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The Effects of Providing Informal Care on Labor Force Participation, Subjective Health, and Life Satisfaction among Middle-aged Family Members*

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Abstract

In Japan, providing care to frail elderly people is still a primary role of family members. What is of primary concern is whether such a role prevents family members from working outside the home. Based on longitudinal data on Japanese middle-aged men and women, this study investigates whether they become less likely to have a job and whether their sense of well-being decreases when they have a family member who needs care. We find a consistent negative impact of having a family member who needs care on labor force participation for both men and women, but no impact on their subjective health and life satisfaction. Further, differences-in-differences (DID) estimation shows that the introduction of Long-Term Care Insurance did not mitigate the adverse impact on labor force participation. This result remains unchanged when the estimation is based on the sample in which the control and treatment groups are matched using the propensity score matching method.

Keywords: informal care, subjective health, life satisfaction, Long-Term Care Insurance

JEL classifications: J21, J22, J01

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1. Introduction

Japan is undergoing unprecedentedly rapid population aging. With this pace of population aging, a dramatic increase is expected in the number of elderly people who need care in the near future. Although there are numerous nursing care services provided by the public and private sectors in Japan, family members continue to be primary caregivers. In particular, in Japan, caregiving to frail elderly family members is often considered to be the responsibility of women. In fact, according to the 2010 Comprehensive Survey of People's Living Conditions (*Kokumin Seikatsu Kiso Chosa*), approximately 70% of co-resident caregivers are women. In such a social atmosphere, a long-standing concern of the Japanese government is that this caregiving responsibility may affect employment and, consequently, reduce the labor force participation rate at the national level, in addition to a shrinking working-age population.

One of the initial objectives of Long-Term Care Insurance (hereafter LTCI) introduced in 2000 was "to socialize care," that is, to shift the burden of caregiving from family to society (Campbell and Ikegami, 2000). In fact, LTCI provides only in-kind benefits (nursing care services) and not cash benefits, as the latter may be thought of as encouraging caregiving by a family member. Further, LTCI also promoted the entry of new service providers, thereby increasing the number of recipients of such services by 130% during the first decade. However, it is still unclear whether an individual *actually* becomes less likely to have a job when he/she has a family member who needs care and whether the introduction of LTCI alleviated the burden of caregiving on family members.

An impediment to measuring the impact of having a family member who needs care is the endogeneity problem that is inherent in caregiving. For example, if a family member who has the tendency of not being able to stay in a job is simultaneously more likely to take on the burden of care, it does not make much sense just to compare a caregiver's probability of working with that of a noncaregiver for assessing the causal relationship between caregiving and labor force participation. An estimation based on panel data would probably mitigate this problem by eliminating such unobservable confounding factors.

Another aspect that complicates the analysis is the timing of the incidence of need for caregiving. One usually does not have a family member, usually a parent, who is in need of care until he/she reaches middle age, which is a time when many individuals begin thinking about their own retirement. According to the Employment Status Survey (*Shugyo Kozo Kihon Chosa*), among those who left their previous job within the past year, only 1.5% of men and 4.8% of women cite "caring for an aged or sick family member" as a reason for quitting their previous job. However, among those aged between 50 and 59, the percentages are approximately 4% for men and 15% for women, respectively, which are much higher than the percentages for other ages. Since factors affecting the decision on whether to work when nearing retirement age is believed to be completely different from such decision-making at other ages, analysis should focus on this concentrated age structure of those who face the need to provide care to a family member. In addition to focusing on ages at which people face the need to provide care, data for the periods both

before and after the year 2000 is required to evaluate the effect of the introduction of LTCI.

In this study, we investigate whether those individuals who have a family member in need of care are less likely to have a job on the basis of a unique Japanese panel survey on middle-aged men and women, which includes periods before and after the introduction of LTCI. Actually, we depend on a variable that indicates whether he/she is *living with* a family member who needs care, instead of a variable indicating whether he/she is a caregiver. Hence, irrespective of whether the person is the *main* caregiver, we examine the effect of the incidence of need for care in the family on the respondent's working decision. We also measure the impact of having a family member who needs care on the respondent's subjective health and life satisfaction. To the best of our knowledge, no previous analysis has measured the effect of LTCI of Japan on labor force participation and well-being of those who have a person who needs care in the family, based on a longitudinal survey, except Sakai and Sato (2007) and Shimizutani et al. (2008). Our analysis utilizes the data set that encompasses the longest period before and after the introduction of LTCI among the studies mentioned above.

The results of our analysis reveal that both husbands and wives that have a family member who needs care are less likely by 7%–10% to participate in the labor force. However, we also find that if a husband has a family member who needs care, there is no reduction in his working hours. Thus, in responding to the incidence of need for care, the extensive margin of labor supply plays a larger role than the intensive margin. There is no difference in the subjective health and life satisfaction between those who have a family

member who needs care and those who do not. Moreover, the difference-in-difference (hereafter DID) estimation, based on both unmatched and matched data, reveals no impact of the introduction of LTCI on the relationship among the burden of care, labor force participation, subjective health, and life satisfaction.

The remainder of this paper is organized in the following manner. In Section 2, we discuss previous studies that analyze the effect of caregiving by a family member on various outcomes. In Section 3, we describe LTCI in Japan. In Section 4, we present the estimation strategy; in Section 5, we describe our data set; and in Section 6, we present the results from estimation. In Section 7, we discuss the robustness of our results. In Section 8, we present a few concluding remarks.

2. Previous Literature

Theory does not predict *a priori* that those who have a family member in need of care are less likely to have a job. For example, some people may become more eager to work to earn more money to cover the cost associated with care when they have a person who needs care in their family. However, almost all previous research has attempted to ascertain the negative, instead of the *positive*, effect of caregiving on labor force participation, assuming the substitution effect. Most existing studies examine whether the independent variable that indicates whether an individual who is *caring* for a family member is negatively associated with the dependent variable of labor force participation. However, whether the individual is a caregiver for a family member is a consequence of self-selection and, thus,

possibly endogenous. For example, one may be willing to care for a family member because he/she does not have a job. Further, an unobservable omitted factor, such as willingness to work, may affect both the decision to work and taking the responsibility of caregiving. These aspects cause a bias in the coefficient if it is estimated using OLS, thereby making it difficult to identify the genuine effect of caregiving.

In order to avoid (or at least mitigate) such a bias, recent studies depend more on non-OLS and panel data; consequently, they have found that the relationship between caring and labor force participation is tenuous. Wolf and Soldo (1994), who estimate simultaneous equations for the decisions of caregiving and working, find little impact of caregiving on labor force participation. Leigh (2010) uses Australian panel data for the period between 2001 and 2007 and finds that the impact of caregiving on labor force participation is much smaller in the panel than in the cross-section. Further, Heitmueller (2007) and Ciani (2012) depend on both the instrumental variable (IV) method and panel data. The former study is on men and women in England, while the latter study is on middle-aged men and women in 13 European countries; both studies reveal a minor impact of caregiving. Michaud et al. (2010) find a negative, but small, effect of co-residential caregiving on future employment based on a dynamic analysis using British Household Panel Survey (BHPS).

