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The Effect of Inheritance Receipt on Individual Labor Supply: Evidence from Japanese Microdata[†]

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Abstract

This paper examines the effects of wealth on individual labor supply by considering inheritance receipts as an exogenous change in household wealth. Using Japanese microdata consisting of individuals aged 26–51, we find that (i) while men's probability of working does not respond to inheritance receipt, women's probability of working decreases; and (ii) in the case of most respondents the receipt of an inheritance seems to be unanticipated. We also test the unitary household model using information on respondents' spouses. The results indicate that who received an inheritance influences the labor supply decision of each household member, meaning that we find no support for the unitary model.

Keywords: Wealth effects, individual labor supply, inheritance receipt, unitary model

JEL Classification: D13, D64, J22

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1 Introduction

Understanding the effects of wealth on individual labor supply can provide meaningful insights for both researchers and policymakers. In an academic context, while many macroeconomic models assume that leisure is a normal good, some studies, especially those analyzing the effects of news shocks on macroeconomic variables (see, e.g., Beaudry and Portier 2014), rely on the formulation of household preferences proposed by Greenwood, Hercowitz, and Huffman (1988) in which the effect of wealth on individual labor supply is zero.[1] To make simulation exercises using macroeconomic models more reliable, it is important to empirically examine to what extent changes in wealth influence individual labor supply. In addition, if wealth has an impact on individual labor supply, this might also provide important insights on the link between wealth and consumption. Several recent studies examining the effect of wealth on household consumption find a much smaller marginal propensity to consume (MPC) out of wealth than predicted by the standard life-cycle/permanent income hypothesis (LC/PIH).[2] As highlighted by Cheng and French (2000), this may be due to a strong positive effect of wealth on leisure. That is, people consume an increase in wealth eventually, but mostly in the form of increased leisure, not consumption.

From policymakers' point of view, it is also important to understand to what extent an exogenous change in wealth reduces people's incentive to work. For example, one important policy issue has been whether an expansion of welfare programs to mitigate inequality depresses recipients' work incentives. While a substantial amount of empirical evidence on the effects of welfare programs on individual labor supply has been accumulated for the United States (see Moffitt 2002 for a comprehensive survey), evidence for Japan is still limited.

Against this background, the current paper examines the effects of wealth on individual labor supply using panel microdata for Japan. To identify the wealth effects on individual labor supply, the simplest approach is to regress individuals' employment status or hours worked on non-labor income using cross-section data. As highlighted by Keane (2011), however, one of the drawbacks of this approach is the endogeneity problem arising from the possible correlation between non-labor income and unobserved preferences for work. For instance, those who prefer working to enjoying leisure likely accumulate more wealth, which in turn means that they likely will receive more non-labor income (asset returns). In this case, the resulting positive correlation between the error term and non-labor income creates an upward bias in the estimation of wealth effects. For example, regressing men's

[1] It is well known that standard real business cycle models incorporating news shocks fail to explain the empirical observation that an anticipated positive technology shock increases current output. One of the reasons for this failure is that a positive future technology shock has a strong wealth effect on current leisure, leading to a drop in current labor supply and hence in current output.

[2] Poterba (2000) shows that, assuming the standard LC/PIH with no bequest motive, the theoretically obtained MPC ranges from 0.027 to 0.103, depending on the after-tax rate of return and the household planning horizon. Compared to these theoretically derived figures, a number of empirical studies find much smaller MPCs of 0.0077-0.0109 for the United States (Christelis, Georgarakos, and Jappelli 2015), 0.005-0.009 for the United Kingdom (Disney, Gathergood, and Henley 2010), and 0.0059–0.0082 for Japan (Hori and Niizeki 2017), to name a few.

hours worked on various types of non-labor income and a number of demographic variables using cross-sectional data for the United States, Pencavel (1986) suggests that an additional 10,000 dollars in asset income are associated with an *increase* in annual hours worked of 46 hours. However, this result seems rather counterintuitive and a possible explanation is the failure to control for unobserved preferences.

One way to overcome the endogeneity problem arising from ignoring preferences is to adopt a fixed effects approach using panel data. However, there may be other omitted variables potentially giving rise to endogeneity. To deal with such endogeneity issues, researchers often exploit situations or events that can be regarded as akin to randomized controlled experiments. In the case of research on the effect of wealth on individual labor supply, most studies following this approach focus on one of the following three types of natural experiment.

The first type of natural experiment employed is to focus on the effects of winning the lottery (Picchio, Suetens, and van Ours 2018, Cesarini et al. 2017, Arvey, Harpaz, and Liao 2004, Imbens, Rubin, and Sacerdote 2001, Lindh and Ohlsson 1996). Since winning the lottery is a random event (once the number of lottery tickets purchased is controlled for), it provides researchers with an ideal opportunity to identify the effect of an exogenous increase in wealth on individual labor supply.

The second type of experiment focuses on exogenous changes in taxes and the social security system such as changes in social benefits for recipients around a certain age (Bargain and Doorley 2011, Lemieux and Milligan 2008), changes in social security benefits after retirement (Coile and Gruber 2007, Chan and Stevens 2004, Krueger and Pischke 1992), changes in the normal retirement age (Hanel and Riphahn 2012, Mastrobuoni 2009), and changes in the tax system (Blundell, Duncan, and Meghir 1998, Eissa and Liebman 1996). Since changes in taxes and the social security system are independent of individuals' decision making, they also enable us to identify the effect of exogenous changes in wealth on individual labor supply.

