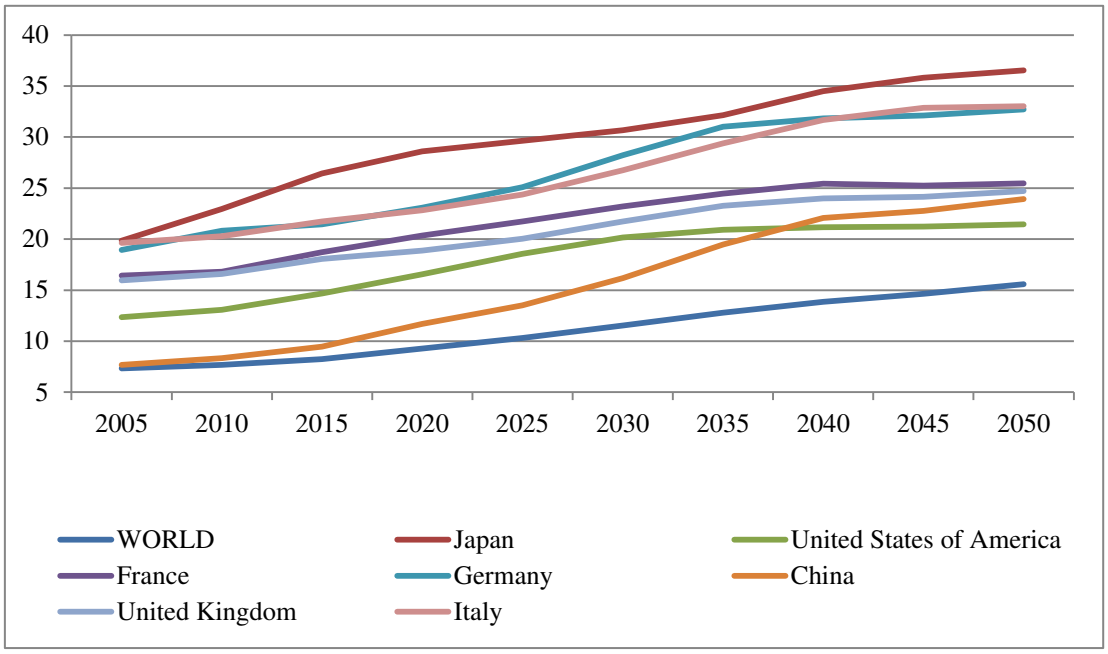
Q29 What was the **total annual pre-tax income for your entire household in 2009**, including bonuses? (For students, please use the figures for your parents' household.) Please select **1 option** from those listed below and circle the number beside it.

1. 1 million yen or less
2. 1 to less than 2 million yen
3. 2 to less than 4 million yen
4. 4 to less than 6 million yen
5. 6 to less than 8 million yen
6. 8 to less than 10 million yen
7. 10 to less than 12 million yen
8. 12 to less than 14 million yen
9. 14 to less than 16 million yen
10. 16 to less than 18 million yen
11. 18 to less than 20 million yen
12. More than 20 million yen

Q34 What is the current assessed value of **the residential and land assets owned by your entire household?** (For students, please answer using the residential and land assets of your parents' household.) Please select the **1 option** that fits best and circle the number beside it.

1. No such assets
2. Less than 5 million yen
3. 5 to less than 10 million yen
4. 10 to less than 15 million yen
5. 15 to less than 20 million yen
6. 20 to less than 30 million yen
7. 30 to less than 40 million yen
8. 40 to less than 50 million yen
9. 50 million to less than 100 million yen
10. More than 100 million yen

Fig. 1　Changes in the Percentage of Those Who Are 65 Years of Age or Older (For Seven Major Countries)



Sources: United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision (after 2015, Using Medium Fertility).

Table 1　Ratio of Those Who Wish to Move to Those Who Wish to Stay Among the Elderly

	Number of responses	Percentage
Wish to move	100	5.7
Wish to stay	1,617	92.24
No response	36	2.05
Total	1,753	100

Source: Produced by the author from the 2009 and 2010 'Preferences Parameters Study'.