While recent studies find only a tenuous relationship between caregiving and labor force participation in many countries, studies based on Japanese data have repeatedly found a large negative impact of caregiving on labor force participation,

although some of these studies do not provide an efficient solution to the problem of endogeneity that is inherent in the caregiving variable (Iwamoto, 2001; Nishimoto and Shichijo, 2004; Ohtsu and Komamura, 2012). Given that caregiving has a significant negative impact on labor force participation, the next question is whether the introduction of LTCI has mitigated the impact, that is, alleviated the burden on caregivers. Based on a longitudinal survey on Japanese middle-aged persons, Sakai and Sato (2007) find that both men and women are less likely to have a job if they have a family member who needs care; this adverse effect was not mitigated even after the introduction of LTCI. On the contrary, based on a unique panel data set, Shimizutani et al. (2008) find a large positive effect of the introduction of LTCI on labor force participation of female caregivers. Based on the Comprehensive Survey of People's Living Conditions, Tamiya et al. (2011) find that the introduction of LTCI increased the working hours of family caregivers for the high-income group, but had no effect for the lower-income and middle-income groups. The DID estimation method is employed in all the studies mentioned above.

Several studies investigate the relationship between burden of nursing care and subjective well-being. Similar to findings on labor force participation, a recent study—based on a non-OLS method—finds no evidence that caregivers are less likely to have a feeling of well-being (Leigh, 2010). Further, Tamiya et al. (2011) report no favorable evidence of the introduction of LTCI on the subjective health of caregivers.

Our study basically replicates the study by Sakai and Sato (2007), but differs in terms of the following aspects: 1) Our data set includes one more year for the period after

the introduction of LTCI to consider the possibility that the effect of LTCI may take several years to manifest, 2) we match both groups on the basis of the propensity score before conducting the DID estimation to obtain a matched sample of respondents with similar attributes from the treatment (having a family member who needs care) and control (not having such a family member) groups, 3) we investigate the impact of caregiving on the subjective health and life satisfaction of the caregiver, and 4) we present a more careful consideration of the endogeneity problem that is inherent in Sakai and Sato (2007).

3. Long-Term Care Insurance in Japan

In response to the rapid increase in care needs in Japan, mandatory public LTCI was introduced in 2000. Although nursing homes and home caregivers were publicly subsidized even before the introduction of LTCI, long-term care service providers were limited to nonprofit organizations, and municipalities allocated resources to persons who needed care, which created a noncompetitive inefficient market of long-term care. Hence, the newly introduced LTCI aimed to increase the number of long-term care providers by allowing entry of profit-making companies and replacing the municipalities' allocation with contract-based services. Needless to say, the motivations behind these new approaches are to alleviate the burden of caregiving on family members by utilizing market mechanism. Indeed, the number of home caregivers doubled in the first five years of LTCI.

The insurance agents for LTCI are municipalities and not divided by employment status, unlike other social insurance providers in Japan. Insured persons who need care must be qualified as a Person Requiring Long-Term Care and ranked by Condition of Need for Long-Term Care to receive Long-Term Care benefit. An insured person's copayment rate is basically 10%.

4. Estimation Strategy

To measure the impact of incidence of care needs in the family on various outcomes, we estimate the following equation:

$$y_{i,t} = \alpha + \beta D_i + \varphi X_{i,t} + v_i + \varepsilon_{i,t}, \quad (1)$$

where the subscript *i* and *t* indicate the index for individuals and years, respectively. *y* takes various outcome measures: labor force participation; working hours; subjective health; and satisfaction with own health, leisure, and life in general[1]. *D* is equal to 1 if a person who needs care is living in the same household, and 0 otherwise. *X* is a vector of individual attributes and includes age, an experience of compulsory retirement (*Teinen Taishoku*), etc. *v* is an individual time-invariant term and ε is the error term.

To investigate whether the introduction of LTCI caused any changes to the relationship between caregiving and the outcomes, we employed the DID estimation, which is specified in the following manner:

$$y_{i,t} = \alpha + \beta D_i + \gamma After + \delta D_i * After + \varphi X_{i,t} + v_i + \varepsilon_{i,t}, \quad (2)$$

[1] Since all outcomes are discrete variables, we adopted logistic regression models.

where *After* is equal to 1 if it is in the year after the introduction of LTCI, and 0 otherwise. If LTCI has mitigated the adverse impact of caregiving on the outcome measures, δ is expected to take significantly positive values. For a more careful correction of the selection bias, Heckman et al. (1997, 1998) propose that the propensity score matching method should be combined with the DID estimation (DID propensity score matching, hereafter DID-PSM). Therefore, in addition to the simple DID estimation above, we matched samples of treated individuals with untreated ones, which we obtained by nearest-neighbor matching based on the propensity score before estimating equation (2)[2]. The treatment group comprises those who had a family member who needed care in any year, and the control group comprises those who did not have such a family member. By using the matched sample, both groups are more likely to comprise those who have very similar attributes[3].

5. Data

The data for our analysis was taken from the Panel Survey on Middle-Aged Persons, which was conducted every two years by the NLI Research Institute between 1997 and 2005. The respondents of the survey are 1502 men living in Japan aged between 50 and 64 in the initial year of the survey. The survey includes questions on the respondent's job, family, health, etc.; the wives of the respondents are also asked many of the same

[2] A similar estimation technique is employed by Stenberg et al. (2012).

[3] Ideally, the treatment group should comprise only those individuals who have a person who needs care in their family both before and after intervention (i.e., the introduction of LTCI). However, the small size of our sample does not permit such an allocation to the treatment group.

questions. It must be noted that respondents were randomly selected from the national population.

The outcomes we examine in our analysis are constructed from questions that ask 1) whether the respondent is usually engaged in work for pay or profit, 2) how many hours the respondent worked in the previous month, 3) the extent to which the respondent is healthy (subjective health), and 4) the extent to which the respondent is satisfied with his/her own health, leisure time, and own life in general. Only the respondent is asked questions on working hours and satisfaction in terms of various aspects, not his wife. In the questionnaire, subjective health is assessed on four levels; we construct a variable that takes the value 1 if the top two levels are circled, and 0 otherwise. On the other hand, satisfaction is assessed on five levels, and the top two levels are combined as 1 and the other three as 0.

The key independent variable that we are most interested in is whether there is a person who needs care among family members who the respondent is living with. In this survey, a person who is currently receiving care in a nursing home or a hospital is also classified as the co-resident family member in need of care, if the respondent considers him/her to be a family member who the respondent is living with[4]. One of the weaknesses of our data set is that "a person who needs care" is not defined by an objective criterion. To ascertain the effect of LTCI, a "person who needs care" in this

[4] Indeed, among the respondents defined here as those having a person who needs care in family, approximately 36% of them are those whose family member in need of care are receiving care in a hospital or a nursing home.

survey must be equal (or at least close) to a person who needs care as certified by LTCI, that is, a person who is issued a Certification of Needed Long-Term Care. However, during the period before the introduction of LTCI, such an objective criterion was not available. Thus, there was no choice but to depend on the respondent's subjective answer to whether a family member needs care. We will compare our results with the results from other studies that depend on objective criteria of care needs. Another weakness of our data set, though minor, is that the survey lacks a question on the duration of time spent on caring for a frail elderly family member. Yamada et al. (2013) report that hours spent on caring for the respondent's family member per week vary considerably between the care receiver's rank of Condition of Need for Long-Term Care: from 10 hours for the lowest level of care need to 50 hours for the highest level. In future research, the hours spent on care must also be examined as the actual burden of care.

As independent variables, the estimation equation includes variables on age, education, total of the respondent's and his wife's property revenue, and whether the respondent has undergone compulsory retirement. As a proxy for offered wage, we also included the imputed wage rate for the respondent and his wife as independent variables. In the estimation of the imputed wage rate, since we do not have information on working hours for wives, we imported aggregated data on working hours[5] from the Basic Wage Structure (*Chingin Kozo Kihon Tokei Chosa*) to calculate the actual wage rate, and employed the Heckman two-step estimator to avoid selection bias (the exact method used to

[5] For consistency, we import information on working hours for *both men and women*.

estimate the imputed wage rate is available on request). Further, we also included subjective health as an *independent variable* in the estimations of labor force participation and life satisfaction[6]. The descriptive statistics of our data set are presented in Table 1. Further, the number of those who have a person who needs care in the family in each year is presented in Table 2, and the number of survey years for which there is a person who needs care in the respondent's household is presented in Table 3.

