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Can Formal Elderly Care Stimulate Female Labor Supply? The Japanese Experience

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This study analyzes the impacts of the Japanese Long-Term Care Insurance (LTCI), a decade after its launch, with respect to the female labor supply in Japan. The radical program has caused the emergence of markets for various care services apart from permanent institutional care, which is only a major formal care sector in many developed countries. The availability of various formal care services can stimulate female labor supply through a reduction of the burden of informal caregiving. To investigate the impacts of the LTCI, we compare the labor market behavior of females who face requirements for elderly care in their household for three periods—before the launch of the LTCI, four years after the launch, and ten years after the launch. Our empirical analysis indicates positive effects of the launch and diffusion of the LTCI on female labor supply. As a result of the LTCI, care for male elders is no longer an obstacle for female labor supply, but care for female elders is still burdensome. We also find that the care requirement reduces the probability of being a regular worker; however, regular workers are more likely to utilize formal care, whereas many nonregular workers provide informal care by themselves.

Keywords: Elderly care, female labor supply, regular workers, Japanese Long-Term Care Insurance program
JEL classification codes: J15; J21; I18

1 Introduction

To address the issue of the world's fastest population aging, the Japanese government established a radical program called the Long-Term Care Insurance (LTCI) in 2000. This study attempts to globally publicize the unique Japanese experience, because many

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other countries may also encounter an explosion in demand for elderly care in the near future. Our study investigates who the LTCI has affected and how much. Specifically, we concentrate on the effects of the LTCI on female labor supply, which is one of the program's main targets under the slogan of "Socialization of Care."

"Socialization of Care" is a policy objective that claims the release of women from the severe burden of voluntary caregiving for coresident elders, which the LTCI does by presenting a market-oriented solution. Specifically, the LTCI does not provide cash allowance for informal caregivers, but covers only purchased service cost through formal sectors. This policy has created a large consumer demand for formal care and new markets have emerged for various services such as home care (*houmon kaigo*), day care service (*tsuusho kaigo*), short-stay care (*tanki nyuusho kaigo*), and so on[1].

The existence of these service markets differentiates Japan from many other developed countries in which institutional care for permanent living comprises only a major formal care sector[2]. In these countries, because informal family care is the only available method of dealing with coresident disabled elders, care requirements generally reduce the labor supply of their household members. Several studies such as Carmichael and Charles (2003), Heitmueller (2007), and Heitmueller and Inglis (2007) have empirically found this negative effect and suggested the expansion of formal care provisions as a policy option for stimulating the female labor supply. The Japanese situation provides an existing example of such a policy.

Because of the industrialization of the care service sector, Japanese families have access to many methods of managing elderly care, which might affect their labor market behavior. As proposed by Carmichael and Charles (1998), under a standard utility maximization model for individual household members, care requirements can have either positive or negative effects on the working status of an individual. A negative effect is the substitution between care and work under a time constraint. On the other hand, a positive effect is that people increase their labor supply to manage care costs. Such a positive response has barely been found in previous empirical studies on European and American data. However, because of the existence of formal care services, this positive effect may be more dominant in Japanese households.

Our study aims to measure the impacts of the social insurance for elderly care. In a similar manner to the preceding program in Germany[3], the LTCI has been continuously revised to balance costs and benefits under the unstable social condition caused by aging. For example, based on the discussion in a government panel called the National Council on Social Security System Reform (*Shakai Hoshou Kaikaku Kokumin Kaigi*), the government is currently planning to exclude elders with lesser care requirements from LTCI coverage. However, because of the shortage of empirical studies, it is not clear who will be influenced by such a reform or to what extent[4].

[1]For English translations of Japanese legal terms in the LTCI, we referred to Sumii and Sawada (2012).

[2]Many countries have formal sectors for home care and day care service, but their market volumes are limited. Bolin et al. (2008b) analyzed home care sectors in European countries.

[3]See Campbell et al. (2010) for details of previous reforms of the social insurance program in Japan and Germany

[4]With regard to the choice of program coverage, Häcker and Hackmann (2012) investigated the German

In this study, we consider the influence of the LTCI on the labor market behavior of the spouses of the sons of coresident elders. Before the launch of the LTCI, daughters-in-law were the typical caregivers in Japan. Therefore, although coresidence of elders and their daughters becomes less frequent today, an investigation of the labor supply of coresiding daughters-in-law is a natural method of evaluating whether the LTCI has achieved its policy objective. We estimate the effects of care requirements on the probability of employment and working hours of coresiding daughters-in-law. To consider the effects in greater detail, we estimate the switching regression model for the working hours of regular and nonregular workers.

Using repeated cross-section data, we estimate the effects of care requirements on female labor supply in Japan for different periods—before the launch of the LTCI, four years after the launch, and ten years after the launch. This approach enables us to analyze the marginal effects of care requirements, controlling for the macroeconomic trend and other observable household and regional characteristics. Specifically, we use a large set of microdata from the Comprehensive Survey of Living Conditions (*Kokumin Seikatsu Kiso Chouse*) for 1998, 2004, and 2010.

Our findings can be summarized in the following manner. Although there remain significantly negative effects of caregiving on labor force participation, the magnitudes of the negative effects were found to be chronically reduced after the launch of the LTCI. Although the data limitation prevents us from analyzing the impact of the launch of the LTCI on female working hours, we can find positive effects of the LTCI on female working hours at least in 2010. We also find a gender difference in the negative effects of care requirements. Specifically, the negative impacts of care requirements were found to recently disappear for male elders, while female elders are still burdensome. This result indicates that when a female elder is disabled, not only caregiving but also housekeeping burdens are turned over to family members, thereby posing a more severe time constraint for coresiding females.

Furthermore, our study indicates a relationship between the work type of females and care requirement. Care requirements reduce the probability of females to be regular workers. However, the effect on working hours can be decomposed into a negative effect for nonregular workers and a positive effect for regular workers. This result suggests that regular workers are more likely to utilize formal care, whereas many nonregular workers are unable to enjoy the benefits of the LTCI and provide informal care by themselves.

Our research contributes to an active study area of labor economics—the relationship between female labor market behavior and elderly care based on the unique experience of Japan. It must be noted that there is no consensus among US and European studies, which are summarized in Lilly et al. (2007), on the magnitude of the effects of caregiving on labor market behavior. For example, Boaz and Muller (1992) found strong negative effects of caregiving on working hours, whereas Wolf and Soldo (1994) found no such significant effect. Recent studies have attempted to control for many factors that may be causing this complication. Pezzin and Schone (1999) analyzed simultaneous decision-making concerning caregiving and living allocation to address the impacts of changing

program.

family structures. Moreover, Van Houtven et al. (2010) and Knoef and Kooreman (2011) utilized panel data to model dynamic decision-making.

