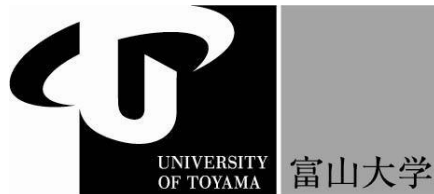**Working Paper No. 321**

Housing inheritance, financial assistance, and reciprocal interdependence

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Housing inheritance, financial assistance, and reciprocal interdependence

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Abstract

When adult children expect that their parents will bequeath residential property to them, they may show their appreciation by providing their parents with financial support. This paper theoretically and empirically examines this possibility. We adopt a simple noncooperative game framework with a Stackelberg equilibrium to examine the reciprocal interdependence between the propensity of housing inheritance and financial assistance when formal care affects decision-making. We use data from Japanese households to test this interaction. After considering both the censoring of financial transfers and the specification of inheritance propensity, which we control for using information on formal care, our empirical results suggest that the propensity to inherit the parental home has a significantly positive impact on the amount of transfers from children to their parents. Consequently, an implicit annuity contract in the form of an intrafamily reverse mortgage appears to exist in Japanese society. However, parents should ensure they convey to their children a high expectation of future housing inheritance to extract sufficient financial assistance for their current consumption needs.

Keywords: Intergenerational transfers; Bequest motives; Housing; Implicit annuity contracts; Japan

JEL classification: D10, J14, R21

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1 Introduction

There has been growing pressure worldwide to cut expenditure on medical benefits and insurance payments for the elderly in aging societies. The elderly therefore increasingly expect to use their accumulated assets for welfare needs rather than relying as heavily on governmental transfers (Toussaint and Elsinga, 2009; Doling and Ronald, 2010). In turn, housing can play an important role in addressing this issue because it is the primary asset held by most elderly households, so financial instruments such as reverse mortgages may allow elderly homeowners to remain in their own home and provide a supplemental income until death. In this manner, a reverse mortgage functions like an annuity. However, reverse mortgages are still quite uncommon because of their potentially high cost, small amount of potential proceeds, and the limited product knowledge of the elderly (Davidoff et al., 2017; Moulton et al., 2017). As an alternative, in some countries, elderly homeowners tend to leave residential property as a future bequest to derive current financial provision from their adult children (see, e.g., Toussaint and Elsinga, 2009 on Europe; Ronald and Doling, 2012 on East Asia).[1] The purpose of this paper is to examine this reciprocal interdependence: whether the anticipation of parental housing inheritance affects the financial assistance behavior of adult children.

Our paper is thus associated with testing a bequest motive related to an implicit annuity contract (Kotlikoff and Spivak, 1981). According to theory, the elderly choose to insure against the longevity risk by creating an implicit annuity contract with their children, whereby parents receive an annuity from their children while they live in exchange for a future bequest. Horioka (2002) suggested that one variant of this type of contract is an intrafamily reverse mortgage, whereby children agree to support their parents financially in exchange for inheriting the parental home (Farnham and Sevak, 2016). Children may also provide nonmonetary assistance rather than monetary support, especially in advanced countries. Indeed, the literature has accumulated evidence for a strategic bequest (exchange) motive by examining whether adult children provide in-kind transfers to their parents in return for receiving bequests (inter vivos

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[1]In some cases, the elderly are more likely to leave their home because inheritance taxes give preferential treatment to real estate assets. This paper, however, is not concerned with tax issues.

gifts).

For instance, Bernheim et al. (1985) found that children's attention to their parents, as measured by visits and phone calls, is positively affected by parental bequests. Norton and Van Houtven (2006) revealed that children who provide informal care appear to receive larger inter vivos transfers, while Fu (2019) showed that inter vivos transfers are dependent on children's current residential proximity, which may facilitate future informal care. Ciani and Deiana (2018) suggested that past downstream housing transfers, such as a real estate donation or down payment, tend to increase current informal elderly care. Tomassini et al. (2003) and Yamada (2006) indicated that past parental housing assistance has effects on current children's geographic proximity. Yin (2010) and Horioka et al. (2018) demonstrated that bequest expectations encourage intergenerational co-residence, while Yamada (2006) reported that children who expect to inherit a parental home in the future are more likely to co-reside with their parents. Turning to studies of upstream monetary support, Ohtake (1991) showed that financial transfers provided by children tend to increase when parents possess a large amount of inheritable assets, where financial and real estate assets are considered separately. The amount of housing assets, however, may not always be positively correlated with housing inheritance.[2] Therefore, to our knowledge, little is known about implicit annuity contracts in the form of intrafamily reverse mortgages. The main contribution of this paper is testing for the existence of such contracts.

