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Abstract

This paper argues that the expectation of having to provide care for aging parents in the future may be a major factor contributing to the current low fertility rate in Japan. Using data from the 1998 and 2008 National Family Research of Japan (NFRJ) surveys and a Poisson-logit hurdle model, this paper examines whether the expectation of having to look after parents in the future affects a couple's current family planning. The first stage model is a logit model which examines the decision of whether or not to have any children, and then in the second stage a Poisson model is applied to explain the number of children a couple has conditional on the couple having at least one child. The empirical evidence presented suggests that there are strong generational effects, and that for the post-war cohort, the probability of having to look after a parent increases the probability of couples being childless.

Keywords: age care, fertility, hurdle model

JEL codes: J13

1. Introduction

The combination of a low fertility rate and an aging population has been one of the major concerns for many western countries. Most of the countries in the Organization for Economic Cooperation and Development (OECD) have shown significant drops in their fertility rates since 1970 (OECD 2014). At the same time, life expectancy has risen due to improvements in medicine. Subsequently, their populations have been ageing rapidly. An aging population challenges the maintenance of a pay-as-you-go pension system and also raises concerns that there may be a shortage of labour supply. These concerns raise policy interest in how we can increase the fertility rate.

The Japanese total fertility rate hit a minimum of 1.26 in 2005, and although recent statistics indicate a slight recovery in the fertility rate to 1.41, the absolute number of births continues to decrease (Ministry of Health, Labour and Social Welfare (MHLSW) 2013). Over the past three decades, the proportion of childless couples has more than doubled, and the proportion of couples with more than two children has shrunk (see Table 1).

[Table 1 around here]

Recently, Japanese Prime Minister Shinzo Abe has proposed increasing the availability of childcare to boost fertility. Although providing cash benefits, reducing the cost of childcare, and/or increasing the availability of childcare may be important factors to increase fertility, this paper will examine this issue from a different perspective, that is, it examines whether the expectation of having to look after parents in the future has any effects on a couple's fertility. It is important to note that in Japan the responsibility for looking after aged parents is primarily on the shoulders of family members rather than private institutions. Table 2 reports who takes care of a family member when that member is in need of care. More than 95% of such frail family members are aged 65 years or older (MHLSW, 2012a). According to Table 2, more than

60% of family care providers live with the family member when that family member is in need of care. In 2010, 75% of the care providers are cohabiting and non-cohabiting family members, and only 13% of them are private care providers.

[Table 2 around here]

The cost of private care is very high. It is estimated that before social security payments, an individual who receives private care spends on average around 180,000 Japanese yen ($US 1,500($1=120 yen)) per month for the services this care involves (MHLSW 2012b). The long-term decline in the fertility rate in Japan means that over time aged parents have to be looked after by fewer children, and possibly for longer periods of time due to the rise in life expectancy. For the children who are potential care providers, this means that the cost of future care of aged parents has increased substantially over time. Moreover, the *Employment Status Survey* suggests that around 5% of the employed are reported to engage in family care, and that in 2011 alone approximately 100,000 people left work to provide care for a family member (Ministry of Internal Affairs and Communication 2012). Departures from the labour force or reductions in their labour supply due to the provision of family care leads to a reduction in an individual's lifetime income, and this in turn potentially reduces their demand for children.

We argue that Japanese react to future uncertainty by adjusting consumption. Zhou (2003) argue that earning uncertainty has a statistically significant effect on Japanese household saving. Bessho and Tobita (2008) find that uncertainty is statistically significant and increases the wealth to income ratio. It can be argued that an increase of uncertainty of having to look after a parent increases precautionary savings. Thus, it can be argued that a couple with high probability of looking after aged parents in the future may reduce family size and consumption on children.

Our search of the literature suggests that the only other paper that discusses the link between caring for the aged and child rearing is Sakata and McKenzie (2014). Their focus is on the connection between the expected burden associated with caring for parents and the *quality* of children, rather than the *quantity* of children that is analyzed here. Sakata and McKenzie's (2014) proxy variable for the expected future burden of caring for parents is based solely on the number of parents and parents in law who are alive at the time of the couple's marriage divided by the total number of siblings of the husband and wife including themselves. In contrast, in this paper, an estimate of the probability that a couple will look after their parents or parents-in-law is estimated from a model using past data and the characteristics of the couple at the time of their marriage. There is evidence that the probability of having to look after parents reduces the probability of having any children.

The rest of this paper consists of five sections. Section 2 discusses the burden hypothesis and estimation technique, while Section 3 describes the data. Section 4 reports the estimation results and discusses their implications, and section 5 examines the effects of the burden of caring for aged parents on investments on children. Section 6 contains a brief conclusion.

2. Empirical Model

The neoclassical economic theory of fertility contends that the decision to have a child is a function of the costs and benefits of children subject to an income constraint and an individual's preference for children. Under such a utility maximization process, the neoclassical economic theory of fertility predicts that any reduction in the cost of having children or any increase in income induces an increase in the demand for children (Becker 1993). If an individual has to leave the labour force or reduce his/her labour supply so as to care for frail and aging parents, the individual's lifetime income will be reduced dramatically. In addition, if the cost of (an)other good(s) namely, the cost of future care for aged parents, increases, individuals may

have to compromise their consumption on children. We argue that any increase in the cost of future care for aged parents will reduce the demand for children. Thus, an increase in future burden of caring for frail and aging parents reduces the demand for children.