There are several empirical studies in the literature on the Japanese context. Using data for the period before the launch of the LTCI, Iwamoto (2001) found a negative effect of caregiving on female labor force participation, and Ogawa and Ermisch (1996) found distinct effects of caregiving on the labor supply of full-time and part-time female workers. For the early stage of the LTCI, Shimizutani et al. (2008) detected no significant effect in 2001 on female labor force participation, but found a positive effect in 2002. Furthermore, using data for 2001, Hanaoka and Norton (2008) showed that opportunity costs of children affect their utilization of formal care, which is a finding that is consistent with our result.

The remainder of this paper is organized in the following manner. In Section 2, we provide a brief review of the LTCI program. In Section 3, we present our econometric framework, and in Section 4 we present the empirical findings. In Section 5, we present the conclusion and aspects for future research.

2 Historical review of Japanese national Long-Term Care Insurance

As a response to rapid population aging, the Japanese government launched the LTCI in 2000[5]. The program does not provide a per capita cash transfer to elders like that in Germany's program for supporting informal caregivers. Instead, the LTCI covers only purchased service costs for formal care. This policy is justified under the "Socialization of Care" policy objective, which aims to release women from the burden of voluntary caregiving for coresident elders. To satisfy the explosion of demand for formal services caused by this policy, many firms have been established to provide various care services. Thus, the LTCI instantaneously generated a large industry for elderly care.

The LTCI is a mandatory insurance system with universal coverage, but only half of its costs are financed by the social insurance principal. The remaining costs are covered by general revenues: 25% from national revenue and 12.5% each from prefectures and municipalities. Along with population aging, the pay-as-you-go policy of the LTCI placed severe pressure on the fiscal budget. As summarized in Campbell et al. (2010), in its first five years, the costs of the LTCI grew faster than prior government estimates. To handle this rapidly growing financial burden, the Japanese government amended the scheme in 2006, which was the first major reform of the LTCI.

The 2006 amendment[6] had two main purposes. The first was the replacement of expensive institutional care by home-based or community-based care sectors. To reduce

[5] See Ikegami and Campbell (2000) for a detailed review for the program, including the background of its launch.

[6] Tsutsui and Muramatsu (2007), Noguchi et al. (2007), and Ohwa and Chen (2012) provided more extensive reviews for the 2006 amendment. The amendment was enforced in April 2006, but hotel costs were omitted earlier in October 2005. Because the amendment was passed by the Diet in June 2005, it is occasionally called the 2005 amendment, as in Tsutsui and Muramatsu (2007).

demand for institutional care, the amendment eliminated room and board expenses, termed*hotel costs*, from LTCI coverage.

Another purpose of the 2006 amendment was the promotion of preventive care, which can affect caregiving in households. A critical reason for the rising costs of the LTCI was the rapid increase in expenses for elders with lesser care requirements. Thus, the 2006 amendment created a new system of services aimed at maintaining the health and well-being of elders. The new preventive care services encouraged elders to participate in activities that would improve their motor and oral functions as well as their nutritional status. However, elders with lesser care requirements also face a reduction in the coverage for benefits of formal care, such as the home helping service, that were available before the amendment.

3 Econometric models

This study is concerned with the effects of the LTCI on the female labor supply in Japan. For simplification, we restrict our analysis to females in a specific family structure comprising at least one elder, his/her coresident son, and the son's spouse. Our econometric models describe behaviors of the daughter-in-law in such a household, and we refer to her simply as "female" hereafter.

To consider the effects of the LTCI, we adopt the explanatory variable of whether elderly care is required in a household. This choice of variable differs from the traditional approach that analyzes the effects of informal caregiving by females on their work intensity. If there is a formal sector only for permanent institutional care, as in many developed countries, the care requirements are satisfied only with formal institutional care or informal home care, but they are mutually exclusive. In other words, direct caregiving by family members is only a possible method of providing care for a coresident elder. Therefore, the effects of care requirements and informal caregiving are equivalent if we focus on households in which the elder and caregiver live together.

In contrast, Japanese households have many options for satisfying elderly care requirements as a combination of informal care and flexible formal care services. Thus, an analysis of the effects of care requirements in general can provide more information for female labor market behavior than an analysis of only informal caregiving.

Our choice of the variable also has two advantages over the conventional choice in previous studies. First, we can avoid the endogeneity problem that studies like Heitmueller (2007) attempted to control for, because care requirements of a coresident elder are likely to be exogenous in natural circumstances. Second, we do not need to consider how to measure the effort level for informal care, which requires a careful treatment, as discussed in van den Berg and Spauwen (2006).

We estimate the effects of care requirements on female labor supply for three different years— 1998, 2004, and 2010—using repeated cross-section data. This approach enables us to analyze the marginal effects of the care requirement, controlling for the macroeconomic trend and changes of observable components. Hereafter, we define all the variables as time-specific, but the time index is abbreviated for simplicity.

We begin with examining the effects of care requirements on the female's employment status using the probit model. Our sample comprises J households. For the jth household, the dependent variable is the employment dummy E_j that takes unity when the female is employed, and zero otherwise. For explanatory variables, C_j denotes the variable for care requirements, which can be either a scalar or a vector depending on the specification, as shown later. $\boldsymbol{w}_j$ is a vector of observable household and regional characteristics for the employment status other than care requirements. The error term $\epsilon_{E,j}$ is assumed to follow the standard normal distribution. Then, our probit model is expressed as

$$E_j = I[C_j\alpha_E + \boldsymbol{w}_j'\boldsymbol{\gamma} + \epsilon_{E,j} \geq 0]. \tag{3.1}$$

Next, we investigate the effects of care requirements on hours worked of females. This analysis is adopted only for data of the 2004 and 2010 rounds, because individual working hours were not interviewed in the 1998 round of the Comprehensive Survey of Living Conditions. Following Bolin et al. (2008a), we adopt the two-part model, which comprises the above probit model for the employment status and the linear regression model for working hours conditional on being employed. The dependent variable H_j denotes the working hours of the female, given that she is employed. For explanatory variables, in addition to the care requirement dummy C_j, we adopt observable household and regional characteristics $\boldsymbol{x}_j$. In the two-part model, the error term $\epsilon_{H,j}$ is assumed to be independent to $\epsilon_{E,j}$, and possible endogeneity between the error terms is analyzed in the later section to check for robustness. Our two-part model is expressed as two equations:

Equation (3.1) and

$$(H_j|E_j = 1) = C_j\alpha_H + \boldsymbol{x}_j'\boldsymbol{\beta} + \epsilon_{H,j}. \tag{3.2}$$

Furthermore, we employ another econometric model for a more detailed decomposition of the effects of care requirements. Under a standard utility maximization model for individual females, there can be both negative and positive effects of elderly care on female labor supply. The negative effect is a result of informal caregiving by females. On the other hand, the positive effect is a result of outsourcing of care to market services for which the household members must manage the payment by increasing their work intensity.