A Stackelberg model of reciprocal interdependence leads to an empirical model where financial assistance is a function of the probability of housing inheritance, which depends on the cost of formal care. That is, the cost of formal care is assumed to influence the bequest behavior of elderly parents. Our theory suggests that the probability of housing inheritance encourages upstream financial support. To test this hypothesis, we used microdata on Japanese households. Such evidence may provide particularly interesting insights because Japan is very close to the situation described in the beginning of this paper. Japan is at the forefront of

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[2]Begley (2017), while providing empirical evidence that an increase in housing wealth, driven by unanticipated shocks to house prices, exerts a positive effect on the probability of elderly homeowners leaving a bequest, did not focus in particular on the probability of bequesting residential property.

population aging. Expenditure on social security is at a record level, with 70 percent of all social security expenditure being on the elderly in the form of public pensions and medical benefits. At the same time, approximately 90 percent of the Japanese elderly aged 65 years or over own residential property, and this accounts for 60 percent of their total wealth.[3] Using the value of residential real estate holdings of the Japanese elderly, Suzuki (2007) calculated that an 810,000 yen annual annuity could be potentially obtained through reverse mortgages per household.[4] This would more than cover the difference between average yearly consumption expenditure and income of approximately 432,000 yen for a nonworking elderly single-person household and 660,000 yen for a nonworking elderly couple household.[5]

Nonetheless, it is quite difficult for elderly homeowners to release cash from housing assets because the financial sector does not readily provide reverse mortgage loans against property (Kojima, 2013).[6] In general, Japanese reverse mortgage loans are recourse loans. Therefore, both the collateral and other assets can be seized by lenders when borrowers default on their loan. Additionally, income support cannot be guaranteed for life; therefore, the support may end even while borrowers are living, and repayment may be required during the loan term when the assessed value falls because of falling land prices.[7] On this basis, institutional innovations in Japan appear to lag far behind those in most Western countries (Mitchell and Piggott, 2004). Under these circumstances, the elderly may instead leave their housing assets to children to

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[3]According to the 2014 National Survey of Family Income and Expenditure (Table 69. Estimated value of assets per household by age group of household head), 88.2 percent of households whose household head is 65 years or older own their own home. In terms of net (gross) value, their total assets are valued at 44,196,000 (66,746,000) yen, while their total housing and land assets are valued at 25,924,000 (45,231,000) yen.

[4]Simulations by Green and Zhu (2018) suggested that converting home equity into annuity income rather than a lump sum tends to increase the feasibility of reverse mortgages in Japan under circumstances such as decreasing land prices and increasing life expectancy.

[5]*Summary Results of the 2016 Family Income and Expenditure Survey* reported that the disposable income of no-occupation one-person households with a household head aged 60 years or older is 107,648 yen per month, while their monthly consumption expenditure is 143,959 yen. They, thus, need an additional 36,311 yen per month to cover their living costs. For no-occupation aged-couple households, composed of a husband aged 65 years or older and a wife aged 60 years or older, the monthly disposable income is 180,958 yen, while their monthly consumption expenditure is 235,477 yen. Therefore, the shortfall is approximately 54,519 yen.

[6]In his analysis, Suzuki (2007) considered various restrictions on contracting reverse mortgages.

[7]The 2016 Japan Household Panel Survey (JHPS) asked respondents ($N = 4,993$) to report their intention to use a reverse mortgage based on the following question: *"How likely is it that you will use a reverse mortgage?"* 1 = have used; 2 = very likely; 3 = likely; 4 = unlikely; 5 = very unlikely; 6 = do not know. On average, about 1.4 and 10.3 percent of respondents selected the second or third response, respectively, but less than 0.1 percent selected the first response.

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draw monetary support while living. Similarly to other Asian societies, it is quite common in Japan for adult children to support their elderly parents, and inherit their parents' property assets (Ronald and Doling, 2012). This is becoming increasingly common because the low fertility rate in Japan implies fewer siblings (Hirayama, 2010).

Two considerations are examined empirically. First, a specification issue may exist associated with the expectation of housing inheritance, which arises from the potential for measurement error inherent in a discrete dichotomous response to a question about housing inheritance expectation and the specification of a dummy variable (Yamada, 2006). Some respondents may be confused by having to select one of two polar responses: they might have to respond with 0 even if they have a low positive propensity to inherit, while others might have to respond with 1 even if they do not expect a 100 percent probability of inheritance. To address this, we specify proxy variables for formal care that appear to affect the bequest behavior of parents, and employ a probit model in our estimation. In fact, our empirical results indicate that the probability of housing inheritance is significantly affected by one of these formal care variables. The probit model is ideal for understanding how elderly parents respond to incentives. Second, we must also account for the censoring of transfers from adult children to aging parents because our transfer observations are limited to values greater than or equal to zero. To examine this, we estimate a Tobit model, which can consider the intensive margin of upstream financial support (Cox, 1987). In light of both issues, our empirical results demonstrate that the expectation of inheriting housing wealth in the future has a significantly positive effect on current support payments. This suggests that an implicit annuity contract is a motive to consider regarding the reciprocal interdependence between housing inheritance and financial assistance. However, our empirical results also indicate that upstream financial transfers appear to be too small to cover the consumption needs of aging parents. To correct this, parents should provide their children with a substantially high expectation of inheriting the parental home.

The remainder of the paper is organized as follows. In Section 2, we present a theoretical model of reciprocal interdependence between housing inheritance and financial assistance. Section 3 discusses the data and empirical model used, along with the empirical results. Section

4 summarizes the main findings of the paper.

2 Model

The purpose of this section is to construct a simple theoretical model that considers the observable characteristics in our empirical study. The theory adopted within the model leads to testable hypotheses and informs the empirical analysis. There are two players in the model: a parent and a child. The parent is assumed to be imperfectly altruistic: the parent cares for the utility of the child, but the parent also cares about monetary transfers t that the child may provide. In contrast, the child is assumed to be nonaltruistic. The following two-stage framework is adopted: the parent first decides the propensity π to leave their own house valued at h as an inheritance to the child, and an amount of formal care m in the market. If the parent plans to bequest the house, then $\pi = 1$, whereas if the parent does not, then $\pi = 0$. Because we treat π as the propensity, which is reasonable for parents who will choose an interior solution, π ranges from zero to one. This also allows us to differentiate the transfer function, as shown later. The child then decides consumption c and the size of transfers t, expecting to consume inherited housing πh. Our model applies a simple noncooperative game framework with a Stackelberg equilibrium that can examine a reciprocal interdependence between t and π. As discussed in Section 1, one reason why housing is left by the parent is the bequest motive arising from the implicit annuity contract: the parent receives financial assistance from the child upon leaving the child the home.