It should be noted that the presence of parents or parents-in-law may also have a positive effect on the decision to have a child. For Japan, there is evidence which suggests that co-residence with parents or parents-in-law is associated with a higher probability of labour force participation by wives (see, for example, Ogawa and Ermisch 1996), but the most recent evidence suggests that co-residence with a mother or a mother-in-law is associated with a higher probability of labor force participation of the wife, whereas co-residence with a father or father-in-law has no effect on the labor supply of the wife (see Mano and Yamamura 2011). The standard explanation for this is that mothers and mothers-in-law help shoulder the burden of housework, whereas fathers and fathers-in-law do not and merely add to the burden of housework. On the other hand, Nagase (1999) finds that following child bearing co-residence with parents or parents-in-laws is strongly associated with a higher probability of labour force participation by a wife. This suggests that the costs of having children for a husband and wife are quite dependent on whether they co-reside with a parent or parent-in law, and the gender of the co-residing parent or parent-in-law. Unfortunately, the data set used in this paper does not contain any information on co-residence with parents or parents-in-laws, so we are unable to investigate this channel.

We first discuss how we model the impact of the probability of having to look after a parent on a woman's fertility (section 2.1), and then we consider the question of how to estimate the probability that a person has to look after a parent or a parent in law (section 2.2).

2.1 Estimating the Effects of the Probability to Look after a Parent on Fertility

This section discusses modelling a couple's decision relating to their family size. It is assumed that couples decide on their family size at the time of their marriage[4]. To be specific, the dependent variable to be explained is the number of children born to a woman who is aged 45 years or older as we assume that women of this age have completed their childbearing activities. The focus of the analysis is the impact of the estimated probability of the couple being the primary care provider for at least one parent or parent in law, P_i, has any effects on the wife's fertility.

As the existing literature (for example, Melkersson and Rooth (2000) and Santos Silva and Covas (2000)) has argued, there may be a significant difference between childless couples and couples with at least one child. Both Melkersson and Rooth (2000) and Santos Silva and Covas (2000)) argue that the outcome of zero children may result from two distinct sources: a couple choosing to have no children or a couple being physically unable to have children at all, whereas the outcome of one or more children is just a result of a couple's choice. Given this difference between childless couples and couples with children, one way of modelling this is to use a Poisson logit hurdle model. The first stage model is a logit model that examines the decision of whether to have a child or not, and in the second stage for couples who decide to have children a standard Poisson regression model is used to explain the number of children they have. If the number of children that couple *i* has is denoted by y_i, then the probability of having 0, 1,.., *N* children is given by (see Winkelmann (2003) and Cameron and Trivedi (2013)):

$$\text{Prob}(y_i = 0|x_i) = w_i \qquad (1a)$$

$$\text{Prob}(y_i = j|x_i) = (1 - w_i)\lambda_i^j exp(-\lambda_i)/[(1 - \exp(-\lambda_i))j!] \ , \quad j=1,2,3,\ldots \qquad (1b)$$

where w_i is given by a logistic function, namely, $w_i = \exp(x_i'y)\ /(1 + \exp(x_i'y)$ and $\lambda_i = \exp(x_i'y)$[5]. In

[4] The reason for this restriction is that if a later date is used for the timing of the decision about family size, it is not possible to incorporate information on the timing of the death of parents because this information is not fully available for parents-in-law in our data set.

[5] Although they assumed to be the same here, the explanatory variables appearing in w_i, and λ_i could be different.

this model, $\mathrm{E}(y_i|y_i > 0) = 1 + \exp(x'_i\beta)$ and $\mathrm{E}(y_i > 0) = 1 - w_i$, so that $\partial \mathrm{E}(yi|yi > 0)/\partial x_i$ $= \exp(x'_i\beta)\beta$, and $\frac{\partial E(yi>0)}{\partial xi} = w_i(1 - w_i)\gamma$, and $\partial \mathrm{E}(yi)/\partial x_i = \exp(x'_i\beta)\beta\ (1 - w_i)\lambda_i^j$.

The vector of control variables, x_i, includes the probability of the couple looking after their parents and/or parents-in-law, P_i, that is discussed in detail in section 2.2, and other control variables such as the husband's age at the time of his marriage, the wife's age at the time of her marriage, the husband's education level, the wife's education level, an urban dummy, seven regional dummies, and cohort dummies for the husband. In addition, we include a 0-1 dummy variable which takes the value 1 if husband is an only child and 0 otherwise to control for some of the effects of being the eldest son[6]. The expectation is that a higher probability of the couple looking after their parents and/or parents-in-law will tend to reduce the number of children the couple has. It should be noted that if we think of the bivariate choice problem of having no children or some children, the model in equations (1a) and (1b) will imply this is determined by a logit model with $\mathrm{Prob}(y_i = 0|x_i) = w_i$ and obviously $\mathrm{Prob}(y_i > 0|x_i) = 1 - w_i$.

2.2 Estimating the Probability of Having to Look after a Parent

As mentioned earlier, in Japan the primary care providers for frail aging parents are other family members rather than private care providers. The 1998 National Family Research of Japan (NFRJ98) survey contains information on whether the respondent was the primary care provider for a parent and parent-in-law before they died. For each deceased father, mother, father-in-law or mother-in-law, the NFRJ98 survey asks respondents whether the relevant parent or parent-in-law required care for a period before they died, and if the answer is yes, respondents are then asked "(t)o what extent were you involved in caregiving and nursing?" The respondent picks an answer from one of the following five choices: 1) I was the primary

[6] In Japan, eldest sons traditionally are expected to have a boy to carry on the family line. This tradition may increase the likelihood of having children. Unfortunately, the survey we are using does not have any information on the birth order for the husband and his siblings, so we are unable to identify if the husband is the eldest son when he has siblings.

person involved in care providing and nursing; 2) I was involved, though not as the primary care provider; 3) I was somewhat involved; 4) I was not much involved; and 5) I had very little opportunity to be involved because of the person's sudden death. Based on cases where the relevant parent or parent-in-law had already died by the time of the survey, Table 3 provides information on who provides what level of care to whom.