Under the Japanese context, it is natural that the sign of the effects of elderly care on female labor supply is dependent on the type of work that females are engaged in. Female workers with higher preferences for working have a higher disutility from the decision to quit. Therefore, such females are more likely to access formal care services so that they can avoid quitting work to provide elderly care and, hence, increase their working hours. To characterize different work types that can induce these behavioral differences, we group females engaged in the labor force into nonregular and regular workers.

It is likely that working hours are simultaneously determined with the choice between regular and nonregular jobs, because nonregular workers generally have a more flexible

working schedule than regular workers do. Thus, we adopt a switching regression model in which working hours depend on the endogenous work type. Due to data limitation, this analysis is conducted only for data of the 2010 round. We define R_j as a regular worker dummy that takes unity when the female is engaged in regular work and zero when she is engaged in nonregular work. $\boldsymbol{z}_i$, $\boldsymbol{x}_{0,j}$, and $\boldsymbol{x}_{1,j}$ are observable characteristics for the choice of work type and working hours of nonregular and regular workers, respectively. For labor force participation, we again adopt the two-part model. In other words,

$$(R_j|E_j=1) = I[C_j\alpha_R + \boldsymbol{z}_j'\boldsymbol{\lambda} + \epsilon_{R,j} \geq 0], \tag{3.3}$$

$$(H_i|E_j=1) = \begin{cases} C_j\alpha_{H0} + \boldsymbol{x}_{0,j}'\boldsymbol{\beta}_0 + \epsilon_{H0,j} & \text{if} \quad R_j = 0 \\ C_j\alpha_{H1} + \boldsymbol{x}_{1,j}'\boldsymbol{\beta}_1 + \epsilon_{H1,j} & \text{if} \quad R_j = 1 \end{cases}. \tag{3.4}$$

We assume joint normality for the error terms $\epsilon_{R,j}, \epsilon_{H0,j}$, and $\epsilon_{H1,j}$, in which there may be correlations between the pairs of error terms $(\epsilon_{R,j}, \epsilon_{H0,j})$ and $(\epsilon_{R,j}, \epsilon_{H1,j})$. We estimate parameters using Heckman's two-step estimator (Heckit).

4 Empirical analysis

4.1 Data

For our empirical analysis, we utilize the Comprehensive Survey of Living Conditions, which provides detailed information on households and individuals. This repeated cross-section survey is conducted by the Ministry of Health, Labor and Welfare and is a detailed source for household demographic, economic, health, and care information. In addition to an annual survey, a large-scale survey is conducted every three years. Because of the considerable sample size, the large-scale survey is a popular resource for Japanese researches on elderly care, such as Iwamoto et al. (2010). To consider the effects of the launch and diffusion of the LTCI, we use the 1998, 2004, and 2010 rounds of the large-scale surveys[7].

The large-scale survey consists of four questionnaires, each with a specific purpose—namely, to acquire household demographic, income, care, and health information. Our study mainly utilizes the household demographic questionnaire, which is the chief survey conducted among all respondent households. The care questionnaire, which has been surveyed since the launch of the LTCI, is conducted among people with LTCI classification levels for half of the population households. The income questionnaire, which is conducted for approximately 15% of respondent households, provides information on the income and expenditure of each household member. We cannot match the income and care questionnaires because their respondents do not overlap. Because of the small sample size, we do not use the income questionnaire for this study and use the care questionnaire only for a supplementary analysis.

[7] We do not use the 2002 round to ascertain the effects of the launch of the LTCI because, as suggested in Noguchi et al. (2007) and Shimizutani et al. (2008), there may be a time lag between policy implementation and realization of effects on female labor supply.

As mentioned in the previous section, we focus on households that include elders with their own son and his spouse, all of whom reside together. An elderly person is defined as an individual who is aged 65 or over. We eliminate households with more than two elders, those with two elders who are not a married couple, and those with two elders who are both disabled. The sons and spouses are restricted to those aged below 65. We also eliminate households with two or more coresident children, those with a disabled son or his spouse, and those with daughters.

Our dataset does not provide information on family members who live separately, which prevents us from studying three important aspects. First, elders who live in permanent care institutions are not studied because such elders are eliminated from our sample. Second, we do not consider intra-family bargaining for caregiving, because the amount of caregiving is likely decided simultaneously with living allocation, as in the model given by Pezzin and Schone (1999). Third, we do not consider the choice of family members for living allocation. The third aspect might cause an endogeneity bias, and we provide a further discussion in a subsequent section.

For dependent variables, both the employment dummy E_j and the regular work dummy R_j are values on interview dates in June. The regular worker dummy takes unity if the female is called as a regular worker at her workplace. The working hours, H_j, represent the weekly number of hours worked during the last week of May. To eliminate peculiar working hours such as those of self-employed workers, we exclude households in which either the son or his spouse is a nonemployed worker or has extremely long working hours—specifically, over 65 hours per week.

For explanatory variables, our main interest is in C_j, which is the care requirements of a coresident elder. We consider several candidates of variables for C_j that are related to elderly care. The basic variable is a disabled elder dummy that takes unity when there is a disabled elder in the household. An elderly person with a disability is defined as one who needs help from others or is required to be under the watch of others. To see more details of this effect, two additional specifications are adopted. First, we divide the disabled elder dummy into male and female disabled elder dummies. Second, we utilize information on living spouses of the disabled elder, because a healthy parent-in-law can share the care burden with the female.

In our model of (3.1) and (3.2), explanatory variables for both labor force participation ($\boldsymbol{w}_j$) and working hours ($\boldsymbol{x}_j$) contain the following elements. For household information, we include the number of household members and a dummy variable for having a child aged under 15. For demographic characteristics of the female, we adopt the logarithm of her age. To control for the behavior of a retired female, we also include a dummy variable for an old female. This variable takes unity if the female is over the age of 60, a typical retirement age in the Japanese labor market at the time these surveys were conducted.