Assume that the (expected) utility function of the child is $u(c) + \pi$, where h is normalized to one because we cannot observe it from the data, and $u_c > 0$ and $u_{cc} < 0$, where the subscripts indicate the first and second derivatives. The child will inherit the parental home whenever the utility obtained is not less than the reservation utility $\bar{u}$ that the child obtains from not inheriting the home.

$$u(c) + \pi \geq \bar{u} \tag{1}$$

The budget constraint of the child becomes:

$$y - t = c, \tag{2}$$

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where y is the income of the child.

The rational parent ensures that the child receives the reservation utility in order to be willing to supply financial support. Hereafter, we only consider the case where Eq. (1) is binding. Substituting the budget constraint Eq. (2) into the utility function Eq. (1) yields $u(y-t)+\pi = \bar{u}$. The amount of transfers must satisfy this relationship. The transfers function then becomes:

$$t = t(\pi, y, \bar{u}). \tag{3}$$

Conversely, the child refuses the inheritance and chooses $t = 0$ when Eq. (1) does not hold.

The primary variable of interest is π. Differentiating the transfer function with respect to a given value of π, we obtain: $\partial t/\partial \pi > 0$. The positive sign indicates that the child can increase monetary support instead of reducing consumption expenditure if the parent is more willing to leave their own home because housing inheritance substitutes for consumption.

We now consider parental behavior. Assume that the private utility function of the parent depends on t and m. That is, financial transfers from the child to the parent directly gratify the parent's utility. For example, assisting the parent with money can be regarded as a form of child attention, so receiving money from one's own children appears to differ from receiving wages or pensions. Because the income of the parent is not observed from the data, private utility is assumed to be quasilinear: $v(t) + m$, where $v_t > 0$ and $v_{tt} < 0$. The imperfectly altruistic parent's utility function can be assumed to be:

$$v(t) + m + u(c) + \pi. \tag{4}$$

The parent uses both the housing asset and financial transfers to purchase m. As mentioned, it is difficult for elderly homeowners to release part of their housing wealth as cash through the financial sector, particularly in Japan. For simplicity, however, we neglect this issue. Namely, the parent can theoretically convert the housing asset into cash. Note that the value of housing is normalized to one and the parent holds the housing asset with propensity $(1-\pi)$. The budget constraint of the parent is then:

$$(1 - \pi) + t = pm, \tag{5}$$

where p is the price of care services.

The parent maximizes Eq. (4) subject to the following four constraints: the child's budget constraint Eq. (2), the transfer function Eq. (3), the parent's budget constraint Eq. (5), and $0 \leq \pi \ (\leq 1)$.

Substituting Eqs. (2), (3), and (5) into the utility function Eq. (4) yields the result that the choice variables are reduced to only one variable: π. Suppose the second-order condition of a maximum and $\partial t / \partial \pi < 1$. The latter assumption implies that the increment of financial help is less than the value of housing, which is normalized to one. Then, the optimal propensity of inheritance satisfies:

$$v_t \frac{\partial t}{\partial \pi} + \frac{1}{p} \left(\frac{\partial t}{\partial \pi} - 1 \right) \leq 0. \tag{6}$$

The optimal value of π is zero when Eq. (6) holds with inequality, while it is positive when Eq. (6) holds with equality. The inheritance propensity function then becomes:

$$\pi = \pi(p, y, \bar{u}). \tag{7}$$

Eqs. (6) and (7) imply that the cost of formal care affects the bequeathing behavior of elderly homeowners. Under our assumptions, the partial derivative of the price of care services p is positive: $\partial \pi / \partial p > 0$. Because care services are assumed to be a substitute for the child's support, the parent is more willing to leave their own home to the child when the price of care services rises.

3 Empirical analysis

3.1 Empirical model

Our data, which are introduced later, are based on a survey of children's households i. We consider the following linear form of the financial transfer function:

$$t_i = \beta_C \pi_i + X_i \gamma_C + \varepsilon_{Ci}, \tag{8}$$

where t_i is an observed value measuring the transfer paid, π_i is the probability of inheriting the parental home, which is the primary variable of interest, X_i is a vector of explanatory

variables, β_C and γ_C are coefficients, and ε_{Ci} is an error term. Theory suggests that the sign of β_C is likely to be positive. Explanatory variables include household income (y_i), which is presented in Eq. (3). We also control for reservation utility $\bar{u}$ using household characteristics, region-specific effects (using regional dummy variables), and time-specific effects (using year dummy variables). Eq. (8) may still include unobserved heterogeneity. Panel data allow us to estimate a fixed effects model, in which we can remove the unobserved effect prior to estimation. We, however, apply pooled ordinary least squares (OLS) in the empirical stage, because we focus on dummy variables related to siblings of adult children, which are generally constant over time.[8]