Perhaps the most surprising finding in Table 3 compared to the conventional wisdom is that for their own parents both the husband and wife report that they are just as likely to be the primary care provider. In the Japanese context, it is not surprising to find that husbands do not look after their in-laws as the primary care provider, but their wives do and they are more likely to do so than for the case of looking the wife looking after her own parents!

[Table 3 around here]

In order to measure the future burden of caring for aged parents, we construct a probability of having to look after a parent or parent-in-law in the future. For the *i*'th couple let p_{ijk} be the probability of individual j in couple i looking after parent k where j denotes either the husband (h) or wife (w) and k refers to husband's (h) or wife's (w) parent(s). For example, for the husband of the *i*'s couple, the probability of looking after his own parent(s) (husband's parent) is denoted by p_{ihh} and the probability of looking after his parent(s)-in-law (wife's parent) is denoted by p_{ihw}.

In order to estimate the probability of looking after a parent in the future, the information in NRFJ98 is more appropriate than the information on whether the respondent is currently involved in caregiving and nursing a parent as many of the respondents do not yet have aging frail parents. Another advantage of this

information is that we can take account of those cases where a parent's death was sudden and the respondent did not have to provide care for the parent when computing the probability of looking after a parent.

Denoting the husband and wife by h and w, respectively, we construct four 0-1 dummy variables $care_{ijk}$ (j=h,w, k=h,w) which take the value one if the ith respondent was the husband (j=h) or wife (j=w) and "the primary person involved in care providing and nursing" for k's parents where k denotes the husband (h) or the wife (w), and 0 otherwise, and denote the associated probability of $care_{ijk} = 1$ by p_{ijk}, then the following logit model is used to model $p_{ijk}$and explain the two outcomes for $care_{ijk}$, for each value of j and k, namely[7][8],

$$p_{ijk} = \Pr(care_{ijk} = 1) = \exp(CARE_{ijk})/(1 + \exp(CARE_{ijk})),\ j=h,w;\ k=h,w;\ i=1,..,N_{jk} \qquad (2)$$

where N_{jk} is the available sample size for the relevant combination of j and k.

For $CARE_{ijk}$, the following four models are assumed:

$$CARE_{ihh} = \beta_{10} + \beta_{11} siblings\_h_i + \beta_{12} one\_parent\_h_i + \beta_{13} birth\_year\_h_i + \beta_{14} educ\_h_i \quad (3)$$

$$CARE_{ihw} = \beta_{20} + \beta_{21} siblings\_w_i + \beta_{22} one\_parent\_w_i + \beta_{23} birth\_year\_h_i + \beta_{24} educ\_h_i \quad (4)$$

$$CARE_{iww} = \beta_{30} + \beta_{31} siblings\_w_i + \beta_{32} one\_parent\_w_i + \beta_{33} birth\_year\_w_i + \beta_{34} educ\_w_i \quad (5)$$

[7] In theory, for each parent or parent-in-law, a multinomial logit model with three choices: the husband is the primary care provider; the wife is the primary care provider; and neither the husband nor the wife are the primary care provider, could be considered. However, in order to estimate this model we need to observe for each parent or parent-in-law, both the husband and the wife's responses to the questions about whether they were the primary care provider. For the 1998 NFRJ survey, we only observe the respondent's answers to the questions, that is, either the husband's responses or the wife's responses, but not both. For the 2008 NFRJ survey, we do not observe either the husband's responses or the wife's responses.

[8] It is natural to expect that the wealth of the parents might influence whether they choose care that could be acquired in the market, and non-market care provided by one or more children. Unfortunately, the surveys we are using have no information on the assets held by the parents. The 1998 survey collects information on the educational level of the parents, but it only relates to the father. The 2008 survey does not even collect this information. Incorporating this information into our models would lead to a sample size reduction of around 60%.

$$CARE_{iwh} = \beta_{40} + \beta_{41} siblings\_h_i + \beta_{42} one\_parent\_h_i + \beta_{43} birth\_year\_w_i + \beta_{44} educ\_w_i \quad (6)$$

where $siblings\_j_i$ is the number of j's siblings (husband (j=h) or wife (j=w))[9], and $one\_parent\_j_i$ is a 0-1 dummy variable which takes the value one if one of j's parents is already deceased at the time of his/her marriage, and 0 otherwise (husband (j=h) or wife (j=w)), $birth\_year\_j_i$ is the year of the birth of individual j (husband (j=h) or wife (j=w)), and $educ\_j_i$ is the years of education for individual j (husband (j=h) or wife (j=w)). As Table 2 indicates, in around 25% of all cases a cohabiting spouse is the care provider, so the variable $one\_parent\_j_i$ highlights the fact that if one of the parents is already deceased at the time of a couple's marriage, the probability of having to look after a parent should increase. $birth\_year\_j_i$ is included to control for cohort effects, and $educ\_j_i$ is used as a proxy for income. Although parental income at the time of marriage may be an important predictor of the probability of their children having to provide future care, such information is not available in our data set[10]. All the explanatory variables used in equations (2)-(5) are measured at the time of the couple's marriage.

In equations (2)-(5), one key issue is the sign of $\beta_{i1}, i = 1,2,3,4$, that is, the impact of the number of siblings. There are a number of possibilities depending on what assumptions are made. If we assume that the couple in question is completely selfish, then they will not care about the provision of care for their parents or for their parents-in-law by themselves or by their siblings, and so the number of siblings that a couple has should be irrelevant, that is, $\beta_{i1} = 0, i = 1,2,3,4$. One simple story for why $\beta_{i1} > 0$ is that if there is only one primary care provider, then on a probabilistic basis with more siblings, the likelihood of being the

[9] It might be argued that birth order could be important for determining who among the siblings cares for the parent, but unfortunately, we could not incorporate the information on the birth order of the respondents among siblings due to the unavailability of the relevant data.