6. Results

The labor force participation rates for those who have a person who needs care in the family and those who *do not* have such a person in the family are presented in Table 4. In each year, both the probability of having a job and the probability of being employed for husbands and wives who have a person who needs care in the family are lower than those of husbands and wives who do not have such a person in the family, with a few exceptions.

Our most basic results are presented in Table 5. These results are all based on the nonmatched sample. We find that having a person who needs care in the same household reduces the probability of labor force participation for both men and women, irrespective of which model is employed (Columns (1)–(4) in Tables 5-a and 5-b). This implies that the

[6] Endogeneity inherent to subjective health is a concern, and several studies have addressed this aspect. For example, Hamaaki and Noguchi (2010) analyze the impact of a middle-aged person's health on his/her labor force participation by using BMI and his/her parents' anamnesis as instrumental variables. However, in our dataset, there are no such instrumental variables. Hence, we treat subjective health as an exogenous factor, although our panel data would mitigate bias caused by unobservable heterogeneity.

adverse relationship between caregiving and labor force participation that we have observed, based on cross-sectional data, does not necessarily come from individual-specific time-invariant factors. To assess the marginal effects of incidence of care need in family, we also estimated the linear probability model (LPM). The results of the fixed-effect LPM estimation show that those with a family member who needs care are less likely by 7% for men and 10% for women to have a job, as compared to 9% for men and 6% for women based on pooled LPM. Analyzing the impact of care needs in the family on married women's labor force participation based on panel data for the period after the introduction of LTCI, Komamura and Ohtsu (2012) report that women who have a frail parent who is certified as being in the Needed Care Condition 1-2 (*Yokaigo-do* 1 or 2) are less likely by 20%–30% to have a job. Thus, our results are much smaller in absolute values; this implies that our data set includes less frail persons in those who need care.

With age, the likelihood of having a job reduces for both men and women. While imputed wage rates have no significant effect on labor force participation, the total property revenue of the husband and wife has a consistent negative impact on labor force participation for both men and women. Further, those who have undergone compulsory retirement are less likely to have a job.

A statistically significant independent variable is subjective health. Coefficients of subjective health consistently take positive values, which implies that those who feel healthier are more likely to have a job than those who do not.

In Columns (5) and (6) of both Tables 5-a and 5-b, the variable indicating the

post-LTCI period and the interaction term of the post-LTCI period with those having a person who needs care in the family are included as independent variables. However, the coefficient of the interaction term does not take any significant values, which implies that the introduction of LTCI does not appear to have caused any changes in the relationship between caregiving and labor force participation.

In Columns (7)–(10) of Tables 5-a and 5-b, we see whether the above results differ according to education. For both men and women, those with relatively low education are less likely to have a job when they have a person who needs care in the same household than those with relatively high education.

The results of effects on working hours for husbands are presented in Table 6. In contrast to the results of the discrete choice of labor force participation, the variable for having a person needing care does not have any effects on the working hours in the fixed-effect model. Therefore, a husband's decision regarding whether to work is affected by the fact that he has a person who needs care in family, but his decision on how many hours he works for is not. This is consistent with the result obtained in Komamura and Ohtsu (2012).

In Japan, men who have worked as full-time regular workers often work for shorter hours on fixed-term contracts after attaining the compulsory retirement age. Therefore, we also included the interaction of "having a person who needs care" and "experience of compulsory retirement" as an independent variable (Columns (5)–(8) in Table 5). However, the interaction term shows no significant sign, thereby implying that

the decision of labor force participation *never* becomes more (or less) responsive to incidence of care needs even after compulsory retirement.

In Table 7, the dependent variables are subjective health (own-rated health) for both men and women, and satisfaction with own health, leisure time, and life in general only for men. We find that if man has a person who needs care in the family, he feels neither less healthy nor less satisfied with his own health, leisure time, and life in general. Further, a woman does not feel worse when she has a person who needs care in the family. Of course, we do not find any positive effects of the introduction of LTCI on the well-being of individuals. In fact, we find a worsening of the subjective health of a man who has a person who needs care after the introduction of LTCI. The exact reason for this remains unexplained. However, at least, it is evident that it is not due to the aging effect, as including the age variable in any form (continuous or discrete) does not change the finding that the treatment group experienced a decline in health. With respect to other control variables, we do not find any clear relationships with the dependent variables.

When using a dummy variable indicating whether the respondent is *actually* living with a person who needs care, in which a person receiving care in a hospital or nursing home is not regarded as a co-resident family member, we find no change to the above results.

The results discussed thus far are based on an unmatched sample. To check the robustness of the findings that LTCI has no impact, we re-estimate the same regressions based on the sample with the treatment and control groups being matched by propensity

scores. By using the matched sample, we can eliminate noise from those in the control group who have rather different attributes from those in the treatment group, although it reduces the size of sample. Table 8 presents the descriptive statistics of the matched sample[7]. We find that in the matched sample, both the treatment and control groups have similar attributes as compared to the unmatched sample presented in Table 1[8]. However, matching the treatment group with the control group makes no difference, with very few exceptions (Table 9). We find a significant negative effect of incidence of person in need of care on labor force participation, but no improvement with the introduction of LTCI. Although these results are not shown in the tables, we also find that the result of estimations in which dependent variables are working hours and various aspects of well-being is not much different from the result based on the unmatched sample.

7. Discussion

7-1. Choice of co-residence

In Japan, sons and daughters often begin living with their elderly parents after the parents have become frail and unable to care for themselves. Indeed, in our data set, one-fourth of those who first had a person in need of care in a co-resident family *had not lived with* that family member in the previous survey. In other words, they have a person who needs care

[7] In calculating propensity scores, the dummy variable that indicates whether the respondent is included in the treatment group is regressed on variables of size of city and regional dummies, as well as the same independent variables used in the estimation based on the unmatched sample. The result of the estimation for calculation using propensity scores is available on request.

[8] This matched sample passed the balancing test.

in a co-resident family not because a family member living with him/her accidentally became too frail to care for themselves, but because they chose to begin living with that family member. This implies that the variable indicating whether an individual is living with a family member who needs care is not exogenous. For example, those who had intended to quit their job early may tend to choose to live with a frail parent who was living apart earlier. Although this kind of endogeneity is not completely resolved in the framework of our analysis, to determine the extent to which our conclusions in the previous section are attenuated by choice of living together, we included a dummy variable in our regression to indicate *whether a person who needs care came to live with the respondent*. However, the coefficient of the dummy variable does not take a significant value (not shown in the tables), which implies that there is no difference in the decision to work between those who always lived with a frail family member and those who began living with a family member subsequently. In conclusion, our data set does include a small number of individuals who brought in a family member in need of care, but this does not affect our results.

7-2. Impact of being the main caregiver

The reason our analysis depends on the variable indicating whether there is a person who needs care in a co-resident family, rather than whether he/she is the main caregiver, is that we are interested in ascertaining whether the incidence of care needs in the family affects his/her labor participation and well-being *even if he/she is not the main caregiver*.