We must account for the fact that optimizing behavior leads to a corner solution response for some significant portion of adult children. That is, observations of monetary support are limited to values greater than or equal to zero. Suppose that children with low chances of inheriting tend to receive monetary transfers from parents rather than give to them. Then, the β_C coefficient estimated in Eq. (8) is likely to be biased downward because of the censoring. To address this, we replace t_i in Eq. (8) as an unobserved latent variable $t_i^{\#}$, and estimate a Tobit model. Namely, we estimate the upstream financial transfers on the intensive margin as in Cox (1987). The nonnegative value t_i is defined as follows:

$$t_i = t_i^{\#}, \text{ if } t_i^{\#} > 0$$

$$= 0, \text{ otherwise.}$$

Unfortunately, we cannot observe the probability of housing inheritance π_i. Instead, we can observe a dummy variable π_i^d measuring whether households have a probability of inheriting the parental home from the dichotomous response to the question. Yamada (2006) also cautioned that the measurement error of the dummy variable for future inheritance expectations may cause attenuation bias, although he did not examine this issue in his empirical analysis. To correct this specification, we obtain a predicted value of the inheritance propensity as a generated regressor from the following linear form of the inheritance propensity function using

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[8] The fixed effects model does not fundamentally change our main results (results not shown).

the probit model:

$$\pi_i^{\#} = \beta_P p_i + X_i \gamma_P + \varepsilon_{Pi}, \tag{9}$$

where $\pi_i^{\#}$ is an unobserved latent variable measuring the inheritance propensity, p_i is the price of formal care, β_P and γ_P are coefficients, and ε_{Pi} is the error term. The latent variable determines the outcome observed for the zero–one dummy π_i^d as follows:

$$\pi_i^d = 1, \text{ if } \pi_i^{\#} > 0$$

$$= 0, \text{ otherwise.}$$

We then replace π_i in Eq. (8) as the probability based on the generated regressor $\hat{\pi}_i^{\#}$, and estimate a second-stage Tobit model. Consistent with the theoretical analysis, this procedure allows the generated regressor of inheritance propensity in Eq. (8) to become a continuous variable ranging from zero to one. Given that the probabilities of inheritance calculated in the first-stage probit estimation provide the generated regressor, we use bootstrap standard errors for significance tests of each coefficient in the second-stage Tobit estimation.

Yamada (2006) assumed that future downstream housing transfers may be exogenous in his empirical analysis. Eq. (8), however, is a structural form model. The β_C estimated coefficient is likely biased because of the endogeneity of π_i, which arises from the possibility of omitted variables. For example, unobservable characteristics of the value of the parental home may have an impact on the bequest behavior of parents (Begley, 2017). The variables also have a tendency to impact on the transfer decisions of children. Our empirical model, however, can consider not only the specification of π_i but also the endogeneity of π_i. Estimating Eq. (9) is useful, because we can interpret how the housing transfer decisions of elderly parents are altered by incentives.

3.2 Data

Our empirical analysis draws on the Japan Household Panel Survey (JHPS) to examine the relationship between heritability and the monetary transfer decisions of adult children. The JHPS, sponsored by the Japan Society for the Promotion of Science (JSPS), is a nationally

representative and large-scale survey of Japanese households. The JHPS comprises two sets of population surveys: one commenced in 2004 (originally called the Keio Household Panel Survey, KHPS) and the other in 2009 (the initial JHPS sample), both of which had an initial sample of approximately 4,000 households.[9] The KHPS was integrated into the current JHPS in 2014. In the following analysis, we use the 12 years of the JHPS from 2005 to 2016. The JHPS is particularly suited to addressing the research questions in this paper because it contains detailed information on housing inheritance, financial support, and includes a rich set of family background characteristics. In our analysis, we use the questionnaire completed from the perspective of the adult child. The JHPS asks these respondents to report the total amount of financial assistance to their parents in the last year if their parents were alive (i.e., "how much financial assistance did you give to your parents last year?"). The possibility of inheriting the parental home in the future is evaluated using a dichotomous question on inheritance (i.e., "is there a possibility that you will inherit the parent's home in the future?"). We therefore obtain a binary variable indicating whether adult children believe they will inherit the parental home in the future.

The housing assets of the Japanese elderly generally go to their eldest male child because patriarchy has traditionally been a common practice in Japanese society (Izuhara, 2010). Filial piety, where adult children have an obligation to look after and support their aging parents, also appears to be considered a virtue in Japanese society (Taniguchi and Kaufman, 2017). Housing asset transmission and intergenerational financial assistance then potentially have a positive correlation in Japan given existing social norms. To control for this effect, we specify a dummy variable for the respondent being the eldest son. Under patriarchy, primogeniture, whereby the firstborn son inherits the parental home, is considered as an appropriate form of inheritance. We also include a binary variable indicating whether a respondent has no siblings (an only child). If Japanese seniors are considering succession, an only child is then more likely to inherit the family home. In addition to these variables, we gather data on a number of important economic and demographic characteristics of adult children from the JHPS. These

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[9]In addition, there were random refreshment samples of approximately 1,400 and 1,000 new respondents in 2007 and 2012, respectively.

include the age of the householder, household income, employment status, and the number of households. Child's income is measured by the total annual income of all household members. Nonworker is a binary variable indicating that a householder is not employed. The dummy variables for region, city size, and the survey year serve as controls in all of our estimations. The JHPS categorizes a respondent's location of residence across seven regions (Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku/Shikoku, and Kyushu) and three city sizes (20 major cities, other smaller cities, and towns/villages). All monetary variables are converted to 2005 prices using the consumer price index.