[10] Although, the data set contains information on the level of education for the father and the occupation of father when the respondent was 15 years old, this information is not available for the father-in-law of the respondent. Since we need both information of own parents and parents in law to estimate the probability of future care for an aging parent, we could not incorporate this information in our estimation.

primary care provider can be expected to be smaller. A more sophisticated story would assume that the couple and the couple's siblings are altruistic with respect to their parents (and parents-in-law), so that the provision of care for their parents (parents-in-law) by them and their siblings can be viewed as being a version of the public goods game. The typical theoretical analysis of this game with Cournot-Nash behavior suggests that with a marginal per capita return (MPCR) that lies somewhere between zero and one, an individual will not contribute anything no matter how many siblings there are because the individual's payoff decreases as his or her contribution to his/her parents' (or parents-in-law) care increases (for an excellent survey see Mercier Ythier, 2006). However, holding the MPCR constant, Isaac and Walker's (1988, Observation 2) experimental evidence suggests that changes in group size have weak, if any, effects at all. However, for a low MPCR their evidence suggests more free riding in smaller groups. Isaac and Walker (1988) also suggest that an alternative potential impact of increasing numbers is to reduce the MPCR itself and reduce the incentive to provide the public good.

Once estimates of the parameters have been obtained, the combination of equations (2) and (3)-(6) enables us to compute the probability that husbands and wives will have to look after a parent or parent-in-law conditional on the explanatory variables in the models. Using a sample of married men and married women in the 1998 NFRJ survey who have a deceased parent, the parameters of the models p_{ihh} and p_{ihw}, and p_{iww} and p_{iwh}, respectively, can be estimated. Using these estimated coefficients and a different sample of all the available married men and women, respectively, including those who yet to experience the death of their parents or parents-in-law in the 1998 and 2008 NFRJ surveys estimates of p_{ihh} and p_{ihw}, and p_{iww} and p_{iwh} can be obtained by inserting the values of explanatory variables and estimated parameters into equations (3)-(6).

Caregiving and nursing of a frail parent should be seen as the joint product of couple. For example, a husband may not be the primary care provider if he is the breadwinner of the household, but his wife can be the primary care provider. Thus, the probability of the couple having to look after at least one of their parents or parents-in-law as a couple, P_i, can be written as[11]:

$$P_i = 1 - (1 - p_{ihh}) * (1 - p_{ihw}) * (1 - p_{iww}) * (1 - p_{iwh}). \quad (7)$$

Here, $(1 - p_{jki})$ is the husband or wife's probability of *not* becoming a primary care provider for a parent or parent-in-law. Therefore, $(1 - p_{ihh}) * (1 - p_{ihw}) * (1 - p_{iww}) * (1 - p_{iwh})$ is the probability that neither the husband nor the wife are the primary care provider for any of their parents or parents-in-law.

3. Data

The data used in this paper are drawn from two repeated cross section surveys, the 1998 and 2008 National Family Research of Japan (NFRJ, Kazoku nitsuiteno Zenkoku Chousa) surveys. These surveys are surveys conducted by the Japan Society for Family Sociology, and the data is archived in the Social Science and the Social Science Japan Data Archive, Information Center for Social Science Research on Japan, Institute of Social Science, The University of Tokyo. The surveys were conducted by the drop-off-pick-up method. In the 1998 survey, 10,500 individuals who were aged between 28 and 77 as of December 1998 were surveyed with a response rate of 66.52% (6,985 responses). In the 2008 survey, 9,400 individuals who were aged between 28 and 72 as of December 2008 were surveyed, and the response rate was 55.35% (5,203 responses). The properties of the 1998 and 2008 NFRJ data sets, including their representativeness, are discussed in Japan Society of Family Sociology (2000, 2010), respectively.

[11] The computation in equation (7) assumes that each of events are independent. The data set we have does not allow us to adequately consider the possibility of dependences among the events.

In our analysis, the two surveys are pooled together and a survey year dummy is added (see Roberts and Binder 2009). One of the advantages of using the NFRJ data sets is that they contain rich information on parents and siblings. Here, information on whether the married respondent's parents and parents-in-law are alive at the time of the respondent's marriage is used. Furthermore, information on the number of siblings the respondent has and the number of siblings for his/her spouse has is also used.

3.1 Sample Selection

We estimate our models explaining the number of children in the household using data for couples where the wife's age is 45 years or older. This selection is imposed to focus on those women who have completed child bearing. The sample is further confined to respondents who satisfy the following six criteria. First, we focus on married respondents where the husband's age at the time of the marriage is 18 years old or older and the wife's age at the time of the marriage is 16 years old or older. This is because the Japanese legal age for marriage is 18 for men and 16 for women. Second, we only used respondents who are currently married and who have never been divorced or widowed. Divorcees or widows may have children from their previous marriage, but the NFRJ surveys do not contain information on their previous marriages. Third, we also excluded an observation if the wife's age at her marriage was 45 or older as she is unlikely to have any child. Fourth, we dropped observations which report a deceased child as this can have an impact on later fertility decisions. Fifth, in order to control for outliers, observations where there are 10 or more siblings (99 % quantile) are excluded. Finally, we exclude all observations which do not contain all the information on all the variables required for estimating the relevant model. After imposing these selection criteria, 4,050 observations remain. Descriptive statistics for this sample are summarized in Table 4.

[Table 4 around here]

4. Results and Discussion

All results reported are obtained using STATA Version 12 (StataCorp. (2011)). Table 5 reports the results of estimating equations (2) with each of (3), (4), (5) and (6), and these results are denoted by (5.1), (5.2), (5.3) and (5.4), respectively. The sibling variables are all have negative estimated coefficients and the variables are statistically significant in the cases of a husband looking after his parents in law (5.2) and a wife looking after her own parents (5.3): that is, as the number of siblings increases the probability of being the primary care provider falls. Nothing is statistically significant in equation (5.1) suggesting that it is rather hard to systematically forecast whether or not a husband will look after his own parents.