In addition to these common variables, we include three job characteristics of the female in $\boldsymbol{x}_j$: job tenure, a dummy variable if the woman works for a large firm (specifically, one with more than 499 workers), and a public-sector job dummy. For $\boldsymbol{w}_j$, we also include the prefecture value of the ratio of active job offers to job seekers (*Yuukou kyuujin bairitsu*) as annual averages for the previous year of the interview,

which are taken from the Report on Employment Services (*Ippan Shokugyou Shoukai Joukyou*). This variable measures the demand in regional labor markets, which might influence the performance of the female in terms of her job search but has no clear relation to her working hours. In the subsequent section, where robustness checks are conducted, we use this variable as an exclusion restriction that affects only female labor force participation and not working hours.

For the explanatory variables of the switching regression model, defined by (3.3) and (3.4), we include all variables used in the two-part model. Specifically, covariates for work type ($\boldsymbol{z}_j$) include all elements of $\boldsymbol{w}_j$, and covariates for working hours for work types ($\boldsymbol{x}_{0,j}$) and ($\boldsymbol{x}_{1,j}$) include all elements of $\boldsymbol{x}_j$. Additionally, we include a higher education dummy in $\boldsymbol{z}_j$ as an exclusion restriction, which is justified in the following manner. The education level, or the skill level of workers, is likely to be an important factor in the hiring decision of firms. On the other hand, there is no clear reason for discriminating working hours of employees on the basis of their skills. This variable takes unity when the female has completed university, junior college (*Tanki daigaku*), or junior technical college (*Koutou senmon gakkou*). Because education attainment was queried for the first time in the 2010 interview, the two-part switching regression model is estimated only for that year.

The total number of respondents of the large-scale surveys were 247,662, 220,948, and 229,785 households in 1998, 2004, and 2010, respectively. After excluding samples with missing and irrational responses, 15,659, 10,150, and 8,515 households remained for the 2004 and 2010 datasets, respectively. Owing to the considerable sample size, we obtained appropriate numbers of households with a disabled elder, namely 1,175 for 1998, 1,959 for 2004, and 2,037 for 2010. These counts show that although the number of households in which elders and their married children coreside was decreasing[8], the number of households with a coresident disabled elder was increasing. Table 1 shows the descriptive statistics of the previously defined variables.

Table 1 about here.

4.2 Estimation results

Table 2 about here

Table 2 reports the probit estimation results for the marginal effects. For the effects of care requirements, column (1) shows the negative effects of a disabled elder on female labor force participation, but the absolute values of their coefficients chronically decreased from the 1998 round to the 2010 round. Specifically, the negative effects on employment probability were 16.0% in 1998, 10.4% in 2004, and 7.0% in 2010. We can infer the extent of the effects of the launch of the LTCI and its diffusion using differences among these estimated marginal effects. The difference between 1998 and 2004 indicates a 5.6% increase in the female labor force participation rate, while the difference between 2004 and 2010 indicates a 3.4% increase in the rate.

[8]The Comprehensive Survey of Living Conditions shows that the ratio of such households among all households with elders accounted for 54.4% in 1975, but decreased to 16.2% in 2010.

Table 3 about here.

For the 2004 and 2010 rounds, Table 3 presents the estimation results for the regression analysis for working hours in the two-part model. For the effects of care requirements, column (1) again shows the negative effects of a disabled elder on working hours and the reduction of absolute values from the 2004 round to the 2010 round. Specifically, the negative effect on working hours reduced from 1.1 hours to 0.8 hours.

We also have reasonable coefficient estimates for the alternative specifications. Column (2) in Tables 2 and 3 shows the results where the disabled elder dummy is decomposed into male and female disabled elder dummies. Under this decomposition, both the negative impacts of male and female care requirement were chronically reduced. In the 2010 round, the care requirements for male elders no longer have significant impacts on both the female employment rate and working hours. However, the female disabled elderly still has negative effects on the female labor supply. This result indicates that when a female elder is disabled, not only caregiving but also housekeeping burdens are turned over to the daughter-in-law, thereby posing a more severe time constraint for the females.

Furthermore, column (3) in Tables 2 and 3 shows the effects of care requirements and existence of a healthy coresident spouse. The disabled elder dummy also has negative impacts on female labor supply, but this effect is canceled out under the presence of a healthy spouse. This might imply that a healthy spouse of a disabled elder can share the burden of care with coresident daughters-in-law, thereby stimulating the labor supply.

For explanatory variables other than care-related factors, the number of household members has a positive effect on employment probability, because the increased number of family members can encourage sharing of the care burden. On the other hand, this variable does not affect working hours. One interpretation is that the other household members can engage in simple care tasks like watching over the elderly person, but they cannot perform more technical care tasks. Thus, females who have the support of many household members do not need to completely devote themselves to caregiving for the elderly person the entire day, but they reduce working hours to spend some time in elderly care. Furthermore, the need for childcare strongly decreases both the female labor force participation rate and working hours, which implies that childcare is another important factor that causes a reduction in female working hours. The age of females reduces both female labor force participation and working hours, although it is not significant for the labor force participation rate in 1998.

The positive effect of the regional demand for labor, which is represented by the ratio of active job offers to job seekers, is found only in 1998 and 2004 and not in 2010. We can interpret this result in the following manner. In 2010, the Lehman Shock had a serious negative effect on the Japanese economy. Because of the negative shift, the prefecture values of the ratio of active job offers to job seekers decreased for a majority of the areas and showed a smaller regional divergence in 2010 than in 1998 or 2004. Thus, the lack of variation prevents us from obtaining a significant coefficient estimate for 2010. We could have obtained more informative results if we utilized a different variable that reflects the performance of regional labor markets at the municipality level, but we do

not have information for municipalities in which households dwell. Longer tenures are associated with longer working hours. Characteristics of the workplace, large firms, and public sector dummies also have considerable influence on working status.

Table 4 about here.

Table 4 presents the results of the probit estimation for the work type and the second-stage estimation of the switching regression model for working hours. Due to the data availability problem, this analysis is employed only for the 2010 round of data. For the probit analysis, the existence of a disabled elder reduces the probability of obtaining a regular job relative to a nonregular job. Our exclusion restriction, the higher education dummy, is significant and the sign is naturally positive. On the other hand, for working hours, the effects of care requirements differ according to work type. The disabled elder dummy has a negative effect on the working hours of nonregular workers and a positive effect on the working hours of regular workers.

These results indicate that regular workers are more likely to utilize formal care, whereas many nonregular workers provide informal care by themselves. In other words, it is true that the LTCI provides many options for outsourcing elderly care; however, these options are more accessible to households in which daughters-in-law are regular workers[9].

With regard to the other explanatory variables, the effects of having a child are significantly negative for the probability of obtaining a regular job and for the working hours of nonregular workers. However, these effects are not significant for working hours of regular workers. This result can be interpreted in the following manner. Childcare should be an important reason for females to choose a less busy workplace. On the other hand, if females continue to work as regular workers, they have access to formal childcare. The significantly negative coefficients for the old female dummies imply that if female workers obtain re-employment after retirement, the new job is typically a nonregular one.