The price of formal care in the vicinity will influence aging parent behavior. In this paper, we consider the long-term care (LTC) services provided by the market. However, we cannot obtain a market price for LTC because it is government controlled. Instead, we use the capacity of LTC institutions in each prefecture, which is obtained from the Survey of Institutions and Establishments for Long-term Care (Ministry of Health, Labour and Welfare). Izuhara (2006) noted that LTC institutions are unevenly distributed across the country, which results in a shortage of such institutions in some regions. Therefore, LTC institutions may provide sufficient variation in the data. To construct this variable, we divide the number of hospital beds, which reflects the supply side of institutional care, by the elderly population, which reflects the demand side. LTC capacity thus likely proxies the accessibility of formal care. Contrary to the expected sign of the price of formal care, the expected sign of LTC capacity is negative. In addition to LTC capacity, we consider professional care services for the home in each prefecture, data for which are also obtained from the above survey, and specify a home helper variable that equals the number of home helpers divided by the elderly population.

The number of observations is 63,097. The JHPS asks respondents to answer whether their parents are alive or not. As we examine financial transfers from adult children to living parents in our empirical analysis, we remove respondents whose parents passed away from this question, resulting in 35,298 observations. In addition, we remove respondents with a missing value for upstream transfers, resulting in 33,494 remaining observations. We also focus on respondents who respond to the question concerning the propensity to inherit the parental home, resulting

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in 33,094 observations. Unfortunately, we cannot obtain the parents' residential location from the data prior to 2016. However, the JHPS asks respondents about the residential proximity to their parents or parents-in-law (respondents are asked to respond about whichever of these live closest to them). From this question, we can observe whether respondents and their parents reside in the same region. As data for LTC capacity and home helpers are only observed at the prefecture level, we restrict the sample to only those respondents whose parents reside in the same prefecture. However, because we cannot obtain data on the parents' residential location when the closest living parents are not parents of the respondent but the parents of their spouse, this reduced the number of observations to 11,671. We thus supplement our data with information on parents' residential location using the 2016 JHPS. From this question, we can use observations of respondents whose parents have resided in the same prefecture since 2016. We also add observations by assuming that these same parents have remained in the same prefecture since before 2016. This assumption is somewhat valid because Japan is known as a low-residential-mobility society (Seko and Sumita, 2007). This increased the sample by 9,564 observations; consequently, there are now 21,235 observations. Finally, restricting the sample to those where all necessary information was available, our estimation is based on a total of 14,204 observations.

Table 1 provides descriptive statistics for our variables. On average, the annual financial support from adult children to their parents is approximately 81,700 yen, equivalent to about $742.7 ($1 = 110 yen). About one in seven respondents provide positive transfers to their parents. However, approximately half of all respondents expect to inherit the parental home. This disparity suggests that not all parents receive financial support from their children in exchange for leaving them the family home.

Table 2 presents the difference in summary statistics for annual financial transfers between respondents who expect to inherit the parental home and those who do not. On average, adult children who expect to inherit the parental home provide a larger amount of financial support than those who do not. The proportion of adult children who provide a positive transfer to parents is also higher for children who expect to inherit the parental home than for those who

do not.

3.3 Estimation results

Table 3 reports the estimation results of the first-stage probit model, which are used to obtain the predicted value of inheritance propensity as the generated regressor. The coefficient of eldest son has a positive and significant sign. This indicates that the eldest son tends to plan to inherit the parental home, and this seems to correspond with the longstanding practice of primogeniture in Japan (Horioka, 2002; Ishino et al., 2017). As expected, respondents who are an only child are more likely to inherit the family home than their counterparts with siblings. The estimated coefficient of income is significantly positive, which is inconsistent with parents behaving in an altruistic way; that is, adult children with low incomes tend to inherit the parental home. The coefficient of household size has a positive sign and is significant, indicating that children are more likely to receive the parental home when they have a large family. As expected, the coefficient of home helper has a negative and significant sign, indicating that children are less likely to inherit the parental home when access to professional care services by seniors increases. In contrast, the coefficient of LTC capacity has an unexpected sign and is statistically insignificant.

Figure 1 represents the kernel densities of the predicted value of the inheritance propensity with and without heritability, which we obtain from the first-stage probit model. Figure 1 indeed demonstrates that children with heritability are more likely to inherit the parental home.

Table 4 provides the OLS and Tobit estimation results for monetary support from children to parents. In the second-stage OLS estimation in Table 4, the coefficient of the generated regressor measuring the propensity of inheriting the parental home has a positive and significant sign. This appears to confirm the hypothesis of an implicit annuity contract in the form of an intrafamily reverse mortgage between adult children and their parents. However, while the second-stage OLS estimation in Table 4 considers the specification issue of inheritance propensity, it does not control for the censoring of financial transfers. The second-stage Tobit model

in Table 4 considers both concerns. Again, the inheritance probabilities have a significantly positive effect on financial assistance from children to parents, which is consistent with our expectation. The coefficient of housing inheritance in the Tobit model is larger in magnitude than in the OLS estimation, as expected. From the estimated results of the Tobit model in Table 4, we can compute a marginal effect of housing inheritance probabilities on financial assistance by setting the values of all covariates to their means. The marginal effect is 86.55 and its bootstrap standard error is 38.63.

In terms of the other explanatory variables, the Tobit model in Table 4 shows as follows. The coefficients indicating the eldest son and an only child have negative and significant signs. These results seem somewhat inconsistent with social norms. One possible interpretation is that these children are more likely to give their parents nonmonetary rather than monetary assistance. Household size also has a negative and significant sign. This indicates that children cannot afford the expense of supporting their parents when they themselves have a large family to support.