Indeed, in our data set, only 17% of husbands are "main caregivers" among households that have a family member in need of care. The incidence of care needs in a family may affect the husband's behavior directly or through a change in the wife's behavior. Our analysis merely measures the *average* effects of care needs in a family. In other words, we may have underestimated the effect of becoming the main caregiver. Therefore, we investigated the extent to which the average effects of the incidence of care needs measured in the above analysis are different from the effect in the case of the husband/wife becoming the main caregiver. However, since using a variable indicating whether he/she is the main caregiver as an independent variable may cause a self-selection bias, as we mentioned above, we conducted an IV estimation. According to the strategies of Heitmueller (2007) and Ciani (2012), we adopted a dummy variable indicating whether there is a person who needs care in a co-resident family *as an IV for being the main caregiver*. The results of the IV estimation are presented in Appendix Table 1, together with the results of the OLS estimation. With regard to the husband's labor force participation (Appendix Table 1-a), the impact of *being the main caregiver* is above 40% in any estimation model, which is much larger than the impact of the presence of a family member in need of care. With regard to husband's working hours (Appendix Table 1-b) and wife's subjective health (not shown in Appendix Table 1), the results are somewhat mixed, in which the coefficients of being the main caregiver are statistically significant in the case of the 2SLS and G2SLS models, whereas the level of significance declines in the case of fixed-effects IV model. The precise impact of being the main caregiver in the

family on an individual's well-being needs to be confirmed through further research.

8. Conclusion

Our estimates show that both men and women are less likely to participate in work when they have a person who needs care in the same household; however, men do so by quitting their jobs, not reducing their working hours. The DID estimates show that the adverse effect of having a person who needs care in the family on labor force participation was not mitigated even after LTCI was introduced in 2000. Moreover, the estimates do not reveal a significant relationship between the incidence of care needs in the family and the well-being of potential family caregivers. These findings are almost the same when the estimation is based on the sample in which the control and treatment groups are matched using the propensity score matching method.

The fact that there is no change in the results of Sakai and Sato (2007), despite the inclusion of an additional year for the period after the introduction of LTCI to the data set, implies either that the effect of LTCI takes more time to manifest or that LTCI does not have the capability of alleviating the burden of family caregivers at all. However, further investigation is required to ascertain the source of the difference in the results of the impact of LTCI between several existing studies and ours.

References

Campbell, J. C., & Ikegami, N. (2000) Long-Term Care Insurance Comes to Japan. *Health Affairs, 19,* 26-39

Ciani, E. (2012) Informal Adult Care and Caregivers' Employment in Europe. *Labour Economics, 19(2)*, 155-164.

Hamaaki, J., & Noguchi, H. (2010) Health Effects on Labor Participation by the Elderly. *(Chukoreisha no Kenko-jotai to Rodo-sanka) The Japanese Journal of Labour Studies (Nihon Rodo Kenkyu Zasshi)*. 601, 5-24 (in Japanese)

Heckman, J., Ichimura, H., & Todd, P. (1997) Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. *Review of Economic Studies, 64*, 605–654.

Heckman, J., Ichimura, H., & Todd, P. (1998) Matching as an Econometric Evaluation Estimator. *Review of Economic Studies, 65*, 261–294.

Heitmueller, A., (2007) The Chicken or the Egg? Endogeneity in Labor Market Participation of Informal Carers in England. *Journal of Health Economics*, 26(3), 536-59.

Iwamoto, Y. (2001) How Does the Provision of Home Care Affect the Labor Force Participation of Family Members? (*Youkaigosha no Hassei ni Tomonau Kazoku no Shuugyou Keitai no Henka*) In Iwamoto, Y. (Ed.) *Economics of Social Welfare and Family* (*Shakai Fukushi to Kazoku no Keizaigaku*). Tokyo: Toyo Keizai Inc. (in Japanese)

Leigh, A. (2010) Informal Care and Labor Market Participation. *Labour Economics, 17(1),* 140-149.

Michaud, P., Heitmueller, A. & Nazarov, Z. (2010) A Dynamic Analysis of Informal Care and Employment in England. *Labour Economics, 17(3),* 455-465.

Nishimoto, M. & Shichijo, T. (2004) How Does Living with and Caring for Parents Affect the Labor force Participation of their Married Daughters? (*Oya tono Doukyo to Kaigo ga Kikon Jyosei no Shugyo ni Oyobosu Eikyo*.) *Quarterly of Social Security Research (Kikan Shakai Hosho Kenkyu), 61,* 62-72 (in Japanese)

Ohtsu, Y. & Komamura, K. (2012) Care Burden and Labor Supply (*Kaigo no Futan to Shuugyou Koudou*). In Higuchi, Y. *et al*. (Eds.) *The Dynamism of parent-child Relationship and Household Expenditure* (*Oyako Kankei to Kakei Koudou no Dainamizumu*). Tokyo: Keio University Press Inc. (in Japanese)

Sakai, T. & Sato, K. (2007) Does Caring for Elderly Parents Affect Their Sons and Daughters' Decisions on Retirement?: An Analysis Using Japanese Panel Data (*Kaigo ga Koureisha no Shuugyou Taishoku Kettei ni Oyobosu Eikyo*). *JCER Economic Journal (Nihon Keizai Kenkyu), 56,* 1-25. (in Japanese)

Shimizutani, S., Suzuki, W., & Noguchi, H. (2008) The Socialization of At-Home Elderly Care and Female Labor Market Participation: Micro-level Evidence from Japan. *Japan and the World Economy, 20(1),* 82-96.

Stenberg, A., de Luna, X., & Westerlund, O. (2012) Can Adult Education Delay Retirement from the Labour Market? *Journal of Population Economics, 25(2),* 677-696.

Tamiya, N., Noguchi, H., Nishi, A., Reich, M. R., Ikegami, N., Hashimoto, H., Shibuya, K., Kawachi, I., & Campbell, J. C. (2011) Population Ageing and Wellbeing: Lessons

from Japan's Long-term Care Insurance Policy. *Lancet*, *378(9797)*, 1183-92.

Wolf, D. A. & Soldo, B. J. (1994). Married Women's Allocation of Time to Employment and Care of Elderly Parents. *Journal of Human Resources, 29(4)*, 1259-1276.

Yamada, A., Tanaka, K., & Ohtsu, Y. (2013). The Facts about Total Costs and Hours for Home Nursing Care (*Zaitaku Kaigo ni Kakaru Souhiyo Jikan no Jittai*). *Japanese Journal of Research on Household Economics (Kikan Kakei Keizai Kenkyu)*, *98*, 12-24 (in Japanese)

Table 1. Descriptive Statistics

Data set used in estimation of husband's labor force participation

		Obs.	Mean	Std. Dev.	Min	Max
Husband's work		3925	0.7248	0.4467	0	1
Husband's working hours		3595	105.0654	94.5203	0	420
Having a person who needs care in family		3925	0.0736	0.2612	0	1
Post-LTCI (year 2001-05)		3925	0.5302	0.4992	0	1
Having a person who needs care in family ×Post-LTCI (year 2001-05)		3925	0.0418	0.2001	0	1
Experienced compulsory retirement		3925	0.3585	0.4796	0	1
Pooled property revenue		3925	10.1034	53.6663	0	1000
Age		3925	61.2566	5.1325	50	72
Education	Jr. High	3925	0.2838	0.4509	0	1
	High school	3925	0.4418	0.4967	0	1
	Senmon / Jr.College	3925	0.0749	0.2633	0	1
	Undergrad / Grad	3925	0.1995	0.3997	0	1
Imputed wage (husband)		3925	-1.3187	0.2929	-1.9894	-0.7257
Imputed wage (wife)		3925	-1.8865	0.1258	-2.1685	-1.4512
Subjective health		3925	0.8341	0.3720	0	1