4.3 Additional analysis for the effects of diffusion of the LTCI

This subsection provides further analysis for the 2004 and 2010 rounds. Our probit estimates show that the launch of the LTCI had a substantial impact on female employment, but the effect of its diffusion between 2004 and 2010 is also 0.63 times as large. To consider greater details of the effects of the diffusion of the LTCI, we investigate two additional aspects.

[9]If longer working hours are a result of good matching between employers and employees, employers could offer generous support to females with longer working hours when these females face care requirements to discourage them from quitting their jobs. Such a model would provide an alternative reasoning for the positive effect of care requirements on working hours that is independent of the LTCI. Although it is difficult to distinguish our main hypothesis and this matching model using our main dataset, the discussions in Section 4.3—which use supplemental data—provide supporting evidence for our main hypothesis that there is a difference between regular and nonregular workers in the utilization of formal care services.

First, we decompose the disability of elders into more specific categories. Specifically, we adopt four disability levels that are self-reported in the Comprehensive Survey of Living Conditions[10]. A lower level corresponds to lesser disability. Level one indicates that the person has some disability but can leave the house alone. Level two indicates that he/she is independent in the house but requires help to leave the house. Level three indicates that the elderly person requires help in the house but can sit upright. Level four indicates that the elderly person is not able to sit up and must lie in bed all day. These detailed disability levels were only queried for 2004 and 2010, and we do not have corresponding observations for 1998.

Table 5 about here

Table 5 presents the estimation results with disability levels. An elder categorized in the lowest disability level did not affect female labor force participation in 2010, although this category had a significantly negative effect in 2004, as shown in (1A) of Table 5. This might imply that lighter care needs are more likely to be passed onto formal care sectors as a response to the diffusion of the LTCI.

Second, we consider the difference between regular and nonregular workers in greater detail. Our switching regression estimates indicate that the distinct effects of work type existed in 2010. However, it is difficult to tell whether this difference was already present as a result of the launch of the LTCI, because the data availability problem prevents us from employing the switching regression estimation to the 2004 round. To address this question, we provide informative descriptive statistics from the care questionnaire of the Comprehensive Survey of Living Conditions.

Table 6 about here.

Table 6 presents the averages of days per month for which households utilize formal care services. The figures are measured for the month previous to the interview. Owing to the small sample size, we only show several descriptive statistics and do not employ estimation based on statistical models. We can see a clear difference in the frequencies of access to formal care services for regular and nonregular workers. From 2004 to 2010, there was a reduction in home care among nonregular workers, while there was in increase in home care among regular workers. Further, there was an increased usage of day care service in both categories of workers, but the magnitude of the increase was

[10] An alternative choice is the LTCI classification, but we do not adopt it for three reasons. First, they have been surveyed after the launch of the LTCI, it is not possible to investigate its effects on the 1998 round. Second, because they are only queried in the care questionnaire, the adoption of this variable causes a large reduction of the sample size. Third, because the classification level is assigned only when elders apply, there is possible self-selection. Furthermore, the self-reported disability levels and the LTCI classification levels are generally compatible. In 2004, there was correspondence between elders with self-reported level one and LTCI levels one or two, self-reported level two and LTCI levels one to three, self-reported level three and LTCI levels two to five, and self-reported level four and LTCI levels three to six. In 2010, there are correspondences between elders with self-reported level one and LTCI levels one to three, self-reported level two and LTCI levels two to five, self-reported level three and LTCI levels three to six, and self-reported level four and LTCI levels five to seven.

larger for regular workers. As a consequence of these changes, households with regular workers utilized more services than households with nonregular workers in 2010, while the opposite occurred in 2004. This finding implies that our estimation result for distinct effects of work types on care requirements and female labor supply were realized only recently.

4.4 A numerical analysis for the effects of the LTCI on increase in female working hours

To consider the overall effect of the LTCI on the female labor supply, we calculate the per-capita expected effects on the potential working hours, which includes both the reduction of working hours for employed workers and the loss caused by changes in the status of female labor force participation. For simplicity, we use the disabled elder dummy—C_j—in this analysis. The overall reduction in working hours per female is calculated in the following manner:

$$E[H|C=1]-E[H|C=0] = \int \{E[H_j|C_j=1,\boldsymbol{w}_j,\boldsymbol{x}_j]-E[H_j|C_j=0,\boldsymbol{w}_j,\boldsymbol{x}_j]\}f(\boldsymbol{w}_j,\boldsymbol{x}_j)d\boldsymbol{w}_j d\boldsymbol{x}_j$$

where for $c=0,1$,

$$\begin{aligned} & E[H_j|C_j=c,\boldsymbol{w}_j,\boldsymbol{x}_j] \\ &= E[H_j|C_j=c,E_j=1,\boldsymbol{w}_j,\boldsymbol{x}_j]Pr(E_j=1|C_j=c,\boldsymbol{w}_j,\boldsymbol{x}_j) \\ &\quad +E[H_j|C_j=c,E_j=0,\boldsymbol{w}_j,\boldsymbol{x}_j]Pr(E=0|C=c,\boldsymbol{w}_j,\boldsymbol{x}_j) \\ &= E[H_j|C_j=c,E_j=1,\boldsymbol{w}_j,\boldsymbol{x}_j]Pr(E_j=1|C_j=c,\boldsymbol{w}_j,\boldsymbol{x}_j). \end{aligned}$$

The integral with respect to $\boldsymbol{w}_j$ and $\boldsymbol{x}_j$ can be approximated using the Monte Carlo integral. The expectations can be approximated using the estimated coefficients from the two-part model, which are denoted as $\hat{\alpha}_H, \hat{\alpha}_E, \hat{\boldsymbol{\gamma}}$ and $\hat{\boldsymbol{\beta}}$. For females without work, because we do not observe explanatory variables for job characteristics, tenure, large firm dummies, and public sector dummies, we evaluate these variables using their sample averages. Then, we obtain the following equations:

$$\begin{aligned} & E[H_j|C_j=1,\boldsymbol{w}_j,\boldsymbol{x}_j] - E[H_j|C_j=0,\boldsymbol{w}_j,\boldsymbol{x}_j] \\ &= (\hat{\alpha}_H + \boldsymbol{x}_j'\hat{\boldsymbol{\beta}})\Phi(\hat{\alpha}_E + \boldsymbol{w}_j'\hat{\boldsymbol{\gamma}}) - (\boldsymbol{x}_j'\hat{\boldsymbol{\beta}})\Phi(\boldsymbol{w}_j'\hat{\boldsymbol{\gamma}}) \\ &= \hat{\alpha}_H\Phi(\hat{\alpha}_E + \boldsymbol{w}_j'\hat{\boldsymbol{\gamma}}) + \boldsymbol{x}_j'\hat{\boldsymbol{\beta}}[\Phi(\hat{\alpha}_E + \boldsymbol{w}_j'\hat{\boldsymbol{\gamma}}) - \Phi(\boldsymbol{w}_j'\hat{\boldsymbol{\gamma}})]. \end{aligned}$$

On the right-hand side of the last equation, the first term represents the expected effect of care requirements on the working hours of female workers who do not change their employment status. The second term represents the expected effect for female workers who change their employment status by exiting from or entering the labor market.