Figure 2 plots the kernel densities of the predicted value of housing inheritance obtained from the first-stage probit model in Table 3 using all observations. Figure 2 also depicts the relationship between the inheritance propensity and financial assistance from the second-stage Tobit model in Table 4. The average predicted value of inheritance propensity is approximately 47.6 percent and at this propensity the predicted value of financial assistance is 141,800 yen per year, which is 60,100 yen higher than the average value in Table 2. As mentioned in Section 1, however, nonworking elderly single-person households and nonworking elderly couple households respectively suffer a deficit in income of approximately 432,000 yen and 660,000 yen per year. The predicted value of financial assistance in the above average case is far below these values. Despite the fact that the number of children who can provide 432,000 or 660,000 yen per year to their parents is small, above the 89.8 or 96.4 percentile of the distribution, children are likely to do so when the predicted value of the inheritance propensity is 65.4 or 73.6 percent. Suzuki (2007) predicted that the elderly could extract 810,000 yen per year if they used formal reverse mortgages. Aging parents can receive this same value using intrafamily

reverse mortgages when they grant their children a 78.0 percent housing inheritance probability. This is despite the number of adult children who could provide 810,000 yen per year to their parents being much smaller, above the 98.3 percentile of the distribution. In sum, intrafamily reverse mortgages appear to serve as substitutes for formal reverse mortgages if parents give their children a substantially high expectation of inheriting the parental home.

We also check whether financial assistance varies among subgroups according to child's income: household incomes below the 25th percentile (low-income child) and those at or above the 25th percentile (high-income child). Table 5 demonstrates that adult children in the high-income group significantly increase their transfers when they expect to receive the parental home. Combined with the results from the first-stage probit model in Table 3, we can observe a strong interdependence between parents and their wealthy children. However, the coefficient of housing inheritance is insignificant for children from the low-income group. This may reflect the fact that children with limited resources are more likely to give parents nonmonetary assistance when they cannot afford to offer monetary support (Taniguchi and Kaufman, 2017). Alternatively, some elderly parents are purely altruistic, therefore, they bequest housing assets without an expectation of receiving financial help while they are alive from their low-income children.

3.4 Robustness checks

The remainder of this section reports the results of addtional specifications to assess the robustness of our main findings. In Table 6, we show the empirical results of the OLS and Tobit models with a zero–one dummy for inheritance propensity, to see how the models in Table 4 modify possible bias. However, it is not easy to compare the magnitude of the coefficients, because the generated regressor of inheritance propensity in Table 4 is a continuous variable ranging from zero to one, while inheritance propensity in Table 6 is a dummy variable taking on the values of zero or one. The results show that the estimated coefficients for this dummy variable are positive and significant in both models, which yield results that are qualitatively similar to those in Table 4.

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Table 7 presents the empirical results of the instrumental variable (IV) regression and the IV Tobit model. We again find that the estimated coefficients of the dummy variable instrumented by the generated instruments indicating that adult children expect to receive the parental home are positive and significant. The test statistics of endogeneity are sufficiently large in both models, indicating rejection of the null hypothesis that inheritance propensity is an exogenous variable at conventional significance levels.

Instead of t_i, we can consider an observed dummy variable measuring whether adult children give financial transfers t_i^d. Then, the latent variable $t_i^{\#}$ is estimated by a probit model, which estimates the upstream transfers on the extensive margins (Cox, 1987). The zero–one dummy t_i^d is defined as follows:

$$t_i^d = 1, \text{ if } t_i^{\#} > 0$$

$$= 0, \text{ otherwise.}$$

Model [1] in Table 8 demonstrates the empirical results of the second-stage probit model. The coefficient of housing inheritance suggests that children are statistically more likely to give financial transfers when they expect to receive the parental home, which is consistent with our expectation. The estimated marginal effect is 0.87 and its bootstrap standard error is 0.45. Models [2] and [3] in Table 8 show the empirical results of the probit and the second-stage IV probit models with a zero–one dummy for inheritance propensity. Both models also correspond with our expectation, because the coefficients of housing inheritance dummy have a significantly positive sign. Overall, the results in Tables 6, 7, and 8 provide some confidence that our preferred findings are not unduly influenced by alternative empirical models.

4   Conclusion

In Japan, elderly homeowners generally leave their housing assets to their children. It is also quite common that adult children demonstrate their appreciation to their aging parents by providing financial support while they are alive. This reciprocal interdependence appears to indicate that adult children and aging parents enter into an implicit annuity contract in the

form of an informal intrafamily reverse mortgage, whereby children agree to support their parents financially in exchange for inheriting the parental home. The purpose of this paper is to theoretically and empirically examine this possibility.

We applied a simple noncooperative game framework with a Stackelberg equilibrium to examine the reciprocal interdependence between the propensity of housing inheritance and financial assistance when formal care affects decision-making. Theoretical models have suggested that adult children increase the amount of financial support to their parents when the probability of housing inheritance increases, which is consistent with a bequest motive arising from an implicit annuity contract.

We used data from Japanese households to test this reciprocal interdependence. Considering both the censoring of financial transfers and the specification of the inheritance propensity, which are controlled using information on formal care, our empirical results indeed suggest that the propensity to inherit the parental home encourages transfers from adult children to their elderly parents. This may confirm that the implicit annuity contract in the form of an intrafamily reverse mortgage appears to exist in Japanese society. However, altruism may also be a motive for bequeathing housing assets and engaging in financial provision. For example, altruistic children may offer financial assistance when parents run out of funds for living expenses. Parents then tend to show their appreciation to their children by bequeathing housing wealth. Instead, the bequest motive related to an implicit annuity contract may be an additional motivator in societies where assets, particularly illiquid housing assets in our context, are quite difficult to convert into cash.