The third type of experiment uses the incidence of inheritance receipt (Sugano and Matsuyama 2017, Doorley and Pestel 2016, Elinder, Erixson, and Ohlsson 2012, Brown, Coile, and Weisbenner 2010, Joulfaian and Wilhelm 1994, Holtz-Eakin, Joulfaian, and Rosen 1993). Compared to the previous two experiments, the disadvantage of this approach is that the probability of inheritance receipt and the inheritance amount may not be completely exogenous to individuals. For example, decedents may give a larger share to lazy children when dividing up their inheritance. Since lazy people are more likely to be out of the labor force, ignoring the preference for work gives rise to a downward bias in estimates of the link between wealth and individual labor supply.[3] This kind of bias, however, can be overcome by using panel data, provided that individual preferences are constant over time.

[3] Alternatively, decedents may give a larger share to *diligent* children when dividing up their inheritance. In that case, ignoring the preference for work leads to an upward bias in the estimation.

In the present paper, we follow the third approach and exploit inheritance receipt as an exogenous change in household wealth. The relative advantage of using this approach compared to focusing on changes in taxes and the social security system is that the latter often apply only to a specific group of the population. Lemieux and Milligan (2008), for example, focus on the fact that in Quebec, before 1989, childless social assistance recipients aged under 30 received much lower benefits than recipients aged 30 or above. Using a regression discontinuity approach, they find that the more generous social assistance benefits for those aged 30 and over reduced labor force participation. However, we think that the labor supply responses of those aged around 30 may substantially differ from other age groups, so that it would be problematic to generalize from such results. In contrast, the incidence of inheritance receipt does not apply to a specific group of the population only and inheritance recipients in our dataset range from age 26 to 51 at the time they received their inheritance.

Another advantage of our dataset is that it provides information on the employment status of the respondent's spouse and whether the respondent's spouse received an inheritance. This information enables us to test the unitary model, in which a household is regarded as a single decision-making unit. The important theoretical prediction of the unitary model is that a household pools its resources, so that household resources (not individual resources) are important for each individual's decision-making. In our dataset, we can test the unitary model by examining whether who received an inheritance within a household affects each household member's labor supply. That is, if the size of wealth effects on individuals' labor supply does depend on who received an inheritance within a household, the unitary model of the household is rejected.

The current paper is not the first attempt to examine the effect of wealth on individual labor supply employing a dataset on inheritances in Japan. Using the Japanese Study of Aging and Retirement (JSTAR), which is a biennial panel dataset covering individuals aged 50–75, Sugano and Matsuyama (2017) show that receiving an inheritance of 1 million yen increases the probability of retirement by 1 percentage point at age 60 and 6 percentage points at age 65 and that an unanticipated inheritance has a larger negative effect on individual labor supply. Our analysis differs from Sugano and Matsuyama's (2017) study in the following respects. First, their focus is the labor supply decision of elderly individuals aged 50–75, whereas we focus on working-age individuals from 26 to 51 years of age. Therefore, the results of our analysis can be regarded as complementary to theirs. Second, while JSTAR provides information on the inheritance amount only at the household level, our dataset, which we describe in detail in Section 2, contains the inheritance amount *at the individual level*. This allows us to test the unitary model as described above.

The remainder of the study is organized as follows. The next section introduces the dataset we employ and a first-shot result from our dataset. Section 3 describes our empirical strategy and estimation results. Finally, Section 4 concludes.

2 Data

The data employed in the current analysis are taken from the second wave of the "Family and Lifestyle Survey" (FLS hereafter) conducted in 2012 by our research group. To create the sample, we utilized the pool of approximately 220,000 consumer testers across Japan who were preregistered by INTAGE Inc., one of the largest research firms in Japan. More precisely, we first randomly drew 4,525 individuals from the pool in such a way that the distribution of individuals in terms of sex, residential area (10 groups), and age group (6 groups) for the first wave of our survey conducted in 2011 resembles that in the Population Census for Japan. We then tracked participants in the first wave to create the sample for the second wave of our survey conducted in 2012, which forms the basis for the current analysis. The response rate for the second wave is 86.2% (3,144 individuals).[4] Note that we only employ the second wave of the FLS to conduct our analysis. However, since the second wave contains some recall-based questions such as the past employment status, we treat it as a panel-structured dataset.

The FLS collects three important pieces of information that we need to conduct our analysis: (i) the year parents died,[5] (ii) the inheritance amount received, and (iii) the employment status before and after the parental death. Note that the FLS asks these questions not only with regard to respondents but their spouse as well, so that there are up to four observations (for each of the four parents) for each respondent. The FLS also collects information on respondents' and their spouses' demographic characteristics such as their age, sex, and number of children.

To conduct our analysis, we confine the sample based on the following criteria. First, individuals born before 1956 are dropped, since the age profiles of the employment status of these older cohorts seem to suffer from serious measurement error. To illustrate this, Figure 1 compares the employment status age profiles obtained from the FLS (our dataset) and the Labor Force Survey conducted by the Ministry of Health, Labour and Welfare (official statistics). As can be seen, both among male and female individuals, the employment rate for cohorts born before 1956 (the first four cohorts) tends to be lower than in the official statistics. A possible reason is that the question about individuals' employment status is on a recall basis and that older respondents find it difficult to correctly recall their employment status a long time ago. Second, we only include observations for which all of the following three variables are available: (i) the year that a parent died, (ii) the inheritance amount received, and (iii) the employment status of the respondent or spouse over a 9-year window centered at the year of parental death. Third, the sample is confined to observations for which information on the respondent's/spouse's characteristics (age, sex, number of children aged 12 or below, and health

[4] It should be noted that the average educational attainment in the FLS is higher and the percentage of single-person households lower than in the Population Census. This means that our results need to be interpreted with caution. See Hori et al. (2013) for more details of the survey

[5] Unfortunately, the FLS only collects information on the year of parental death, not the year of inheritance receipt. However, we believe that the time lag between these two events is not very long.

status) *at the time of the death of the parent*, not the time of the survey (2012), is available. Fourth, the sample is limited to individuals who lost only one of their own parents in a 9-year window, since otherwise it would be difficult to determine the death of which parent (and hence which inheritance) caused the individual's change in labor supply.[6] The final sample consists of 158 men and 205 women that lost at least one of their own parents.