[Table 5 around here]

Using the parameter estimates reported in Table 5, and equations (2)-(6), the probability of a married couple having to look after at least one parent, P_i, is estimated. Since P_i is a generated regressor, the standard errors in any model that uses this generated regressor will, in general, not be computed appropriately (see Newey and McFadden (1994)), so bootstrapped standard errors based on 1000 replications are reported.

It can be argued that there may be substantial generational differentials among the respondents. Japanese society has undergone a huge transition during the World War II and the post war period. Urbanization and the rise of nuclear family can be expected to have huge impacts on family planning and the support families provide for frail aging parents. To account for possible cohort effects, the sample was divided into three groups according to the "generation" the husband belonged to: those husbands born before 1938; those husbands born between 1937 and 1947; and those husbands born after 1946[12].We used this division to compare the post-war generation and previous generations, and at the same time, to maintain a sufficient sample size in each cohort.

[12] In this analysis, the probability of having to look after a parent or parent in law using (6) is based on the estimates reported in Table 6 that use the whole sample. Ideally it would have been better to estimate each of the models on each of the cohort samples, but this was not possible given the small sample sizes in each case.

4.1 Preliminary Logit Analysis

Before estimating the Poisson-logit hurdle model specified in equations (1a) and (1b), some preliminary logit analyses to show the difference between childless couples and couples with one or more children are conducted. Three logit models for the first birth, the second birth and the third birth, respectively, are estimated. For the first birth case, the dependent variable is a 0-1 binary variable which takes the value 1 if the couple has at least one child and 0 otherwise. For the second (third) birth case, the dependent variable is a binary variable which takes the unity if the couple has at least two (three) children, and takes the value 0 if the couple has only one child, (two children). Moreover, as Wakabayashi and Kureishi (2011) indicate, there is evidence to suggest that a son preference exists among the older generation in Japan, so we include an additional variable to account for son preference in the models for second and third births. "First_girl" is a dummy variable that takes the value 1 if the first child is a girl, and 0 if it was a boy. "No_boy" is a dummy variable which takes the value unity if the first child and second child are both girls, and 0 otherwise.

The estimated results for the logit analyses for the first, second and third births are summarized in Table 6. For first births, the probability of having to look after at least one parent is insignificant except for the post war cohort born after 1946. This suggests that for the post war cohort a couple with a high probability of looking after a parent in the future is more likely to be childless. On the other hand, for second births, the estimated coefficient on P_i is not significant in any case. For third births, the estimated results are even more complex. Using the full sample, the estimated coefficient of P_i is positive and significant. However, similar to the estimated results for the first child, for the respondents who were born after 1946, the estimated coefficient of P_i is negative and significant. Thus, there appears to be some strong cohort effects. The post-war generation, born after 1946, is more likely to reduce the family size when they face a high probability of having to look after a parent. The results for the post-war cohort are consistent with the macro data reported in Table 1. According to Table 1, there has been a significant increase in the proportion of

couples that are childless, but the proportion of couples with two children has remained rather steady. Furthermore, the proportion of couples with 3 or more children has declined over time.

[Table 6 around here]

It is important to note that the empirical evidence suggests there is a son preference in Japan as the "First_girl" dummy has a positive and significant coefficient for second births (equation (6.5)) and the "No_boy" dummy has a positive and significant coefficient for third births (equations (6,9) and (6.10)). However, younger generation do not have son preference as the coefficients of these variables tend to be insignificant for the younger cohorts. These results are consistent with Wakabayashi and Kureishi (2011).

4.2 Poisson-Logit Hurdle Analysis

As discussed earlier, the difference between childless couples and couples with children may be significant, and one way of modelling this is to use a Poisson logit hurdle model. The empirical results for the Poisson-logit hurdle model estimated using the *hplogit* command in Stata[13] are summarized in Table 7. Using all observations, the probability of having to look after at least one parent has a negative estimated coefficient in the first stage logit analysis, but it is positive in the subsequent Poisson regression. However, these neither of these estimates are significant.

[Table 7 around here]

When we divide the sample into the three cohort groups, the estimated coefficient on the probability of having to look after at least one parent in the first stage logit analysis is only significant in the case of the cohort born after 1946. For this later cohort, the estimated coefficient of the probability of having to look after a parent is negative in the first stage of logit.

[13] The code for the hplogit command is available from the following URL:
http://fmwww.bc.edu/RePEc/bocode/h/

In the subsequent stage of Poisson regression, for the full sample analysis and the sub-sample analysis, the estimated coefficients of the probability of having to look after a parent is positive except for the cohort born after 1946, but all the estimated coefficients are insignificant.

5. Concluding Remarks

This paper examines whether the expectation of having to look after parents in the future affects current fertility. The main focus of research in this area has been on the effects of factors such as female labour force participation, child care availability, and child care benefits on fertility. In contrast, this paper proposes that the expectation of future care for aging parents may be another major factor contributing to the low fertility rate in Japan. As far as we know, no study has examined the effects of the future burden of aging parents on fertility. In this paper, a Poisson-logit hurdle model is used to examine this issue. The first stage model is a logit model which examines the decision of whether to have a child or not, and in the second stage the number of children is explained using a Poisson model. The empirical evidence based on estimates of the logit Poisson hurdle model suggests that there are strong generational effects. In particular, for the post-war cohort, an increase in the probability of having to look after a parent increases the probability of couples being childless. Our simpler logit analysis also provides similar results. For the post-war generation, in particular, an increase in the probability of having to look after a parent increases the probability of couples being childless and reduces the probability of having a third child. These micro data based results correspond well with the macro data for Japan that indicates recently more couples are becoming childless, while more couples who decide to have a child give up after the second birth.