Table 2　Percentage of Elderly (Who Wish to Stay) Who Cite Education as the Reason for Choosing Their Area of Residence

Respondents who cited education as a reason for choosing their area of residence (wish to stay)		Number of Responses	Percentage
Responses	Unselected	1,445	89.36
	Selected	74	4.58
Non-responses		98	6.06
Total		1,617	100

Source: Produced by the author from the 2009 and 2010 'Preferences Parameters Study'.

Table 3 Other Selections Made by Respondents Who Chose 'Education', 'Culture', and 'Child Raising' (Multiple Choices Are Possible)

(Multiple choices are possible)	Respondents who chose 'a good educational environment'		Respondents who chose 'a good cultural environment'		Respondents who chose 'a good environment for raising children'	
Choice	Number of respondents	Mean difference test	Number of respondents	Mean difference test	Number of respondents	Mean difference test
To obtain a higher income than I currently have	1	**Higher for the education group**	0	×	0	×
A good cultural environment	13	**Higher for the education group**	\	\	0	Lower for the child raising group
A good educational environment	\	\	13	**Higher for the culture group**	4	**Higher for the child raising group**
A good environment for raising children	4	**Higher for the education group**	0	Lower for the culture group	\	\
A good climate and natural environment	47	×	75	Lower for the culture group	18	×
It is possible to find a job I like	7	Lower for the education group	15	Lower for the culture group	6	×
I can live with my family	31	×	37	Lower for the culture group	11	×
This is where I grew up	29	Lower for the education group	48	Lower for the culture group	11	Lower for the child raising group
It would be expensive to move to another prefecture	9	Lower for the education group	17	Lower for the culture group	3	Lower for the child raising group
Local taxes are low	1	×	2	×	2	**Higher for the child raising group**
The welfare system is robust	5	×	6	×	2	×
There are many hospitals or medical institutions	23	×	65	**Higher for the culture group**	8	×
The area is convenient because of the availability of supermarkets and department stores	23	Lower for the education group	79	**Higher for the culture group**	3	Lower for the child raising group
Prices are low	3	Lower for the education group	5	Lower for the culture group	4	×
Transportation is convenient	25	Lower for the education group	88	**Higher for the culture group**	9	×
It is easy to find a job	1	×	1	×	0	×
Other	0	Lower for the education group	9	Lower for the culture group	0	Lower for the child raising group
Total	222		460		81	

Note: The mean difference test indicates the results of determining whether a mean difference occurred between the groups of respondents that chose an option and those that did not at a level of significance of 10%.

Source: Produced by the author from the 2009 and 2010 'Preferences Parameters Study'.

Table 4 Descriptive Statistics

Variable	Average	Standard deviation	Minimum	Maximum
Chose education dummy	0.049	0.216	0	1
Chose culture dummy	0.110	0.313	0	1
Lives w/ children dummy	0.659	0.474	0	1
Single-person household	0.086	0.281	0	1
Single-person household × Household real estate assets	0.326	1.269	0	10
Age	68.349	2.673	65	76
Female dummy	0.480	0.500	0	1
Household income	3.788	1.667	1	12
Household real estate assets	5.040	2.386	1	10
Academic background	3.261	1.907	1	9

Table 5 Estimation Results (Models 1 and Model 2)

	Explanatory variable	Model 1	Model 2
educ	Lives w/ children dummy	-0.229 *	
		(0.136)	
	Single-person household dummy		-0.656 *
			(0.394)
	Age	0.044 *	0.0412 *
		(0.0227)	(0.0226)
	Female dummy	0.194	0.205
		(0.134)	(0.137)
	Household income	0.0167	0.0195
		(0.0366)	(0.0354)
	Household real estate assets	0.0659 **	0.0628 **
		(0.0294)	(0.0299)
	Academic background	-0.0254	-0.0275
		(0.0371)	(0.0369)
	Constant term	-4.968 ***	-4.875 ***
		(1.578)	(1.569)
culture	Lives w/ children dummy	0.0830	
		(0.114)	
	Single-person household dummy		0.218
			(0.172)
	Age	0.0132	0.0140
		(0.0179)	(0.0178)
	Female dummy	0.138	0.122
		(0.106)	(0.107)
	Household income	-0.0140	-0.0116
		(0.0367)	(0.0349)
	Household real estate assets	0.0426 *	0.0454 *
		(0.0248)	(0.0249)
	Academic background	0.118 ***	0.118 ***
		(0.0270)	(0.0267)
	Constant term	-2.84 **	-2.875 **
		(1.254)	(1.258)