Data set used in estimation of wife's labor force participation

		Obs.	Mean	Std. Dev.	Min	Max
Wife's work		4275	0.4587	0.4984	0	1
Having a person who needs care in family		4275	0.0723	0.2590	0	1
Post-LTCI (year 2001-05)		4275	0.5008	0.5001	0	1
Having a person who needs care in family ×Post-LTCI (year 2001-05)		4275	0.0393	0.1943	0	1
Pooled property revenue		4275	11.4634	105.8825	0	6000
Age		4275	58.0807	5.6108	45	75
Education	Jr. High	4275	0.2669	0.4424	0	1
	High school	4275	0.5593	0.4965	0	1
	Senmon / Jr.College	4275	0.1273	0.3333	0	1
	Undergrad / Grad	4275	0.0465	0.2107	0	1
Imputed wage (husband)		4275	-1.3059	0.2964	-1.9894	-0.7257
Imputed wage (wife)		4275	-1.8844	0.1247	-2.1685	-1.4512
Subjective health		4275	0.8873	0.3163	0	1

Data set used in estimation of husband's wellbeing

		Obs.	Mean	Std. Dev.	Min	Max
Satisfied with own health (husband)		4182	0.6373	0.4808	0	1
Subjective health (husband)		4182	0.8405	0.3662	0	1
Satisfied with own life in general (husband)		4182	0.5956	0.4908	0	1
Satisfied with own leisure time		4182	0.5057	0.5000	0	1
Having a person who needs care in family		4182	0.0701	0.2553	0	1
Post-LTCI (year 2001-05)		4182	0.4955	0.5000	0	1
Having a person who needs care in family ×Post-LTCI (year 2001-05)		4182	0.0387	0.1930	0	1
Pooled property revenue		4182	11.4904	106.8328	0	6000
Age		4182	60.8331	5.2754	50	72
Education	Jr. High	4182	0.2767	0.4474	0	1
	High school	4182	0.4417	0.4966	0	1
	Senmon / Jr.College	4182	0.0758	0.2647	0	1
	Undergrad / Grad	4182	0.2059	0.4044	0	1

Data set used in estimation of wife's wellbeing

		Obs.	Mean	Std. Dev.	Min	Max
Subjective health (Wife)		4174	0.8881	0.3153	0	1
Having a person who needs care in family		4174	0.0702	0.2555	0	1
Post-LTCI (year 2001-05)		4174	0.4998	0.5001	0	1
Having a person who needs care in family ×Post-LTCI (2001-05)		4174	0.0386	0.1926	0	1
Pooled property revenue		4174	11.5144	106.9341	0	6000
Age		4174	58.0537	5.6474	45	75
Education	Jr. High	4174	0.2607	0.4390	0	1
	High school	4174	0.5630	0.4961	0	1
	Senmon / Jr.College	4174	0.1299	0.3362	0	1
	Undergrad / Grad	4174	0.0465	0.2105	0	1

Source: The Panel Survey on Middle-Aged Persons (The NLI Research Institute)

Table 2. The Number of Those who Have a Person who Needs Care in Family

	1997	1999	2001	2003	2005	Total
Having a person who needs care in family	85	64	61	55	59	324
(%)	6.15	6.66	7.26	7.23	8.48	6.98

Source: The Panel Survey on Middle-Aged Persons (The NLI Research Institute)

Table 3. The Number of Survey Years that Each Household Has a Person who Needs Care

	Freq.	Percent
1 years	134	64.11
2 years	42	20.1
3 years	18	8.61
4 years	12	5.74
5 years	3	4.31
Total	209	100.0

Source: The Panel Survey on Middle-Aged Persons (The NLI Research Institute)

Table 4. Intra-household Need in Care and Labor Force Participation Rate

			1997	1999	2001	2003	2005	Total
Percentage of people having a job	Husband (Respondent)	Having a person who needs care in family	76.2	61.9	61.7	63.6	62.7	66.0
		Not having a person who needs care in family	83.0	76.1	73.7	67.2	59.9	73.9
	Wife	Having a person who needs care in family	36.5	51.6	43.3	31.5	37.3	40.1
		Not having a person who needs care in family	50.5	48.5	48.3	40.1	37.8	46.1
Percentage of people being employed	Husband (Respondent)	Having a person who needs care in family	45.0	39.7	31.0	30.9	37.3	37.5
		Not having a person who needs care in family	57.4	48.0	43.3	38.3	31.3	45.8
	Wife	Having a person who needs care in family	21.7	28.1	20.3	16.7	27.1	22.9
		Not having a person who needs care in family	32.2	29.2	29.5	24.5	21.4	28.2

Source: The Panel Survey on Middle-Aged Persons (The NLI Research Institute)

Table 5-a. Effect of Incidence of Person who Needs Care in Family on Husband's Labor Force Participation

	Husband's work									
	All						Jr. High / High school		Senmon /Jr. Cllg / Undergrad / Grad	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	-0.586	-0.558	-1.065	-0.955	-1.2	-0.763	-0.883	-0.898	-1.055	0.146
	[0.158]***	[0.158]***	[0.286]***	[0.354]***	[0.406]***	[0.453]*	[0.394]**	[0.510]*	[0.856]	[1.172]
Post-LTCI (year 2001-05)					0.758	0.487		0.434		0.733
					[0.217]***	[0.313]		[0.355]		[0.697]
Having a person who needs care in family					0.2	-0.396		0.063		-3.219
×Post-LTCI (year 2001-05)					[0.506]	[0.591]		[0.653]		[2.003]
Age	-0.16	-0.168	-0.273	-0.32	-0.298	-0.3	-0.309	-0.293	-0.378	-0.357
	[0.010]***	[0.014]***	[0.034]***	[0.100]***	[0.036]***	[0.101]***	[0.113]***	[0.114]**	[0.219]*	[0.223]
Education High school	0.269									
	[0.100]***									
Senmon / Jr.College	0.245									
	[0.179]									
Undergrad / Grad	0.369									
	[0.130]***									
Imputed wage (husband)		-0.019	-0.077	-1.034	0.77	0.249	-0.774	0.432	-2.255	-0.959
		[0.210]	[0.513]	[1.476]	[0.566]	[1.696]	[1.671]	[1.935]	[3.193]	[3.686]
Imputed wage (wife)		0.359	-0.405	-1.869	0.384	-1.945	-2.975	-3.043	1.505	3.061
		[0.376]	[0.936]	[2.497]	[0.967]	[2.493]	[2.841]	[2.842]	[5.430]	[5.562]
Pooled property revenue	0	0	-0.002	-0.003	-0.002	-0.003	-0.001	-0.001	-0.007	-0.007
	[0.001]	[0.001]	[0.001]*	[0.002]*	[0.001]*	[0.002]**	[0.002]	[0.002]	[0.004]*	[0.004]**
Subjective health	1.135	1.163	1.556	0.693	1.526	0.702	0.699	0.721	0.738	0.468
	[0.105]***	[0.105]***	[0.212]***	[0.266]***	[0.212]***	[0.268]***	[0.303]**	[0.307]**	[0.571]	[0.606]
Experienced compulsory retirement	-1.619	-1.591	-3.484	-2.775	-3.487	-2.834	-2.742	-2.796	-3.167	-3.471
	[0.089]***	[0.089]***	[0.260]***	[0.454]***	[0.261]***	[0.457]***	[0.502]***	[0.506]***	[1.153]***	[1.216]***
Constant	10.669	11.987	18.515		22.324					
	[0.672]***	[1.142]***	[2.620]***		[2.871]***					
Model	pooled logit	pooled logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit
N. of Obs.	3925	3925	3925	1285	3925	1285	1001	1001	284	284
N. of ID	1258	1258	1258	309	1258	309	238	238	71	71
Log-likelihood	-1724.1631	-1728.9472	-1426.6543	-330.70013	-1419.8043	-329.39831	-260.57444	-259.77695	-68.418425	-66.174153
Hausman test				74.22		70.55				
（Prob>chi2）				0		0				