The estimated results, however, suggest that on average, the amount of financial transfers from children tends to be too small to cover the welfare needs of their parents. Intrafamily reverse mortgages are effectively available to elderly homeowners if children have high expectations of inheriting the parental home. This could be resolved if adult children were to legally contract with their elderly parents in relation to housing inheritance and financial assistance. For example, in the USA, National Family Mortgage, LLC provides a family-funded reverse mortgage called the Caregiver Mortgage, whereby adult children crowdfund a line of credit

against the equity in the parental home.

Subsample analysis indicated that the reciprocal interdependence found tends to operate best for children whose income is relatively high. However, financial support from children to parents is small when the income of the children is sufficiently low. These children cannot afford to assist their elderly parents financially even if they receive the parental home in the future. Prolonged economic stagnation in Japan has resulted in a decreasing share of adult children in the higher income class. This suggests that intrafamily reverse mortgages may be available to even fewer elderly homeowners in the not-too-distant future. Nevertheless, this could be resolved if the commercial financial sector promoted customer-friendly reverse mortgage products to elderly homeowners.

There is, however, a consideration in that waiving inherited housing is becoming more common in Japan (Hirayama, 2010). Indeed, the number of vacant houses is soaring in unattractive locations in Japan. Intrafamily reverse mortgages therefore would not be effective in maintaining the welfare of the elderly in such areas. It is also difficult for the commercial financial sector to develop reverse mortgages in locations with little prospect for profit. This situation is more likely to occur when adult children live a considerable distance away from their parents. Because we restricted our sample to respondents whose parents reside in the same prefecture, this issue remains a topic for future research.