Table 1 provides descriptive statistics of the sample we employ to conduct our analysis. The average age of individuals in our sample at the time of the survey in 2012 was about 49 years for both sexes. However, what we are really interested in in our investigation is individuals' age at the time their parent died, which in our sample on average is about 38 years for men and 37 years for women. This may seem much younger than one might expect, but note that our sample consists only of those that did lose a parent, while in the general population many in the age group we focus on still have all their parents. Next, a majority of respondents (including spouses) in our sample report that the amount they inherited when their parent passed away was zero, with only 41% of men and 32% of women reporting a non-zero (positive) amount. This likely reflects that in many cases the other parent was still alive. The average inheritance amount (including those whose inheritance amount was zero) converted into 2010 prices using the Consumer Price Index is 4.30 million yen for men and 2.41 million yen for women (approximately 43,000 and 24,100 U.S. dollars, respectively). Note that since more than half of respondents (including their spouses) reported a zero inheritance amount, the median is zero for both sexes.

3 Empirical strategy and results

3.1 Benchmark case

In our benchmark estimation, we compare changes in the employment status of those who received an inheritance with those who did not after controlling as much as possible for other factors. Normalizing the year of parental death to $t = 0$, the benchmark estimation equation is:

$$Emp_{it} = \beta_0 + \beta_1 POST_t + \beta_2 [POST_t \times Inher_{i0}] + \boldsymbol{\beta_3'} \boldsymbol{X_{it}} + \alpha_i + \mu_t + \varepsilon_{it}, \quad (1)$$

where Emp_{it} is an employment dummy that equals one if individual i is employed and zero otherwise, $POST_t$ is a dummy that equals one if $0 \leq t \leq 4$ and zero if $-4 \leq t \leq -1$, $Inheri_{i0}$ is a dummy that equals one if individual i received an inheritance and zero otherwise, and $\boldsymbol{X_{it}}$ is a vector of control variables consisting of the number of children aged 12 or below and an illness dummy that equals one if individual i had a major illness in year t impeding normal daily life and zero

[6] Note that the respondent does not have a legal right to receive an inheritance when his/her spouse's parent died in Japan. Thus, the information on the death of spouse's parent is not used for analyzing the respondent's labor supply decision, except in Section 3.3 in which the unitary model of household is tested.

otherwise. The key parameter in Equation (1) is β_2, which captures the *additional* effect of inheritance receipt on changes in the probability of working and is expected to be negative. It is important to add the control variables to avoid endogeneity issues. For example, if receiving an inheritance leads individuals to be more inclined to have (more) children because it eases the financial burden of child-rearing, and those who have more children are more likely to quit their job, the estimate for β_2 would be downward-biased if the number of children was not controlled for. Similarly, some individuals may exit the labor market due to a mental health problem caused by the death of their parent death and, as a result, might be treated favorably when the inheritance is divided among heirs. That is, given that in Japan it is common for inheritances to be divided up in negotiations among surviving family members, such individuals may be treated favorably in such negotiations and receive a larger inheritance as a result (see Hamaaki, Hori, and Murata 2016 for custom of intra-family division of bequests in Japan). Thus, ignoring such health issues could result in downward biased estimates.

All time-constant factors including unobservables such as the preference for work are captured by α_i as an individual fixed effect, while aggregate effects are controlled for by year dummies, μ_t. Note that $Inheri_{i0}$ alone cannot be incorporated in Equation (1), since it is time-constant so that it is included in α_i. The idiosyncratic error ε_{it} is assumed to be uncorrelated with the explanatory variables. We regard Equation (1) as a linear probability model and estimate it using the fixed effect approach.

Table 2 shows the regression results obtained estimating Equation (1). To check the robustness of the results, the pre-inheritance period is defined in two ways, namely as $t = -1$ and $t \leq -1$. In the former case, we simply drop observations for $t \leq -2$ when estimating Equation (1). Columns (1) to (4) show the benchmark model estimates excluding the control variables. Except in column (1), coefficients have the expected sign, although only in column (2) are the coefficient estimates statistically significant. Taken together, the results provide weak evidence that, in the case of women, receiving an inheritance has a negative effect on labor supply. To check whether the coefficient estimates are contaminated by other factors, we add control variables including year dummies in columns (5) to (8). Columns (5) and (7) suggest that inheritance receipt does not have a statistically significant impact on men's labor supply.[7] In sharp contrast, columns (6) and (8) show that receiving an inheritance reduces women's labor supply despite the fact that the average amount inherited by women (excluding zero inheritances) is smaller than men's.

Looking at the results in more detail, column (6) suggests that women whose parent passed away but who did not receive an inheritance were 6.50 percentage points more likely to be working after the death of the parent than before. One possible explanation for this phenomenon is that these women

[7] The small and statistically insignificant labor supply responses of men may be due to the fact that some men out of work started their own business using their inheritance. In fact, some previous studies show that positive wealth shocks *increase* the probability of being self-employed (Doorley and Pestel 2016, Lindh and Ohlsson 1996). Unfortunately, we cannot distinguish between employment and self-employment in our dataset.

had expected to inherit something but then discovered they did not. In this case, not receiving an inheritance represents an unexpected negative shock to their wealth, increasing the likelihood that they worked.[8] Another possible explanation is that some of these women did not work before the death of their parent in order to provide home care to the parent. In this case, the death of their parent enabled them to rejoin the labor market.