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Table 5-b. Effect of Incidence of Person who Needs Care in Family on Wife's Labor Force Participation

	Wife's work									
	All						Jr. High / High school		Senmon /Jr. Cllg / Undergrad / Grad	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	-0.268	-0.278	-0.782	-0.792	-0.633	-0.533	-0.769	-0.517	-0.92	-0.64
	[0.125]**	[0.126]**	[0.237]***	[0.269]***	[0.320]**	[0.359]	[0.308]**	[0.417]	[0.564]	[0.717]
Post-LTCI (year 2001-05)					-0.148	0.707		0.875		-0.189
					[0.168]	[0.234]***		[0.258]***		[0.559]
Having a Person who needs care in family					-0.267	-0.514		-0.483		-0.597
×Post-LTCI (year 2001-05)					[0.409]	[0.443]		[0.497]		[0.997]
Age	-0.095	-0.12	-0.226	-0.132	-0.22	-0.128	-0.15	-0.144	-0.068	-0.055
	[0.006]***	[0.008]***	[0.023]***	[0.075]*	[0.024]***	[0.075]*	[0.084]*	[0.085]*	[0.171]	[0.172]
Education High school	-0.066									
	[0.077]									
Senmon / Jr.College	-0.291									
	[0.111]***									
Undergrad / Grad	-0.196									
	[0.162]									
Imputed wage (husband)		-0.887	-0.682	2.135	-0.87	3.738	2.194	4.199	0.481	0.157
		[0.161]***	[0.427]	[1.096]*	[0.469]*	[1.224]***	[1.230]*	[1.375]***	[2.574]	[2.883]
Imputed wage (wife)		-0.326	-1.14	-2.75	-1.352	-2.314	-3.172	-2.628	2.152	1.897
		[0.300]	[0.809]	[1.721]	[0.830]	[1.738]	[1.926]*	[1.944]	[4.242]	[4.256]
Pooled property revenue	0	0	0	-0.003	0	-0.003	-0.003	-0.003	-0.003	-0.003
	[0.000]	[0.000]	[0.001]	[0.001]*	[0.001]	[0.001]**	[0.002]*	[0.002]**	[0.003]	[0.003]
Subjective health	0.613	0.653	0.635	0.235	0.637	0.235	0.244	0.246	0.039	-0.012
	[0.107]***	[0.108]***	[0.207]***	[0.243]	[0.207]***	[0.246]	[0.269]	[0.274]	[0.567]	[0.576]
Constant	4.909	4.476	9.005		8.111					
	[0.386]***	[0.750]***	[1.853]***		[2.026]***					
Model	pooled logit	pooled logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit
N. of Obs.	4275	4275	4275	1719	4275	1719	1437	1437	282	282
N. of ID	1346	1346	1346	393	1346	393	328	328	65	65
Log-likelihood	-2792.0256	-2770.3768	-2258.5847	-566.94083	-2257.8475	-562.0374	-463.52133	-457.57328	-101.16102	-100.88695
Hausman test				54.97		59.26				
（Prob>chi2）				0		0				

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Table 6. Effect of Incidence of Person who Needs Care in Family on Husband's Working Hours

	Husband's working hours							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	-14.601	-24.287	-9.826	1.148	-18.708	-27.346	-14.03	-6.545
	[7.805]*	[11.734]**	[7.330]	[8.737]	[6.332]***	[9.342]***	[6.201]**	[7.421]
Post-LTCI (year 2001-05)	10.667	19.509	9.172	12.82				
	[3.616]***	[5.426]***	[3.584]**	[5.352]**				
Having a person who needs care in family	2.001	2.752	-4.972	-15.143				
×Post-LTCI (year 2001-05)	[10.399]	[15.862]	[9.369]	[10.386]				
Age	-5.348	-7.595	-5.106	-7.318	-5.094	-7.146	-4.823	-7.413
	[0.399]***	[0.593]***	[0.499]***	[1.650]***	[0.390]***	[0.580]***	[0.486]***	[1.652]***
Imputed wage (husband)	8.857	25.554	11.011	7.394	1.873	12.626	2.62	-19.844
	[6.969]	[10.534]**	[8.850]	[26.825]	[6.584]	[9.954]	[8.189]	[24.013]
Imputed wage (wife)	17.961	12.77	4.22	-101.182	8.855	-4.096	-4.732	-111.126
	[12.155]	[18.295]	[15.236]	[37.869]***	[11.776]	[17.737]	[14.768]	[37.497]***
Pooled property revenue	-0.012	-0.016	-0.024	-0.043	-0.01	-0.012	-0.021	-0.037
	[0.025]	[0.037]	[0.025]	[0.032]	[0.025]	[0.037]	[0.025]	[0.032]
Subjective health	32.371	58.175	24.699	15.931	33.102	59.457	25.307	16.306
	[3.621]***	[5.776]***	[3.770]***	[4.832]***	[3.614]***	[5.769]***	[3.765]***	[4.835]***
Experienced compulsory retirement	-58.39	-90.191	-62.217	-68.438	-59.857	-91.899	-62.834	-67.834
	[3.120]***	[4.854]***	[3.690]***	[6.005]***	[3.206]***	[4.982]***	[3.760]***	[6.073]***
Person who needs care in family					17.438	19.95	5.568	-3.534
× Experienced compulsory retirement					[10.927]	[17.414]	[10.665]	[12.397]
Constant	469.122	575.031	440.464	379.633	432.747	508.468	399.633	337.035
	[33.765]***	[50.146]***	[40.720]***	[82.409]***	[31.455]***	[46.697]***	[37.122]***	[79.610]***
Model	pooled reg	tobit	random-effects	fixed-effects	pooled reg	tobit	random-effects	fixed-effects
N. of Obs.	3595	3595	3595	3595	3595	3595	3595	3595
N. of ID	1223	1223	1223	1223	1223	1223	1223	1223
Hausman test				26.01				25.93
（Prob>chi2）				0.002				0.0011

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Table 7. Effect of Incidence of Person who Needs Care in Family on Subjective Health and Satisfaction