Number of observed values	1,138		1,138	
rho	0.259	**	0.256	**
Log-likelihood	-591.30		-590.15	
chi2_c	6.73	***	6.63	**

Note: The lower row shows the robust standard error. ***, **, and * show a 1%, 5%, and 10% statistical significance, respectively. Rho shows the estimated value of ρ, which is the covariance of the error terms of the two equations.

Table 6　Estimation Results (Model 3)

	Explanatory variable	Model 3	
educ	Single-person household dummy	-1.584	***
		(0.335)	
	Single-person household dummy × Household real estate assets	0.164	**
		(0.0638)	
	Age	0.0412	*
		(0.0226)	
	Female dummy	0.204	
		(0.137)	
	Household income	0.0194	
		(0.0354)	
	Household real estate assets	0.0573	*
		(0.0306)	
	Academic background	-0.0270	
		(0.0370)	
	Constant term	-4.843	***
		(1.571)	
culture	Single-person household dummy	-0.214	
		(0.352)	
	Single-person household dummy × Household real estate assets	0.0989	
		(0.0692)	
	Age	0.0143	
		(0.0179)	
	Female dummy	0.119	
		(0.108)	
	Household income	-0.0103	
		(0.0350)	
	Household real estate assets	0.0343	
		(0.0261)	
	Academic background	0.121	***
		(0.0268)	
	Constant term	-2.853	**
		(1.258)	

Number of observed values	1,138	
rho	0.255	**
Log-likelihood	-588.70095	
chi2_c	6.56	**

Note: The lower row shows the robust standard error. ***, **, and * show a 1%, 5%, and 10% statistical significance, respectively. Rho shows the estimated value of ρ, which is the covariance of the error terms of the two equations.

Table 7　Estimation Results (Marginal Effect When y = Pr(choice_educ = 1, choice_culture = 0))

Explanatory variable	Model 1	Model 2
Lives w/ children dummy	-0.0194 *	
	(0.0109)	
Single-person household dummy		-0.0552 *
		(0.0319)
Age	0.00329 *	0.00306 *
	(0.00184)	(0.00183)
Female dummy	0.0133	0.0144
	(0.0106)	(0.0108)
Household income	0.00152	0.00172
	(0.00291)	(0.00284)
Household real estate assets	0.00458 *	0.0043 *
	(0.00234)	(0.00238)
Academic background	-0.00377	-0.00392
	(0.00299)	(0.00297)
chi2	1.26	

Note: The lower row shows the standard error using the delta method. ***, **, and * show the levels of statistical significance of 1%, 5%, and 10%, respectively. chi2 shows the results of testing whether the marginal effects for the dummy for living with children dummy in Model 1 and the dummy for a single-person household in Model 2 are equal.

Table 8　Estimation Results (Marginal Effect When y = Pr(choice_educ = 1, choice_culture = 0))

Explanatory variable	Model 3
Single-person household dummy	-0.122 ***
	(0.0312)
Single-person household dummy × Household real estate assets	0.0115 **
	(0.00539)
Age	0.00304 *
	(0.00183)
Female dummy	0.0144
	(0.0108)
Household income	0.00169
	(0.00283)
Household real estate assets	0.00402 *
	(0.00243)
Academic background	-0.00392
	(0.00298)

Note: The lower row shows the standard error using the delta method. ***, **, and * show the levels of statistical significance of 1%, 5%, and 10%, respectively.