Columns (6) and (8) also show that women who received an inheritance were significantly less likely to work following the death of their parent than before, with the probability being around 10 percentage points lower than that of women that did not receive an inheritance, which is consistent with the idea that wealth has a negative effect on labor supply. Thus, the results in column (6) suggest that the combined effect is that the likelihood that women whose parent died and who did receive an inheritance were 4.70 percentage points less likely to work after the death of their parent than before.

So far, we have only considered whether individuals received an inheritance or not and have not exploited information on the inheritance *amount*. Therefore, we next replace the key explanatory variable with the inheritance *amount* (including zero) and examine whether those who received a larger inheritance were more likely to stop working. To do so, we estimate the following equation:

$$\begin{aligned} Emp_{it} = \beta_0 + \beta_1 POST_t &+ \beta_2[POST_t \times Amount_{i0}] \\ &+ \beta_3[POST_t \times Amount_{i0}^2] \\ &+ \beta_4[POST_t \times Amount_{i0} \times Morethan_{i0}] \\ &+ \beta_5[POST_t \times Amount_{i0}^2 \times Morethan_{i0}] \\ &+ \boldsymbol{\beta}_6' \boldsymbol{X_{it}} + \alpha_i + \mu_t + \varepsilon_{it}, \end{aligned} \tag{2}$$

where $Amount_{i0}$ is the inheritance amount (measured in 100 million yen in 2010 prices). In addition, we interact the square of $Amount_{i0}$ with $POST_t$ to allow for possible non-linear effects. $Morethan_{i0}$ is a dummy variable that equals one if the amount inherited was larger than expected, and zero if the amount was either as expected or smaller than expected. This variable enables us to examine whether those who received a larger than expected inheritance were more likely to stop working than those who did not. All other settings are identical to those in the estimation of Equation (1).

Columns (1) to (4) in Table 3 show the estimation results obtained using the specification including only $POST_t$ and $POST_t \times Amount_{i0}$ as key explanatory variables. We find that in all specifications none of the coefficients are significant, including in columns (2) and (4) for women,

[8] We tested this hypothesis by making use of the following question in the survey: "Was the amount of inheritance (including zero) higher or lower than expected?" We created a "less than expected" dummy variable, interacted it with the $POST_t$ dummy, and added this interaction term as an additional explanatory variable in Equation (1). However, the estimated coefficient on the interaction term was statistically insignificant, probably due to the fact that only a small share of respondents who did not receive an inheritance answered the question.

which at first glance seems surprising given the estimation results in Table 2. One possible explanation for this result can be found in columns (6) and (8), in which the square of the inheritance amount is additionally included. In these columns, both the first- and the second-order term are significant, suggesting that there is a non-linear wealth effect on whether women work. That is, some women that received a relatively small inheritance stopped to work, while some women did not change their employment status despite receiving a large inheritance.

Columns (10) and (12) in Table 3 also show some interesting results. They indicate that the negative link between the inheritance amount and women's likelihood to work is mainly driven by those who received a larger inheritance than expected. To interpret the estimates, suppose the amount inherited is 7 million yen. Taking the estimates in column (10) as an example, the probability of working for those who inherited more than expected fell by about 25 percentage points *more* than that of those who received an inheritance that was as expected or smaller. This finding is consistent with standard labor supply models which predict that people reduce their labor supply when they become aware of changes in their lifetime resources, not the moment that they change in practice.

3.2 The role of anticipating the parent's death

Until now, our investigation of individuals' labor supply response to inheritance receipt has focused on whether changes in the probability of being in work after the death of a parent are larger among those who received an inheritance than those who did not. However, inheritors may have anticipated the inheritance receipt before the death of their parent, so that their labor supply may have changed before the death of the parent and actual inheritance receipt. In this case, the estimates of the labor supply response in Tables 2 and 3 would be misleading.

Following Brown, Coile, and Weisbenner (2010) and Sugano and Matsuyama (2017), one way to examine this would be to use a question asking whether individuals thought they might receive an inheritance in the future. Tracking the same individuals over time, this would enable us to identify whether the inheritance was anticipated or not. Unfortunately, however, the FLS does not contain such information, so that we follow the alternative and more straightforward approach taken by Doorley and Pestel (2016) and Elinder, Erixson, and Ohlsson (2012), which examines whether individual's labor supply changed prior to an inheritance receipt. Specifically, we investigate whether changes in the probability of working in the period from $t = -1$ to $t(= -4, -3, -2, 0, 1, 2, 3, 4)$ differ depending on whether an individual received an inheritance or not. If individuals anticipate receiving an inheritance, they might adjust their labor supply in $t \leq -1$. This approach also enables us to examine if there is a time lag between the parental death and the labor supply response. Concretely, we estimate the following specification:

$$Emp_{it} = \beta_0 + \beta_1 \mathbf{1}(t = d) + \beta_2 [\mathbf{1}(t = d) \times Inher_{i0}] + \boldsymbol{\beta_3'} \boldsymbol{X_{it}} + \alpha_i + \mu_t + \varepsilon_{it}, \qquad (3)$$

$$(d = -4, -3, -2, 0, 1, 2, 3, 4)$$

where $\mathbf{1}(.)$ is an indicator variable that equals one if the expression inside of the parentheses occurs at time *t* and zero otherwise. Note that the sample is always confined to two periods ($t = -1$ and $t = d$) in estimating Equation (3). In other words, we run a regression for each d and obtain the eight estimates for β_2. All other settings are identical to those in the estimation of Equation (1).