	Subjective health (husband)		Satisfied with own health (husband)		Satisfied with own leisure time (husband)		Satisfied with own life in general (husband)				Subjective health (wife)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	0.241	0.708	0.312	0.565	-0.223	-0.101	0.161	0.185	0.157	0.179	-0.27	0.087
	[0.415]	[0.512]	[0.296]	[0.357]	[0.253]	[0.295]	[0.259]	[0.296]	[0.260]	[0.299]	[0.459]	[0.582]
Post-LTCI (year 2001-05)	0.337	0.189	0.181	0.157	0.043	0.338	0.076	0.298	0.038	0.287	0.266	-0.038
	[0.169]**	[0.255]	[0.122]	[0.186]	[0.107]	[0.174]*	[0.110]	[0.175]*	[0.109]	[0.177]	[0.185]	[0.297]
Having a person who needs care in family	-1.04	-1.492	-1.152	-1.49	-0.185	-0.344	-0.487	-0.49	-0.393	-0.391	-0.931	-1.101
×Post-LTCI (year 2001-05)	[0.518]**	[0.616]**	[0.376]***	[0.430]***	[0.330]	[0.356]	[0.336]	[0.356]	[0.337]	[0.358]	[0.556]*	[0.670]
Age	-0.102	-0.076	-0.03	-0.029	0.042	-0.011	0.003	-0.051	0.014	-0.046	-0.061	0.003
	[0.022]***	[0.044]*	[0.016]*	[0.032]	[0.013]***	[0.030]	[0.014]	[0.030]*	[0.013]	[0.031]	[0.023]***	[0.052]
Education High school	1.309		0.512		0.175		0.286		0.167		0.81	
	[0.262]***		[0.190]***		[0.155]		[0.159]*		[0.156]		[0.279]***	
Senmon / Jr.College	0.442		-0.095		0.031		0.243		0.195		0.533	
	[0.422]		[0.315]		[0.261]		[0.269]		[0.263]		[0.400]	
Undergrad / Grad	0.995		0.771		0.784		1.045		0.949		0.516	
	[0.306]***		[0.226]***		[0.185]***		[0.193]***		[0.189]***		[0.592]	
Pooled property revenue	0	0.001	0.001	0.001	0.003	0	0.002	0	0.002	0	0.002	0
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]***	[0.001]	[0.001]*	[0.000]	[0.001]*	[0.000]	[0.002]	[0.001]
Subjective health					0.75	0.52			1.193	0.776		
					[0.136]***	[0.173]***			[0.137]***	[0.171]***		
Constant	8.499		2.332		-3.44		-0.054		-1.622		6.937	
	[1.345]***		[0.949]**		[0.812]***		[0.818]		[0.824]**		[1.340]***	

Model	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit
N. of Obs.	4182	1070	4182	1938	4182	2255	4182	2182	4182	2182	4174	787
N. of ID	1360	256	1360	453	1360	540	1360	515	1360	515	1361	185
Log-likelihood	-1487.5125	-386.14221	-2382.7546	-729.82559	-2596.2132	-853.13124	-2540.0818	-823.90012	-2501.0298	-813.24356	-1187.4884	-288.3924
Hausman test	3.4		0.78		24.71		3.43		19.82		3.09	
（Prob>chi2）	0.6391		0.9783		0.0004		0.6347		0.003		0.6858	

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Table 8. Descriptive Statistics (Matched Sample)

		Men									
		Having a person who needs care in family					Not having a person who needs care in family				
		N. Obs.	Mean	Std. Dev.	Min.	Max.	N. Obs.	Mean	Std. Dev.	Min.	Max.
Husband's work		155	0.8000	0.4013	0	1	155	0.8387	0.3690	0	1
Subjective health		155	0.8258	0.3805	0	1	155	0.8387	0.3690	0	1
Experienced compulsory retirement		155	0.2129	0.4107	0	1	155	0.1742	0.3805	0	1
Age		155	57.8129	4.2469	50	64	155	0.8387	0.3690	0	1
Education	Jr. High	155	0.2710	0.4459	0	1	155	0.2903	0.4554	0	1
	High school	155	0.4129	0.4940	0	1	155	0.4194	0.4951	0	1
	Senmon / Jr.Colleg	155	0.0581	0.2346	0	1	155	0.0452	0.2083	0	1
	Undergrad / Grad	155	0.2581	0.4390	0	1	155	0.2452	0.4316	0	1
Imputed wage (husband)		155	-1.0642	0.2146	-1.3947	-0.7257	155	-1.0705	0.2178	-1.3947	-0.7257
Imputed wage (wife)		155	-1.8359	0.1032	-1.9575	-1.5151	155	-1.8304	0.1048	-1.9575	-1.5151
Having a person who needs care in fam		155	0.4581	0.4999	0	1	155	0	0	0	0
Pooled property revenue		155	18.8839	87.4324	0	700	155	15.2387	65.3458	0	400
Post-LTCI (year 2001-05)		155	0	0	0	0	155	0	0	0	0
Having a person who needs care in fam ×Post-LTCI (year 2001-05)		155	0	0	0	0	155	0	0	0	0

		Women									
		Having a person who needs care in family					Not having a person who needs care in family				
		N. Obs.	Mean	Std. Dev.	Min.	Max.	N. Obs.	Mean	Std. Dev.	Min.	Max.
Wife's work		181	0.5138	0.5012	0	1	181	0.5138	0.5012	0	1
Subjective health		181	0.8840	0.3211	0	1	181	0.8840	0.3211	0	1
Age		181	54.2320	4.5487	45	64	181	54.0663	4.5014	45	64
Education	Jr. High	181	0.2155	0.4123	0	1	181	0.2044	0.4044	0	1
	High school	181	0.5967	0.4919	0	1	181	0.5801	0.4949	0	1
	Senmon / Jr.Colleg	181	0.1381	0.3460	0	1	181	0.1713	0.3778	0	1
	Undergrad / Grad	181	0.0497	0.2180	0	1	181	0.0442	0.2061	0	1
Imputed wage (husband)		181	-1.0591	0.2135	-1.3947	-0.7257	181	-1.0542	0.2042	-1.3947	-0.7257
Imputed wage (wife)		181	-1.8374	0.1027	-1.9575	-1.5151	181	-1.8303	0.1116	-1.9575	-1.4921
Person who needs care in family		181	0.4365	0.4973	0	1	181	0	0	0	0
Pooled property revenue		181	17.4696	82.2530	0	700	181	40.5249	447.1559	0	6000
Post-LTCI (2001-05)		181	0	0	0	0	181	0	0	0	0
Person who needs care in family ×Post-LTCI (year 2001-05)		181	0	0	0	0	181	0	0	0	0

Source: The Panel Survey on Middle-Aged Persons (The NLI Research Institute)

Table 9-a. Effect of Incidence of Person who Needs Care in Family on Husband's Labor Force Participation
(Matched data)

	Husband's work (DID-PSM)									
	All						Jr. High / High school		Senmon /Jr. Cllg / Undergrad / Grad	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	-0.59	-0.559	-0.918	-0.914	-0.965	-0.671	-0.809	-0.677	-2.645	-2.882
	[0.188]***	[0.187]***	[0.309]***	[0.372]**	[0.431]**	[0.491]	[0.401]**	[0.541]	[1.497]*	[1.991]
Post-LTCI (year 2001-05)					0.731	0.069		0.29		-3.063
					[0.402]*	[0.603]		[0.653]		[2.260]
Having a person who needs care in family					0.117	-0.52		-0.247		-32.923
×Post-LTCI (year 2001-05)					[0.573]	[0.679]		[0.730]		[7277.995]
Age	-0.159	-0.15	-0.225	-0.185	-0.253	-0.186	-0.164	-0.161	-0.481	-0.644
	[0.019]***	[0.024]***	[0.054]***	[0.158]	[0.055]***	[0.159]	[0.170]	[0.170]	[0.547]	[0.608]
Education High school	0.36									
	[0.179]**									
Senmon / Jr.College	0.447									
	[0.396]									
Undergrad / Grad	0.843									
	[0.234]***									
Imputed wage (husband)		0.4	0.352	0.348	1.1	0.241	-0.114	0.438	1.575	-7.021
		[0.368]	[0.850]	[2.357]	[0.920]	[2.701]	[2.527]	[2.894]	[8.317]	[10.008]
Imputed wage (wife)		1.053	0.442	-1.06	1.345	-1.132	1.357	1.358	-17.358	-21.443
		[0.709]	[1.586]	[3.809]	[1.637]	[3.825]	[4.149]	[4.152]	[12.998]	[13.167]
Pooled property revenue	0.001	0.001	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002	0.007	0.004
	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.020]	[0.020]
Subjective health	1.355	1.375	1.766	1.11	1.709	1.082	0.891	0.876	2.902	19.323
	[0.194]***	[0.192]***	[0.365]***	[0.447]**	[0.362]***	[0.450]**	[0.503]*	[0.506]*	[1.739]*	[3794.234]
Experienced compulsory retirement	-0.973	-0.989	-2.127	-2.016	-2.065	-2.036	-1.867	-1.907	-15.957	-34.097
	[0.169]***	[0.168]***	[0.407]***	[0.705]***	[0.402]***	[0.707]***	[0.729]**	[0.735]***	[2082.541]	[8416.673]
Constant	9.999	12.276	16.726		20.755					
	[1.199]***	[1.988]***	[4.159]***		[4.628]***					
Model	pooled logit	pooled logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit
N. of Obs.	1114	1114	1114	400	1114	400	331	331	69	69
N. of ID	310	310	310	91	310	91	75	75	16	16
Log-likelihood	-501.55454	-507.93571	-427.84877	-113.66788	-425.80903	-113.36174	-97.586489	-97.463695	-12.610476	-10.339164
Hausman test				20.08		18.07				
（Prob>chi2）				0.0054		0.0343				