Under the Japanese Public Nursing Care Insurance Law (Kaigo hoken ho) of 1997, a Nursing Care Insurance system which aims to reduce the burden of aged care on families by introducing a compulsory national nursing care insurance levy, and using the revenue from that levy to fund nursing care for those

requiring it began operation on 1 April 2000. Kan and Kajitani (2014) find that the introduction of the Public Nursing Care Insurance significantly reduced the time that wives devoted to nursing care. If the expectation of having to look after parents in the future affects current fertility, then as Kan and Kajitani (2014) find the introduction of long-term care benefits in 2000 should reduce some of the burden on families to care for their parents and possibly work to increase the fertility rate over the short- and long-term. The Japanese fertility rate has slightly increased since 2005 and casual empiricism might suggest that this results from this policy change. Our next research goal is to examine the impacts of the introduction of compulsory long-term care benefits scheme in 2000 on fertility.

The analysis in this paper has assumed that the age at which the husband and wife get married are not affected by the probability that they will have to look after their parents or parents-in-law. Given that women bear a disproportionate weight of the burden associated with caring for parents and parents-in-law, it is possible that women delay the age at which they marry or do not marry at all. Since the age at which the wife marries has (a) a statistically significant and negative effect on whether to have children or not, and (b) in the case where the couple decides to have children, this age also has in most cases a statistically significant negative effect on the expected number of children, considering this indirect channel for their impact of the probability of care could lead to an even stronger effect than is found in this paper.

One potential motive for parents to have children is that if the parents think about their own aged care in the future. In this case, there would seem to be an incentive to have more children, but for your own care it is not obvious whether it is better to have a small number of high quality children or a large number of lower quality, or choose to save for old age rather than having children.

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Table 1: The Number of Children Born to Couples with a Marriage Duration of 15-19 Years

Year	Number of Children					
	0	1	2	3	4 or more	Total (%)
1977	3	11	57	23.8	5.1	100
1982	3.1	9.1	55.4	27.4	5	100
1987	2.7	9.6	57.8	25.9	3.9	100
1992	3.1	9.3	56.4	26.5	4.8	100
1997	3.7	9.8	53.6	27.9	5	100
2002	3.4	8.9	53.2	30.2	4.2	100
2005	5.6	11.7	56	22.4	4.3	100
2010	6.4	15.9	56.2	19.4	2.2	100

Source: National Institute of Population and Social Security Research (IPSS) (2011).

Note:

For each year, the figures shown are the perecentages of first-marriage couples who have been married for 15-19 years (excluding couples who did not state the number of their children) in each group.

Table 2: Who Looks After a Frail Family Member in Japan?

Year	Total	Sub-total	Cohabiting Family Members					Non-Cohabiting family members	Private Caregivers	Other	Not Known
			Spouse	Child	Spouse of Child	Mother or Father	Other family				
2001	100	71.1	25.9	19.9	22.5	0.4	2.3	7.5	9.3	2.5	9.6
2004	100	66.1	24.7	18.8	20.3	0.6	1.7	8.7	13.6	6	5.6
2007	100	60	25	17.9	14.3	0.3	2.5	10.7	12	0.6	16.8
2010	100	64.1	25.7	20.9	15.2	0.3	2	9.8	13.3	0.7	12.1

Source: MHLSW (2012a).

Table 3: Who Provides How Much Care to Whom?

Care giver	Care Receiver	Care Level: Primary Caregiver	Involved but Not Primary Caregiver	Somewhat Involved	Not Much Involved	Sudden Death	Total	Sample Size
Husband	Father	16.7	30.4	24.8	23.3	4.9	100	658
	Mother	18.5	32.4	24.1	22.5	2.6	100	623
	Father-in-law	3.7	15.3	30.0	45.8	5.3	100	380
	Mother-in-law	3.9	16.2	31.7	44.1	4.1	100	413
Wife	Father	14.7	26.8	31.6	22.5	4.4	100	675
	Mother	24.0	26.5	29.3	17.5	2.7	100	709
	Father-in-law	35.2	17.3	25.0	19.3	3.3	100	452
	Mother-in-law	47.3	19.8	17.0	13.6	2.2	100	581

Source:
Computed from the 1998 NFRJ survey.
Notes:
(1) This Table reports the percentage of respondents who said they provided a particular level of care for a specified parent or parent-in-law. This information is only available if the relevant parent or parent-in-law has died by the time of the survey and the respondent reported that the relevant parent or parent-in-law required care for a period before his or her death. . This is one of the important reasons for differences in the sample sizes for identical care givers.

(2)This Table contains estimates of the care level provided for two types of caregivers and four types of care receivers based on answers to supplementary questions 1 for questions 32, 33, 34, and 35 for fathers, mothers, fathers-in-law, and mothers-in-law, respectively, on the 1998 NFRJ survey. It should be noted that these questions are only asked on the 1998 NFRJ survey.

Table 4: Descriptive Statistics for the Sample Used to Estimate the Poisson-Logit Hurdle Model

Variable	Obs	Mean	Std. Dev.	Min	Max
Estimated Probability of Having to Look after a Parent	4050	0.482	0.064	0.275	0.737
Number of Children	4050	2.201	0.882	0	6
Number of Husband's Siblings	4050	3.644	2.124	0	9
Number of Wife's Siblings	4050	3.505	2.034	0	9
One_parent_h (1 if only one of the husband's parents is alive)	4050	0.225	0.418	0	1
One_parent_w (1 if only one of the wife's parents is alive)	4050	0.185	0.388	0	1
Husband's Birth Year	4050	1940.736	9.749	1911	1973
Wife's Birth Year	4050	1943.496	9.304	1917	1963
Uni_h (1 if the husband has a university degree or higher)	4050	0.224	0.417	0	1
Uni_w (1 if the wife has a university degree or higher)	4050	0.053	0.223	0	1
Husband's Age at Marriage	4050	27.166	3.617	19	53
Wife's Age at time of Marriage	4050	24.402	3.361	16	43
Only_son (1 if the husband is an only child)	4050	0.062	0.241	0	1
Urban (1 if lives in a urban area)	4050	0.578	0.494	0	1
1998 Survey dummy	4050	0.713	0.453	0	1
1st_child (1 if had first child)	4050	0.963	0.188	0	1
2nd_child (1 if had second child)	3892	0.884	0.320	0	1
3rd_child (1 if had third child)	3428	0.371	0.483	0	1
First_girl (1 if the first child is a girl)	3892	0.475	0.499	0	1
No_boy (1 if both of the two children are girls)	3428	0.229	0.420	0	1

Source: NFRJ surveys for 1988 and 2008.