Figure 2 shows our estimates for β_2 in Equation (3) – that is, the estimated *additional* effects on the labor supply response of receiving an inheritance compared to the response of not receiving an inheritance – over a 9-year window, with 90% confidence intervals. For example, in Figure 2(b), the estimate for three years after the parent's death (about -0.16), means that the probability of women who received an inheritance working decreased by about 16 percentage points more than that of women who did not receive an inheritance. For men, receipt of an inheritance in all years (except in $t = -4$) does not have a statistically significant impact on their labor supply. In contrast, women's probability of working begins to decline additionally in response to the inheritance receipt at $t = 0$ and the peak of decline occurs at $t = 3$. This implies there is some time lag for women who received an inheritance to change their labor supply behavior. More importantly, changes in the probability of women to work from $t = -1$ to $t = -4, -3, -2$ do not significantly differ between those that subsequently received an inheritance and those that did not, rejecting the hypothesis that they changed their labor supply before their parent's death in anticipation of receiving an inheritance. This result may not be surprising since the average age of individuals in our sample at the time of their parent's death is about 38 for men and 37 for women, which is much younger than the age of individuals in the surveys used in previous studies.[9] This means that the death of their parent is probably an unanticipated event for most individuals in our sample.

In summary, while men's labor supply is not affected by inheritance receipt, women tend to decrease their labor supply with some time lag. Given that the mean and median of women's inheritances in our sample are only about 7.60 and 3.58 million yen (about 76,000 and 35,800 U.S. dollars), respectively, the decision to leave the labor market seems irrational in light of the rigidity of Japan's labor market, which makes it difficult for people to return to work once they have left. One possible explanation for women's labor supply response therefore is that at least some of the women were non-regular workers, since the income elasticity of labor supply of non-regular workers is usually higher than that of regular workers. Unfortunately, the FLS does not allow us to distinguish between regular and non-regular workers, so that we cannot examine this issue.

3.3 Unitary model

[9] For example, the Health and Retirement Survey employed by Brown, Coile, and Weisbenner (2010) and the JSTAR employed by Sugano and Matsuyama (2017) cover only those aged 50 or over.

As mentioned earlier, one of the advantages of the FLS is that it provides information on the employment status and inheritance receipt not only of the respondent but also of the spouse, which makes it possible for us to examine whether who within a household received an inheritance is important. More precisely, we can use our dataset to test the unitary model, which regards the household as a single decision-making unit. Testing the unitary model is instructive for the following two reasons. First, if receiving an inheritance lowers the probability of being in work not only of the inheritor but also their spouse, our estimates so far understate the overall labor supply response. Second, if the unitary model holds, this may have important implications for the formulation of policies aimed at certain household members such as women and children. On the other hand, rejection of the unitary model means that who receives monetary transfers affects how they are spent.

A popular approach to test the unitary model is to examine whether relative income (the ratio of the husband's income to the wife's income) influences relative expenditure using cross-sectional data. However, as highlighted by Lundberg, Pollak, and Wales (1997) and Ward-Batts (2008), relative income may not be exogenous and, as a result, the unitary model may be rejected due to omitted variables. For instance, if preferences for expenditure and leisure are not separable, omitting relative hours worked could lead to the false rejection of the unitary model.

To address this problem, what is needed is exogenous changes in relative income. Lundberg, Pollak, and Wales (1997) and Ward-Batts (2008) exploit the 1979 reform of child benefit in the U.K., which resulted in an exogenous income shift from fathers to mothers. Meanwhile, Attanasio and Lechene (2002) focus on Progresa, a large-scale welfare program implemented in Mexico, in which monetary transfers are given exclusively to women in the household in order to improve the conditions of women in rural areas. More recently, Cesarini et al. (2017), using a dataset of lottery winners in Sweden, tested the unitary model by comparing the labor supply responses of winners and winners' spouses. If the unitary model holds, who in the household won the lottery should not affect each member's labor supply decision. However, all of these studies reject the unitary model.

To examine whether the unitary model is also rejected in our setting, we compare the labor response of those whose parent has died with that of their spouse. To the best of our knowledge, this is the first attempt to test the unitary model by focusing on inheritance receipts. Specifically, our approach is as follows. Our analysis so far has focused on the labor supply response of individuals whose own parent has died. For the sake of convenience, we refer to this as the "vertical analysis." Here, we additionally focus on the labor supply response of the spouse of those whose parent has died, which refer to as the "cross analysis." For example, if the husband's parent has died, the "cross analysis" focuses on the labor supply response of the wife. Note that in the cross analysis, the individual wealth of the person we focus on has not increased through the spouse's inheritance receipt. To test the unitary household model, we then compare the labor supply responses of the vertical and the cross analysis.

The ideal setup for this exercise would be to confine our sample to households in which we could

directly compare a parallel situation, where both the husband and the wife each lost a parent. In this case, we would be able to compare the *same* individuals' labor supply responses when losing their own parent and when losing the spouse's parent. However, because respondents to our survey were quite young when their parents died, there are few households for which this is the case. To make the samples in the vertical and cross analyses as comparable as possible, we confine the sample in the vertical analysis to married couples only, since a prerequisite for the cross analysis is that respondents have a spouse.

Table 4 shows the regression results for the test of the unitary model. Due to space limitations, we only report the results in which the reference year is one year before their parents died. Column (2), which shows the results of the vertical analysis for married women, indicates that, as in the baseline results in Table 2, if a woman receives an inheritance this lowers the probability that she will continue to work. On the other hand, the cross analysis in column (4) shows that if the husband receives an inheritance, this has no significant impact on the probability that the wife will continue to work. In this context it is interesting to note that the average inheritance of husbands in column (4) is about 13.23 million yen, which is almost twice the amount of wives' average inheritance in column (2) of about 7.70 million yen. The fact that there is no significant change in the probability that wives will work even when household wealth increases by a substantial amount when the husband's parent dies implies that there is no support for the unitary model.

Next, columns (5) to (12) show the results when the inheritance amount is included in the regression. As in Table 3, the results of the vertical analysis in column (10) show that the size of the inheritance has a non-linear effect on the likelihood that women will work. In contrast, the results in column (12) for the cross analysis again show that if the husband receives an inheritance this has no significant effect on the probability that the wife will work.