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Table 9-b. Effect of Incidence of Person who Needs Care in Family on Wife's Labor Force Participation
(Matched data)

	Wife's work (DID-PSM)									
	All						Jr. High / High school		Senmon /Jr. Cllg / Undergrad / Grad	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Having a person who needs care in family	-0.404	-0.381	-0.755	-0.722	-0.529	-0.23	-0.679	-0.187	-1.05	-0.456
	[0.142]***	[0.141]***	[0.238]***	[0.268]***	[0.322]	[0.359]	[0.313]**	[0.421]	[0.570]*	[0.764]
Post-LTCI (year 2001-05)					0.019	0.611		0.953		-0.718
					[0.287]	[0.395]		[0.448]**		[0.882]
Having a person who needs care in family					-0.453	-0.991		-0.976		-1.207
×Post-LTCI (year 2001-05)					[0.438]	[0.482]**		[0.545]*		[1.131]
Age	-0.073	-0.071	-0.108	0.113	-0.105	0.14	0.075	0.099	0.229	0.303
	[0.011]***	[0.014]***	[0.036]***	[0.117]	[0.038]***	[0.120]	[0.134]	[0.136]	[0.260]	[0.277]
Education High school	0.18									
	[0.141]									
Senmon / Jr.College	-0.335									
	[0.202]*									
Undergrad / Grad	0.579									
	[0.321]*									
Imputed wage (husband)		-0.032	0.68	4.572	0.644	6.004	4.409	6.551	2.781	1.715
		[0.279]	[0.697]	[1.739]***	[0.758]	[1.978]***	[1.976]**	[2.250]***	[4.123]	[4.765]
Imputed wage (wife)		-0.964	-2.489	-2.311	-2.665	-2.083	-2.88	-2.418	5.038	4.569
		[0.532]*	[1.269]**	[2.615]	[1.327]**	[2.662]	[2.933]	[2.983]	[7.033]	[7.175]
Pooled property revenue	0.001	0.001	0.001	-0.001	0.001	-0.001	-0.002	-0.003	0.006	0.005
	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.006]	[0.006]
Subjective health	0.71	0.731	0.954	0.604	0.941	0.56	0.618	0.585	0.58	0.424
	[0.187]***	[0.187]***	[0.334]***	[0.370]	[0.336]***	[0.372]	[0.430]	[0.434]	[0.742]	[0.792]
Constant	3.49	1.555	1.39		0.828					
	[0.690]***	[1.297]	[2.842]		[3.239]					
Model	pooled logit	pooled logit	random-effects logit	fixed-effects logit	random-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit	fixed-effects logit
N. of Obs.	1344	1344	1344	654	1344	654	533	533	121	121
N. of ID	362	362	362	144	362	144	116	116	28	28
Log-likelihood	-886.48706	-890.34813	-741.60398	-227.04291	-741.02834	-224.25848	-179.69933	-176.48121	-44.977598	-43.829265
Hausman test				14.98		20.99				
（Prob>chi2）				0.0204		0.0072				

Note- ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Appendix Table 1-a. Effect of Being the Main Caregiver on Husband's Labor Force Participation

	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
Main caregiver	-0.243	-0.465	-0.478	-0.431
	[0.053]***	[0.126]***	[0.131]***	[0.161]***
Age	-0.019	-0.019	-0.016	-0.019
	[0.002]***	[0.002]***	[0.002]***	[0.007]***
Imputed wage (husband)	0.05	0.052	0.08	0.132
	[0.030]*	[0.030]*	[0.038]**	[0.100]
Imputed wage (wife)	-0.041	-0.045	-0.174	-0.708
	[0.053]	[0.054]	[0.069]**	[0.155]***
Pooled property revenue	0	0	0	0
	[0.000]	[0.000]	[0.000]	[0.000]
Subjective health	0.199	0.201	0.141	0.088
	[0.016]***	[0.017]***	[0.017]***	[0.020]***
Experienced compulsory retirement	-0.293	-0.292	-0.323	-0.368
	[0.014]***	[0.014]***	[0.017]***	[0.025]***
Constant	1.845	1.827	1.492	0.771
	[0.142]***	[0.143]***	[0.170]***	[0.336]**
Model	OLS	2SLS	G2SLS	Fixed-effects IV
N of Obs.	3922	3922	3922	3922
N of ID	1257	1257	1257	1257
Underidentification test (Anderson canon. corr. LM statistic)		689.112		
Chi-sq(1) P-val		0.000		
Weak identification test (Cragg-Donald Wald F statistic)		834.296		
Sargan statistic (overidentification test of all instruments)		0.000	(equation exactly identified)	
Endogeneity test of endogenous regressors		3.759		
Chi-sq(1) P-val		0.0525		

Note - ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

Appendix Table 1-b. Effect of Being the Main Caregiver on Husband's Working Hours

	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
Main caregiver	-32.462	-58.113	-58.1	-35.139
	[11.188]***	[25.537]**	[27.987]**	[38.241]
Age	-5.049	-5.015	-4.757	-7.472
	[0.390]***	[0.391]***	[0.487]***	[1.648]***
Imputed wage(husband)	1.783	2.121	2.97	-20.82
	[6.582]	[6.594]	[8.189]	[23.957]
Imputed wage(wife)	8.917	8.441	-5.597	-113.164
	[11.768]	[11.784]	[14.773]	[37.719]***
Pooled property revenue	-0.011	-0.011	-0.021	-0.036
	[0.025]	[0.025]	[0.025]	[0.032]
Subjective health	33.77	33.961	26.008	16.543
	[3.612]***	[3.619]***	[3.766]***	[4.830]***
Experienced compulsory retirement	-58.528	-58.412	-62.142	-67.714
	[3.119]***	[3.123]***	[3.687]***	[6.005]***
Constant	428.573	426.227	393.687	335.294
	[31.452]***	[31.545]***	[37.247]***	[79.757]***
Model	OLS	2SLS	G2SLS	Fixed-effects IV
N of Obs.	3592	3592	3592	3592
N of ID	1222	1222	1222	1222
Underidentification test (Anderson canon. corr. LM statistic)		690.382		
Chi-sq(1) P-val		0.000		
Weak identification test (Cragg-Donald Wald F statistic)		852.742		
Sargan statistic (overidentification test of all instruments)		0.000	(equation exactly identified)	
Endogeneity test of endogenous regressors		1.254		
Chi-sq(1) P-val		0.2629		

Note - ***; p<0.01, **; p<0.05, *; p<0.1. Standard errors are in brackets.

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