Table 5: Probability to Look after a Parent or Parent-in-Law

	(5.1)	(5.2)	(5.3)	(5.4)
Main Care Provider	Husband		Wife	
Care Recipient	Own Parent	Parent-in-law	Own Parent	Parent-in-law
Number of husband's siblings	-0.0026			-0.0116
	[0.004]			[0.007]
One_parent_h (1 if only one of husband's parents is alive)	-0.0234			-0.0461
	[0.025]			[0.032]
Husband's birth year	-0.0014	0.001		
	[0.002]	[0.001]		
Uni (1 if husband's has a university degree or higher)	0.0029	-0.0155*		
	[0.031]	[0.009]		
Number of wife's siblings		-0.0056*	-0.0194***	
		[0.003]	[0.005]	
One_parent_w (1 if only one of wife's parents is alive)		-0.0169*	0.0385	
		[0.009]	[0.032]	
Wife's birth year			-0.0027	-0.0071**
			[0.002]	[0.003]
Uni (1 if wife's has a university degree or higher)			0.0599	0.1043
			[0.095]	[0.144]
Observations	1,097	839	1,200	957
Log likelihood	-465.4	-97.22	-550.2	-594.2
Pseudo R-squared	0.0018	0.0451	0.0221	0.0104
Wald Statistics (Chi2) for the test of the null hypothesis that all coefficients in the model (except the constant) are jointly zero.	1.687	9.378**	21.48***	12.68**

Notes: For each variable, marginal effects are reported, and the figures in brackets are robust standard errors. The statistical significance of variables at the 1%, 5% and 10% significance levels are denoted by ***, ** and *, respectively. All equations include a constant term whose estimated coefficient is not reported.

Table 6: Results of estimating logit models for each birth occurrence

	First Child				Second Child				Third Child			
	ALL	Husband's birth year<1938	1938<= Husband's birth year<1947	Husband's birth year>=1947	ALL	Husband's birth year<1938	1938<= Husband's birth year<1947	Husband's birth year>=1947	ALL	Husband's birth year<1938	1938<= Husband's birth year<1947	Husband's birth year>=1947
	(6.1)	(6.2)	(6.3)	(6.4)	(6.5)	(6.6)	(6.7)	(6.8)	(6.9)	(6.10)	(6.11)	(6.12)
Probability of Having to Look after Parents	-0.0709	0.0417	0.0184	-0.296**	0.00187	-0.0431	-0.058	0.2074	0.365*	0.2827	0.3569	-0.9853**
	[2.441]	[4.456]	[4.711]	[4.454]	[1.314]	[2.149]	[2.706]	[2.909]	[0.967]	[1.529]	[1.699]	[1.949]
Uni_h (1 if husband has a university degree or higher)	-0.001	-0.0019	0.0192*	-0.0143*	-0.0000	-0.0244	0.0071	0.0187	0.0501**	0.0081	0.0387	0.0590*
	[0.216]	[0.517]	[0.563]	[0.315]	[0.132]	[0.247]	[0.221]	[0.210]	[0.095]	[0.201]	[0.174]	[0.151]
Uni_w (1 if wife has a university degree or higher)	0.0101	0.003	-0.0185	0.0397**	-0.00318	0.0124	-0.0304	-0.008	-0.0582	0.0436	0.0307	-0.0163
	[0.492]	[0.819]	[0.891]	[0.673]	[0.276]	[0.611]	[0.485]	[0.485]	[0.208]	[0.527]	[0.371]	[0.320]
Husband's Age at Marriage	-0.001	-0.0003	0.00156	-0.0047***	-0.00247	-0.0029	0.0009	-0.0047	-0.00855**	-0.0145**	-0.0001	-0.0078
	[0.033]	[0.054]	[0.064]	[0.057]	[0.019]	[0.034]	[0.037]	[0.040]	[0.015]	[0.023]	[0.027]	[0.028]
Wife's Age at Marriage	-0.0048***	-0.0043***	-0.0056***	-0.0029*	-0.0093***	-0.0085**	-0.0127***	-0.0065*	-0.0121***	-0.0175***	-0.0196***	-0.0037
	[0.034]	[0.060]	[0.064]	[0.061]	[0.021]	[0.038]	[0.040]	[0.044]	[0.017]	[0.028]	[0.032]	[0.031]
Husband's Birth Year	-0.0003	0.000637	-0.000183	-0.00125	-0.0000363	-0.0017	-0.0047	0.0006	-0.00108	-0.0116***	-0.0078	0.0034
	[0.016]	[0.046]	[0.065]	[0.051]	[0.008]	[0.022]	[0.037]	[0.028]	[0.006]	[0.017]	[0.028]	[0.019]
Only_son (1 if husband is the only child)	-0.0059	-0.0109	-0.0138	0.0197	0.0202	-0.0153	0.0637	0.0242	-0.0182	0.0098	-0.0547	0.0251
	[0.340]	[0.629]	[0.619]	[0.616]	[0.235]	[0.370]	[0.546]	[0.495]	[0.148]	[0.276]	[0.290]	[0.291]
Urban (1 if lives in a urban area)	-0.0084*	-0.0065	-0.0044	-0.0106	-0.0259**	-0.0204	-0.0396**	-0.016	-0.0494***	-0.1055***	-0.0541*	0.0242
	[0.194]	[0.344]	[0.389]	[0.341]	[0.114]	[0.183]	[0.199]	[0.205]	[0.078]	[0.135]	[0.140]	[0.139]
1998 Survey dummy	-0.0016	-0.0279	0.00562	-0.0047	-0.0462***	-0.0535*	-0.0527**	-0.0395*	-0.0531**	-0.051	-0.0444	0.0122
	[0.218]	[0.564]	[0.397]	[0.387]	[0.140]	[0.354]	[0.254]	[0.230]	[0.093]	[0.228]	[0.149]	[0.169]
First_girl (1 if the first child is a girl)					0.0210**	0.0121	0.0222	0.028				
					[0.101]	[0.173]	[0.182]	[0.203]				
No_boy (1 if both the first child and the second chid are girls)									0.0454**	0.0820**	0.0176	0.0429
									[0.086]	[0.147]	[0.153]	[0.158]
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4050	1423	1378	1249	3892	1376	1331	1185	3428	1209	1167	1052
Log likelihood	-560.3	-172.6	-168	-203.3	-1341.0	-476.7	-455.3	-396.2	-2214.0	-765.0	-721.3	-686.4
Pseudo R-squared	0.122	0.121	0.106	0.185	0.038	0.044	0.057	0.038	0.021	0.060	0.023	0.022
Wald Statistics (Chi2) for the test of the null hypothesis that all coefficients in the model (except the constant) are jointly zero.	149.5***	62.57***	34.48***	78.45***	104***	39.58***	46.32***	31.21***	83.81***	84.96***	29.01***	30.94***