In sum, while we find that receiving an inheritance has a negative effect on the probability that women will work when they receive an inheritance when one of their parents passes away, we find no evidence of a decline in the probability that women will work when their husband receives an inheritance, meaning that we find no support for the unitary household model. This implies that who receives an inheritance – the wife herself or the husband – is important for wives' labor supply decision.

4 Conclusion

Using panel-structured microdata for Japan, this study examined the effect of wealth on individuals' labor supply by exploiting inheritance receipts as an exogenous change in wealth. The estimation results showed that while the probability that men worked did not change in response to receiving an inheritance, the probability that women worked did decrease when they received an inheritance despite the fact that women tended to receive smaller inheritances than men. We further found that the size of the inheritance had a non-linear effect on women's probability of working, reflecting that some women

did not change their employment status despite receiving a large inheritance. In addition, we did not find any evidence that inheritors had anticipated their inheritance receipts a few years before the death of their parent, implying that the decline in women's labor supply after receiving an inheritance is caused simply by the unanticipated positive wealth shock.

Taking advantage of the fact that our dataset also provides information on respondents' spouse, we further tested the unitary model by comparing the impact of inheritance receipt on the inheritor's and the inheritor's spouse's labor supply response. We found that no significant decline in the probability that women worked could be observed when their husband received an inheritance, so that we found no support for the unitary household model.

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Table 1: Descriptive statistics of observations in our sample

Variable	N	Mean	Median	Std. dev.	Min.	Max.	N	Mean	Median	Std. dev.	Min.	Max.
At time of parent's death	**Men**						**Women**					
Age	158	38.11	38.00	6.89	26.00	51.00	205	37.07	37.00	6.84	26.00	51.00
Employment dummy	158	0.94	1.00	0.23	0.00	1.00	205	0.57	1.00	0.50	0.00	1.00
Inheritance dummy	158	0.41	0.00	0.49	0.00	1.00	205	0.32	0.00	0.47	0.00	1.00
Inheritance amount (million yen)												
Including those that did not receive an inheritance	158	4.30	0.00	12.05	0.00	100.50	205	2.41	0.00	9.33	0.00	102.46
Excluding those that did not receive an inheritance	65	10.45	3.63	17.06	1.01	100.50	65	7.60	3.58	15.42	1.00	102.46
No. of children aged 12 or less	158	0.84	0.50	0.96	0.00	3.00	205	1.07	1.00	1.03	0.00	4.00
Illness dummy	158	0.12	0.00	0.33	0.00	1.00	205	0.07	0.00	0.26	0.00	1.00
At the time of survey (in 2012)												
Age	158	48.71	50.00	5.93	32.00	56.00	205	48.97	50.00	5.73	31.00	56.00

Notes: The inheritance dummy takes a value of one if an individual whose parent has died reports receiving a non-zero inheritance and takes a value of zero otherwise. Inheritances are converted into 2010 prices using the Consumer Price Index. The illness dummy takes a value of one if individuals had a major illness that impeded their normal daily life and zero otherwise.

Table 2: Effect of inheritance receipt on employment

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employment status	Men	Women	Men	Women	Men	Women	Men	Women
Reference year	-1		-4,-3,-2,-1		-1		-4,-3,-2,-1	
Post	0.0108	0.0529*	0.0161	0.0404	-0.00697	0.0650**	0.0101	0.0449
	(0.0160)	(0.0282)	(0.0164)	(0.0322)	(0.0151)	(0.0268)	(0.0114)	(0.0287)
Post×Inheritance dummy	0.0108	-0.0929**	-0.0177	-0.0688	0.0266	-0.112**	-0.0123	-0.0911**
	(0.0221)	(0.0468)	(0.0166)	(0.0479)	(0.0211)	(0.0432)	(0.0150)	(0.0418)
No. of children aged 12 or less					-0.0126	-0.114***	-0.000301	-0.115***
					(0.00797)	(0.0289)	(0.00601)	(0.0272)
Illness dummy					0.0720	-0.0193	0.0382	-0.0305
					(0.0659)	(0.109)	(0.0339)	(0.0921)
Average inheritance amount (million yen, excluding zero)	10.45	7.60	10.45	7.60	10.45	7.60	10.45	7.60
Year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	948	1,230	1,422	1,845	948	1,230	1,422	1,845
No. of respondents	158	205	158	205	158	205	158	205
Adj. R-sq	0.002	0.005	0.002	0.004	0.092	0.068	0.030	0.092

Notes: The dependent variable is the employment status of individuals whose parent died. The dummy *Post* takes a value of one if the number of years since the parent's death is 0 or greater, and zero otherwise. In columns (1) to (4) the number of children aged 12 or less, the illness dummy, and the year dummies are not included, whereas in columns (5) to (8) they are all included. In estimating columns (1), (2), (5), and (6), observations reported for year -4, -3, and -2 are dropped. The inheritance amount is measured in million yen (approximately 10,000 U.S. dollars). Figures in parentheses show clustering robust standard errors. ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 3: Effect of inheritance amount on employment