Table 7 about here.

Table 7 presents our calculation for the expected per capita reduction in working hours. The care requirements had a smaller effect on the reduction in working hours in 2010 than in 2004, both for ongoing workers and for workers who change their working status. The calculated effect of diffusion of the LTCI is an increase of approximately three hours per week for each female.

4.5 Robustness check

This subsection provides an additional analysis to guarantee robustness of our main empirical results provided in the previous subsection. Specifically, we consider the endogeneity between female labor force participation and female working hours for the 2004 and 2010 rounds. It is possible that those who cannot work longer fail to earn a desirable amount of labor income and are more likely to quit their job. To address such endogeneity, we adopted the following Type-II Tobit model:

$$\begin{aligned} E_j &= I[C_j\alpha_{ET} + \boldsymbol{w}_j'\boldsymbol{\gamma}_T + \eta_{E,j} \geq 0], \\ H_j &= \begin{cases} 0 & \text{if} \quad E_j = 0 \\ C_j\alpha_{HT} + \boldsymbol{x}_j'\boldsymbol{\beta}_T + \eta_{H,j} & \text{if} \quad E_j = 1 \end{cases}, \end{aligned}$$

where $\eta_{E,j}$ and $\eta_{H,j}$ are error terms that are possibly correlated. We use the Heckit estimation to handle the endogeneity.

We also consider the endogenous working decision in our analysis of work types. Instead of the two-part switching regression model in (3.3) and (3.4), we adopt the following switching regression with a polychotomous choice. The jth household has three options: not employed (as a reference alternative), employed as a nonregular worker, or employed as a regular worker. Working hours are differently characterized for nonregular and regular workers in the switching regression framework. That is,

$$\begin{aligned} N_i^* &= C_j\alpha_{NT} + \boldsymbol{z}_{N,i}'\boldsymbol{\lambda}_N + \epsilon_{N,i}, \\ R_i^* &= C_j\alpha_{RT} + \boldsymbol{z}_{R,i}'\boldsymbol{\lambda}_R + \epsilon_{R,i}, \\ N_i &= 1 \quad \text{if } N_i^* \geq 0,\ N_i^* \geq R_i^*, \\ R_i &= 1 \quad \text{if } R_i^* \geq 0,\ R_i^* \geq N_i^*, \\ H_i &= \begin{cases} C_j\alpha_{HN} + \boldsymbol{x}_{N,i}'\boldsymbol{\beta}_N + \epsilon_{HN,i} & \text{if} \quad N_i = 1 \\ C_j\alpha_{HR} + \boldsymbol{x}_{R,i}'\boldsymbol{\beta}_R + \epsilon_{HR,i} & \text{if} \quad R_i = 1 \end{cases}, \end{aligned}$$

where N_j and R_j are the nonregular work and regular work dummies, respectively. We use the multinomial logit model for the choice among the three alternatives. Further, we allow for the existence of correlations between pairs of error terms $(\epsilon_{N,i}, \epsilon_{HN,i})$ and $(\epsilon_{R,i}, \epsilon_{RN,i})$, and utilize the Heckit estimation, which is described by Maddala (1983, pp. 275-277).

Table 8 about here.

Table 8 presents the Heckit estimation results for the second-stage of the Type-II Tobit model, the multinomial logit model for a polychotomous choice, and the second-stage of the switching regression model. The estimated signs of the disabled elder dummies are consistent with our basic estimation. However, these estimation results exhibit weak identification. For the Type-II Tobit model, our exclusion restriction, the ratio of active job offers to job seekers, does not have significant effects for the 2010 sample, as seen in (1B) of Table 2. Moreover, for the switching regression model with a polychotomous choice, it is difficult to find an appropriate exclusion restriction to characterize the choice of work type. In addition to exclusion restrictions, the nonlinearity of the inverse Mills ratio can also help to guarantee identification of the Heckit estimators. However, as summarized in Puhani (2000), the inverse Mills ratio is nonlinear only for extreme values of the explanatory variables in the first stage. Therefore, our basic estimation in the previous section provides more reasonable estimates, at least with regard to finite sample analysis.

5 Discussion and conclusion

This study analyzed Japan's unique experience of market-oriented social insurance of elderly care. We investigated the effects of this policy on female labor supply using newly available large-scale microdata. Our empirical study has revealed that the negative impact of caregiving on work intensity continues to exist, but has decreased after the launch of the LTCI and its diffusion. Further, there is a gender gap in the negative impacts of care requirement. Male disabled elders no longer have an influence on the female labor supply, but female elders still reduce the work intensity of coresident females. Moreover, the care requirement negatively affects the probability of obtaining a regular job. On the other hand, female regular workers are more likely to utilize formal care, whereas many nonregular workers provide informal care by themselves.

Because of the lack of micro-level information, the scope of this study is limited to quantifying general impacts of the LTCI without consideration of underlying mechanisms. There are two possible directions in which further studies can extend the perspective of this study using more intensive datasets.

The first direction of future studies is to use detailed information of receipt data. As a limitation of our study, even with the care questionnaire of the Comprehensive Survey of Living Conditions, we cannot observe details of household expenditures for ascertaining the benefits of LTCI. Because of this data availability problem, we cannot show the underlying causes responsible for the effects of the LTCI. In particular, as mentioned in Section 4.3, there are several distinctions between the effects in the 2004 and 2010 rounds, but the source of these differences cannot be investigated in this study. For example, there is a possibility that the difference was caused by the 2006 LTCI amendment, which is conventionally considered to have negative effects on female labor supply because of the reduction of benefits for elders who are assigned to lighter care classifications. For more comprehensive analysis, we need information regarding detailed consumption behaviors of elders for various care services.