Note:

For each variable, marginal effects are reported, and the figures in brackets are bootstrapped standard errors (1000 repetitions). The statistical significance of variables at the 1%, 5% and 10% significance levels are denoted by ***, ** and *, respectively. All equations include a constant term whose estimated coefficient is not reported.

Table 7: Results of estimating of a Poisson-Logit Hurdle regression model

		(7.1)	(7.2)	(7.3)	(7.4)
		ALL	Husband's birth year<1938	1938<= Husband's birth year<1947	Husband's birth year>=1947
logit	Probability of Having to Look after Parents	-2.8928	1.9827	0.9285	-10.7492**
		[2.558]	[4.602]	[5.241]	[4.746]
	Uni_h (1 if husband has a university degree or higher)	-0.0629	-0.1184	0.9117*	-0.518
		[0.213]	[1.113]	[0.544]	[0.330]
	Uni_w (1 if wife has a university degree or higher)	0.4072	0.1718	-0.9469	1.3918**
		[0.491]	[7.092]	[3.643]	[0.678]
	Husband's Age at Marriage	-0.0396	-0.0143	0.0816	-0.1645***
		[0.031]	[0.058]	[0.069]	[0.054]
	Wife's Age at Marriage	-0.1923***	-0.2129***	-0.2680***	-0.1019*
		[0.034]	[0.064]	[0.068]	[0.059]
	Husband's Birth Year	-0.014	0.0306	-0.0081	-0.0444
		[0.016]	[0.045]	[0.065]	[0.048]
	Only_son (1 if husband is the only child)	-0.2381	-0.4975	-0.7822	0.703
		[0.365]	[0.799]	[1.891]	[4.806]
	Urban (1 if lives in a urban area)	-0.3415*	-0.3068	-0.2068	-0.4067
		[0.203]	[0.386]	[0.398]	[0.343]
	1998 Survey dummy	-0.0643	-1.3872	0.3218	-0.2055
		[0.217]	[6.486]	[0.385]	[0.397]
	Regional Dummies	Yes	Yes	Yes	Yes
poisson	Probability of Having to Look after Parents	0.3346	0.0761	0.1134	-0.6426
		[0.224]	[0.351]	[0.366]	[0.429]
	Uni_h (1 if husband has a university degree or higher)	0.0307	-0.044	0.0192	0.0676**
		[0.020]	[0.042]	[0.034]	[0.033]
	Uni_w (1 if wife has a university degree or higher)	-0.0535	0.0197	-0.0272	-0.0075
		[0.045]	[0.120]	[0.080]	[0.070]
	Husband's Age at Marriage	-0.0128***	-0.0233***	-0.0007	-0.0093
		[0.003]	[0.006]	[0.006]	[0.006]
	Wife's Age at Marriage	-0.0156***	-0.0109*	-0.0285***	-0.0118*
		[0.004]	[0.007]	[0.007]	[0.007]
	Husband's Birth Year	-0.0029**	-0.0183***	-0.0122**	0.0059
		[0.001]	[0.004]	[0.005]	[0.004]
	Only_son (1 if husband is the only child)	0.0504	0.0364	0.0579	0.0942
		[0.036]	[0.064]	[0.056]	[0.061]
	Urban (1 if lives in a urban area)	-0.0604***	-0.0834***	-0.0692**	-0.0084
		[0.016]	[0.029]	[0.027]	[0.028]
	1998 Survey dummy	-0.0883***	-0.1221***	-0.0653**	-0.0094
		[0.019]	[0.046]	[0.028]	[0.034]
	Regional Dummies	Yes	Yes	Yes	Yes
Observations		4,050	1,423	1,378	1,249
Log likelihood		-5,781	-2,055	-1,899	-1,788
Wald Statistics (Chi2) for the test of the null hypothesis that all coefficients in the model (except the constant) are jointly zero.		153.6***	720.5***	527.9***	80.65***

Notes:

The statistical significance of variables at the 1%, 5% and 10% significance levels are denoted by ***, ** and *, respectively.

Alhough both the Logit and Poisson models both contain constant terms, the estimates of these constant terms are not reported.

The figures in brackets are bootstrapped standard errors (1000 repetitions)