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Employment status	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Reference year	-1		-4,-3,-2,-1		-1		-4,-3,-2,-1		-1		-4,-3,-2,-1	
Post	0.00514	0.0341	0.00572	0.0185	0.00548	0.0418*	0.00623	0.0282	0.00842	0.109*	-0.0152	0.0692
	(0.00984)	(0.0213)	(0.00935)	(0.0231)	(0.0106)	(0.0217)	(0.00996)	(0.0238)	(0.00930)	(0.0581)	(0.0153)	(0.0614)
Post×Inheritance amount	-0.0244	-0.187	-0.0178	-0.105	-0.0406	-0.856**	-0.0427	-0.907***	-0.177	-0.508	0.0700	-0.606
	(0.0351)	(0.156)	(0.0271)	(0.191)	(0.102)	(0.350)	(0.0922)	(0.348)	(0.183)	(0.567)	(0.0749)	(0.553)
Post×Inheritance amount^2					0.0224	0.909**	0.0345	1.091***	0.199	0.306	-0.0579	0.635
					(0.0954)	(0.374)	(0.0951)	(0.367)	(0.209)	(0.569)	(0.0677)	(0.552)
Post×Inheritance amount									-0.00711	-4.292**	-0.0514	-3.876***
×More than expected									(0.0798)	(1.734)	(0.0622)	(1.201)
Post×Inheritance amount^2									-0.0235	10.56**	0.0454	9.172***
×More than expected									(0.0999)	(4.381)	(0.0620)	(2.909)
N	948	1,230	1,422	1,845	948	1,230	1,422	1,845	372	396	558	594
	158	205	158	205	158	205	158	205	62	66	62	66
Adj. R-sq	0.090	0.061	0.029	0.087	0.089	0.063	0.028	0.091	-0.017	0.225	-0.036	0.232

Notes: See notes for Table 2. The inheritance amount is measured in 100 million yen (approximately 1 million U.S. dollars). The *More than expected* dummy takes a value of one if the inheritance an individual received was larger than expected and zero otherwise. All specifications include the number of children aged 12 or less, the illness dummy, year dummies, and individual fixed effects.

Table 4: Effect of inheritance receipt or amount on employment (Cross analysis vs. vertical analysis)

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Employment status	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Reference year	-1		-1		-1		-1		-1		-1	
Type of analysis	Vertical		Cross		Vertical		Cross		Vertical		Cross	
Post	-0.00676	0.0689**	-0.0105	0.0366	0.00727	0.0320	-0.00818	0.00934	0.00776	0.0412*	-0.00864	0.0125
	(0.0102)	(0.0312)	(0.00894)	(0.0352)	(0.00613)	(0.0229)	(0.00720)	(0.0265)	(0.00571)	(0.0238)	(0.00752)	(0.0286)
Post×Inheritance dummy	0.0294*	-0.123***	0.00948	-0.0516								
	(0.0174)	(0.0465)	(0.00727)	(0.0426)								
Post×Inheritance amount					-0.0225	-0.200	0.0185	0.103	-0.0437	-0.932**	0.0633	-0.0256
					(0.0321)	(0.160)	(0.0159)	(0.129)	(0.0855)	(0.418)	(0.0499)	(0.429)
Post×Inheritance amount^2									0.0290	0.972**	-0.0570	0.171
									(0.0805)	(0.436)	(0.0450)	(0.498)
Average inheritance amount (million yen, excluding zero)	11.49	7.70	8.51	13.23	11.49	7.70	8.51	13.23	11.49	7.70	8.51	13.23
No. of observations	780	1,014	918	1,092	780	1,014	918	1,092	780	1,014	918	1,092
No. of respondents	130	169	153	182	130	169	153	182	130	169	153	182
Adj. R-sq	0.012	0.059	0.016	0.054	0.009	0.050	0.016	0.052	0.007	0.053	0.015	0.052

Notes: See notes for Table 2.

Figure 1(a): Age profile of employment rate by birth-year cohort (Men)

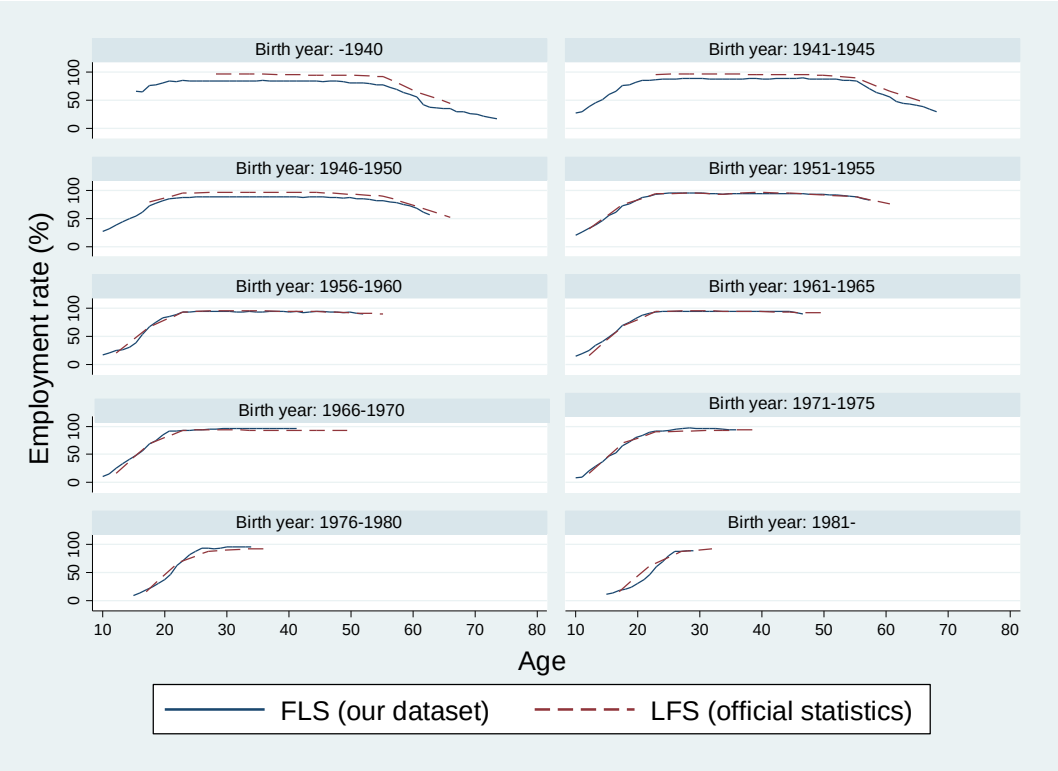

Figure 1(b): Age profile of employment rate by birth-year cohort (Women)