The second direction of future studies is to use panel data like the Japanese Study of Aging and Retirement (JSTAR), which began recently and is ongoing. Our analysis using cross-section data at different periods can control macroeconomic trends and observed household and regional characteristics. However, we cannot address possible endogeneity in unobserved factors and care requirements. Specifically, living allocation of family members can be correlated both with the health status of elders and the female labor supply. The sharp decline in the number of households in which elders and their married children coreside can cause a change in Japanese social norms and hence the conventional caregiving practice by daughters-in-law. Further analyses to control the living allocation choice using panel data can reveal more systematic implications of the effects of the LTCI.

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Figures and tables

Year		(1)1998	(2)2004	(3)2010
Dependent variables	Employment (E_j)	0.609(0.488)	0.676(0.468)	0.695(0.461)
	Working hour (H_j)		24.618(19.345)	24.807(19.171)
	Regular work (R_j)		0.342(0.474)	0.303(0.460)
Care related explanatory variables (C_j)	Disabled elder	0.075(0.263)	0.193(0.395)	0.239(0.427)
	Male disabled elder	0.028(0.165)	0.060(0.238)	0.064(0.244)
	Female disabled elder	0.047(0.212)	0.133(0.339)	0.175(0.380)
	Elder disability level 1		0.062(0.241)	0.073(0.261)
	Elder disability level 2		0.065(0.247)	0.092(0.289)
	Elder disability level 3		0.033(0.178)	0.039(0.193)
	Elder disability level 4		0.033(0.180)	0.035(0.184)
	Spouse of disable elder	0.027(0.162)	0.057(0.232)	0.060(0.237)
Other explanatory variables	# Household members	5.155(1.250)	5.004(1.271)	4.792(1.280)
	Having children	0.484(0.500)	0.405(0.491)	0.347(0.476)
	Age	44.405(7.580)	46.496(7.540)	48.459(7.790)
	Age 60	0.021(0.144)	0.033(0.177)	0.063(0.243)
	Ratio of active job offers	0.908(0.252)	0.669(0.160)	0.464(0.093)
	Tenure		8.332(10.044)	9.926(11.506)
	Large firm		0.056(0.229)	0.103(0.304)
	Public sector		0.067(0.249)	0.071(0.257)
	Higher education			0.237(0.425)
Sample size		15,659	10,150	8,515

Table 1: Descriptive statistics. Standard deviations in parentheses.

	(1)			(2)			(3)		
Year	(A)1998	(B)2004	(C)2010	(A)1998	(B)2004	(C)2010	(A)1998	(B)2004	(C)2010
Disabled elder	-0.160***	-0.104***	-0.0697***				-0.223***	-0.148***	-0.102***
	(0.0155)	(0.0127)	(0.0126)				(0.0190)	(0.0151)	(0.0143)
Male disabled elder				-0.0854***	-0.0497**	-0.0149			
				(0.0245)	(0.0207)	(0.0213)			
Female disabled elder				-0.206***	-0.132***	-0.0913***			
				(0.0192)	(0.0153)	(0.0145)			
Spouse of disabled elder							0.152***	0.124***	0.112***
							(0.0248)	(0.0194)	(0.0202)
# Household members	0.0306***	0.0295***	0.0338***	0.0296***	0.0274***	0.0323***	0.0278***	0.0237***	0.0285***
	(0.00397)	(0.00456)	(0.00486)	(0.00398)	(0.00460)	(0.00488)	(0.00400)	(0.00467)	(0.00497)
Having children	-0.105***	-0.0794***	-0.0733***	-0.104***	-0.0759***	-0.0715***	-0.102***	-0.0714***	-0.0668***
	(0.0115)	(0.0139)	(0.0156)	(0.0116)	(0.0140)	(0.0156)	(0.0116)	(0.0140)	(0.0156)
Age	-0.0290	-0.0870**	-0.0649*	-0.0213	-0.0784**	-0.0571	-0.0206	-0.0711**	-0.0528
	(0.0285)	(0.0351)	(0.0387)	(0.0286)	(0.0352)	(0.0388)	(0.0286)	(0.0352)	(0.0388)
Age ≥ 60	-0.414***	-0.422***	-0.294***	-0.414***	-0.420***	-0.291***	-0.412***	-0.418***	-0.290***
	(0.0241)	(0.0273)	(0.0242)	(0.0241)	(0.0274)	(0.0242)	(0.0242)	(0.0275)	(0.0242)
Ratio of job seekers	0.267***	0.0870***	0.0457	0.266***	0.0874***	0.0460	0.265***	0.0844***	0.0469
	(0.0158)	(0.0293)	(0.0541)	(0.0158)	(0.0293)	(0.0541)	(0.0158)	(0.0293)	(0.0541)
Sample size	15,659	10,150	8,515	15,659	10,150	8,515	15,659	10,150	8,515

Table 2: Probit estimation for employment, marginal effect. Standard errors in parentheses. $***$, $**$ and $*$ denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

	(1)		(2)		(3)	
Year	(A)2004	(B)2010	(A)2004	(B)2010	(A)2004	(B)2010
Disabled elder	-1.057***	-0.810**			-1.670***	-1.289***
	(0.349)	(0.361)			(0.439)	(0.441)
Male disabled elder			-0.664	-0.252		
			(0.515)	(0.594)		
Female disabled elder			-1.292***	-1.073**		
			(0.441)	(0.423)		
Spouse of disabled elder					1.607**	1.471**
					(0.656)	(0.676)
# Household members	0.146	0.219	0.130	0.201	0.0828	0.155
	(0.123)	(0.134)	(0.124)	(0.134)	(0.125)	(0.137)
Having children	-1.210***	-1.466***	-1.188***	-1.438***	-1.137***	-1.389***
	(0.351)	(0.401)	(0.352)	(0.401)	(0.353)	(0.403)
Age	-8.460***	-10.94***	-8.386***	-10.83***	-8.302***	-10.74***
	(1.105)	(1.224)	(1.109)	(1.225)	(1.107)	(1.227)
Age ≥ 60	-2.849**	-1.352	-2.822**	-1.321	-2.759**	-1.276
	(1.388)	(0.917)	(1.388)	(0.918)	(1.388)	(0.915)
Tenure	0.467***	0.434***	0.467***	0.434***	0.467***	0.433***
	(0.0129)	(0.0132)	(0.0129)	(0.0132)	(0.0129)	(0.0132)
Large firm	-1.521***	-1.526***	-1.523***	-1.523***	-1.516***	-1.519***
	(0.416)	(0.378)	(0.415)	(0.378)	(0.415)	(0.377)
Public sector	-0.658*	2.491***	-0.657*	2.488***	-0.662*	2.479***
	(0.373)	(0.424)	(0.373)	(0.424)	(0.373)	(0.423)
Constant	63.07***	71.35***	62.86***	70.99***	62.77***	70.88***
	(4.268)	(4.766)	(4.279)	(4.766)	(4.271)	(4.772)
Sample size	6,865	5,916	6,865	5,916	6,865	5,916