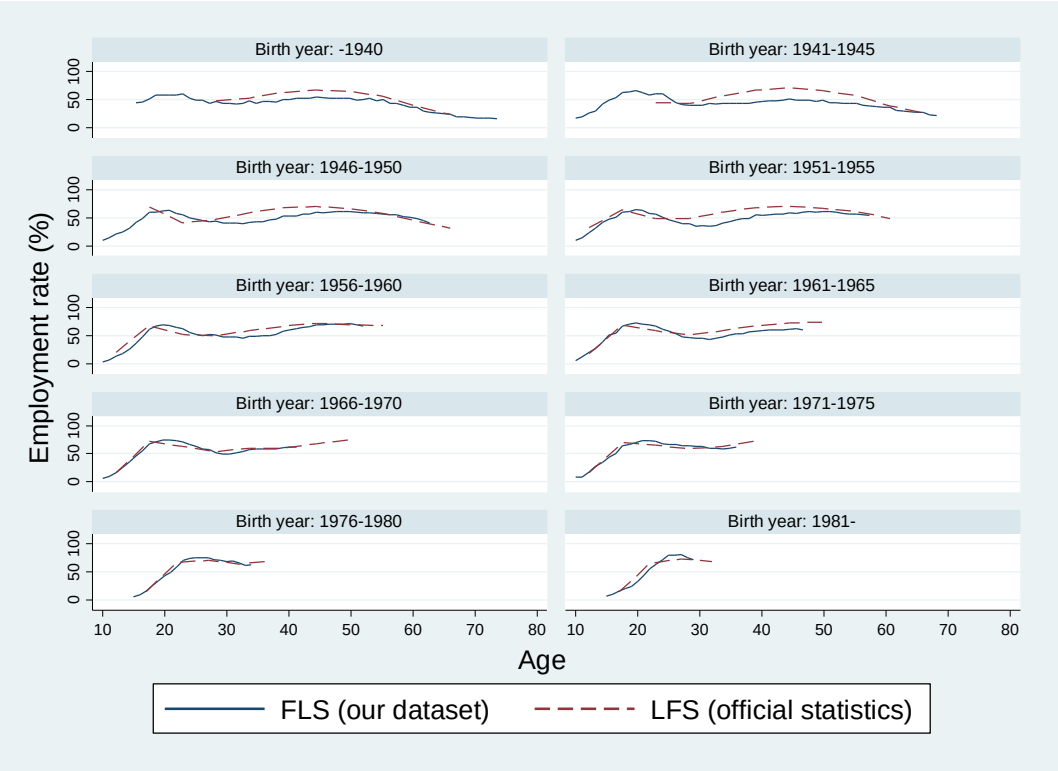

Figure 2(a): Estimates of β_2 for 9-year window (Men)

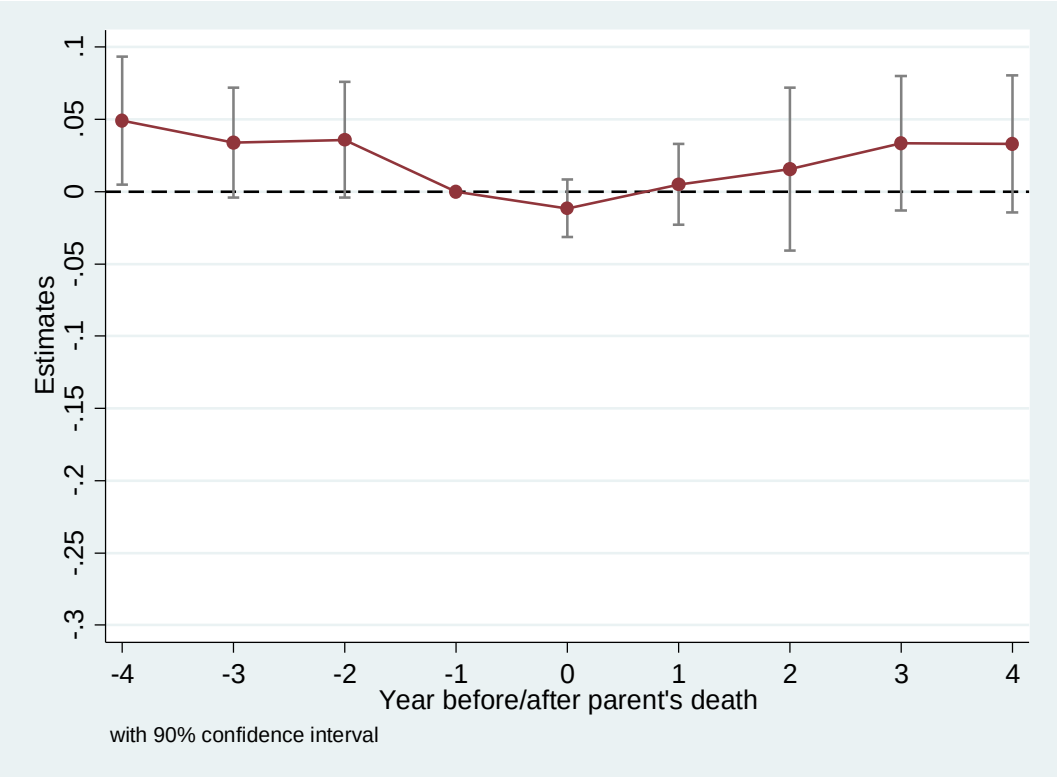

Figure 2(b): Estimates of β_2 for 9-year window (Women)