Table 3: Regression estimation for working hours. Robust standard errors in parentheses. $***$, $**$ and $*$ denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

	(1)Probit	(2)Switching regression	
		(A)Nonregular	(B)Regular
Disabled elder	-0.0383**	-1.418***	0.857**
	(0.0161)	(0.512)	(0.386)
# Household members	0.00161	0.107	0.115
	(0.00623)	(0.184)	(0.136)
Having children	-0.0391**	-1.289**	-0.303
	(0.0187)	(0.589)	(0.430)
Age	0.0211	-6.119***	-1.886
	(0.0531)	(1.638)	(1.246)
Age ≥ 60	-0.238***	-0.152	-0.399
	(0.0307)	(1.557)	(1.630)
Ratio of active job seekers	-0.0396		
	(0.0701)		
Higher education	0.0899***		
	(0.0151)		
Tenure		0.331***	0.0650***
		(0.0208)	(0.0153)
Large firm		-0.743	-0.486
		(0.521)	(0.432)
Public sector		1.704**	1.367***
		(0.852)	(0.426)
Inverse Mills ratio		-3.039	5.196**
		(3.380)	(2.224)
Constant		52.61***	52.99***
		(6.738)	(5.190)
Sample size	5,916	3,332	2,584

Table 4: Two-part switching regression results: (1) Probit estimation for work type (marginal effect) and (2) switching regression estimation for working hours(second stage). Standard errors in parentheses. $***$, $**$ and $*$ denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

	(1)Probit		(2)Regression	
Year	(A)2004	(B)2010	(A)2004	(B)2010
# Household members	0.0297***	0.0341***	0.151	0.217
	(0.00456)	(0.00486)	(0.123)	(0.134)
Having children	-0.0795***	-0.0746***	-1.220***	-1.488***
	(0.0139)	(0.0156)	(0.351)	(0.402)
Age	-0.0829**	-0.0625	-8.409***	-10.96***
	(0.0351)	(0.0387)	(1.105)	(1.223)
Age $\geq$ 60	-0.419***	-0.293***	-2.827**	-1.358
	(0.0275)	(0.0242)	(1.393)	(0.917)
Ratio of job seekers	0.0893***	0.0469		
	(0.0293)	(0.0542)		
Tenure			0.468***	0.434***
			(0.0129)	(0.0132)
Large firm			-1.524***	-1.527***
			(0.416)	(0.378)
Public sector			-0.650*	2.491***
			(0.373)	(0.424)
Elder disability level 1	-0.0507**	-0.0113	-0.342	0.176
	(0.0203)	(0.0198)	(0.546)	(0.563)
Elder disability level 2	-0.118***	-0.0720***	-1.638***	-1.575***
	(0.0206)	(0.0188)	(0.585)	(0.534)
Elder disability level 3	-0.115***	-0.151***	-1.503**	-1.362
	(0.0286)	(0.0288)	(0.761)	(0.876)
Elder disability level 4	-0.177***	-0.109***	-1.037	-0.579
	(0.0283)	(0.0297)	(0.815)	(0.897)
Constant			62.85***	71.42***
			(4.269)	(4.764)
Sample size	10,150	8,515	6,865	5,916

Table 5: Estimation with disability levels: (1) Probit estimation for employment(marginal effects) and (2) regression estimation for working hours(second stage). Standard errors for probit, robust standard errors for regression in parentheses. $***$, $**$ and $*$ denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

		(1)2004		(2)2010	
		Average days	Sample size	Average days	Sample size
Nonregular workers	Home care	2.152(4.958)	322	1.497(4.310)	290
	Day care service	3.339(5.343)	322	4.776(6.310)	290
Regular workers	Home care	1.828(4.421)	145	1.959(5.211)	121
	Day care service	2.372(4.561)	145	5.000(6.177)	121

Table 6: Average numbers of utilization's of formal care services, days per month. Standard deviations in parentheses.

	Employed workers	Change of working status	Total reduction
2004	-0.618(0.192)	-10.230(1.174)	-10.849(1.274)
2010	-0.514(0.116)	-6.940(0.889)	-7.455(0.941)

Table 7: Expected reduction of working hours per female. Standard deviations in parentheses

	(1)Type-II Tobit		(2)Multinomial logit		(3)Switching regression	
	(A)2004	(B)2010	(A)Nonregular	(B)Regular	(A)Nonregular	(B)Regular
Disabled elder	-5.572***	-4.443**	-0.259***	-0.410***	-1.123**	1.014**
	(0.982)	(1.777)	(0.0629)	(0.0694)	(0.496)	(0.423)
# Household members	1.394***	1.923**	0.157***	0.169***	-0.0234	-0.0127
	(0.282)	(0.828)	(0.0258)	(0.0276)	(0.248)	(0.150)
Having children	-4.522***	-5.105***	-0.282***	-0.444***	-1.025*	-0.129
	(0.762)	(1.792)	(0.0800)	(0.0852)	(0.575)	(0.466)
Age	-12.05***	-14.17***	-0.352*	-0.274	-5.847***	-1.586
	(1.290)	(1.957)	(0.209)	(0.222)	(1.699)	(1.250)
Age ≥ 60	-24.85***	-18.30**	-0.863***	-1.990***	1.537	0.0223
	(4.655)	(8.169)	(0.110)	(0.176)	(1.230)	(1.841)
Ratio of job active job offers			0.179	0.00517		
			(0.287)	(0.309)		
Higher education			0.0373	0.408***		
			(0.0653)	(0.0667)		
Tenure	0.468***	0.434***			0.331***	0.0651***
	(0.0136)	(0.0134)			(0.0208)	(0.0153)
Large firm	-1.478***	-1.520***			-0.746	-0.485
	(0.454)	(0.398)			(0.521)	(0.433)
Public sector	-0.612	2.507***			1.689**	1.387***
	(0.431)	(0.476)			(0.853)	(0.427)
Inverse Mills ratio	-29.40***	-35.92**			4.238	4.237**
	(5.998)	(17.22)			(5.558)	(1.957)
Constant	57.72***	60.67***	1.011	0.506	54.00***	52.48***
	(4.260)	(6.915)	(0.827)	(0.883)	(7.726)	(5.163)
Sample size	6,865	5,916	8,515	8,515	3,332	2,584

Table 8: Robustness check for endogeneity of working decisions: (1)Type-II Tobit estimation for working hours, (2) multinomial logit estimation for work type and (3)Switching regression for working hours(second stage). Standard errors in parentheses. $***$, $**$ and $*$ denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.