Acknowledgments

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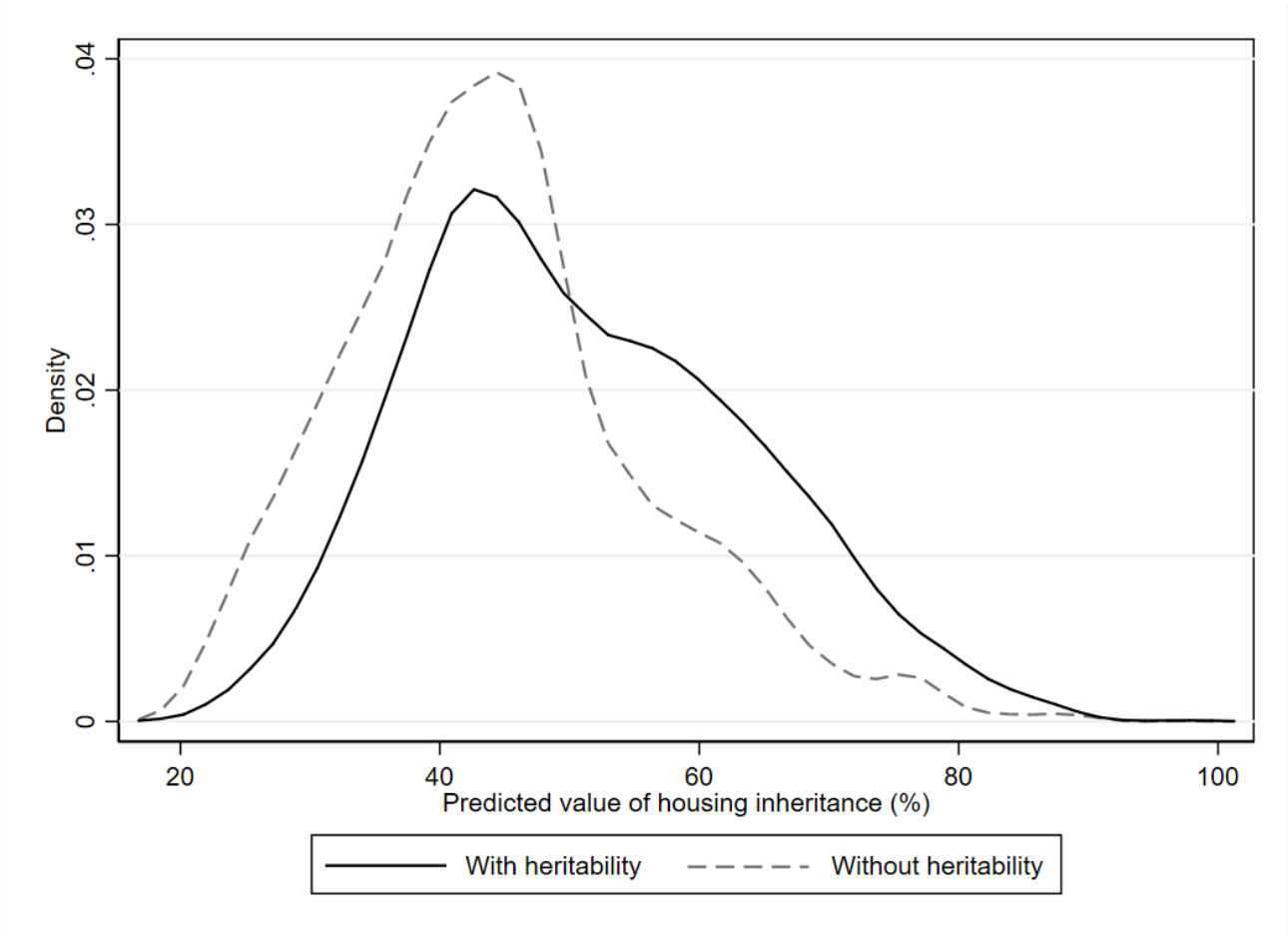
Figure 1: Kernel densities of predicted value of housing inheritance probabilities with and without heritability
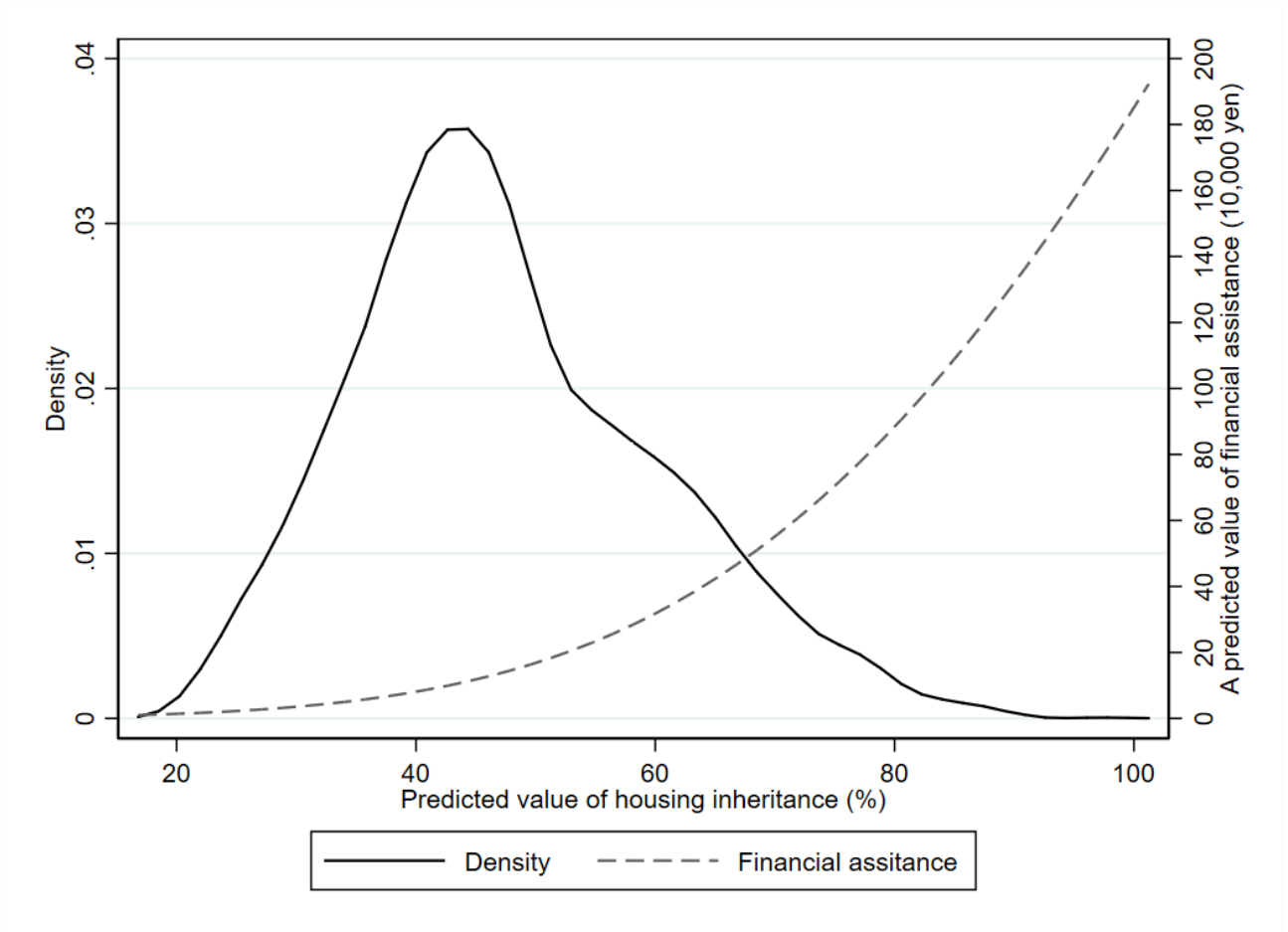
Figure 2: Predicted value of housing inheritance probabilities and financial assistance

Table 1: Descriptive statistics of the full sample

Variables	Mean	Std. Dev.	Min.	Max.
Financial assistance (10,000 yen)	8.17	58.37	0.00	5197.51
Positive assistance (%)	13.57	34.25	0.00	100.00
Housing inheritance (dummy)	0.48	0.50	0.00	1.00
Eldest son (dummy)	0.25	0.43	0.00	1.00
Only child (dummy)	0.06	0.23	0.00	1.00
Age	46.00	10.97	20.00	86.00
Child's income (10,000 yen)	734.38	485.26	0.00	9771.31
Nonworker (dummy)	0.07	0.25	0.00	1.00
Household size (#)	3.73	1.39	1.00	10.00
LTC capacity (1,000 beds/100,000 elderly)	2.98	0.65	1.54	5.99
Home helper (1,000 person/100,000 elderly)	1.41	0.51	0.61	2.74
Observations	14,204			

Note: Descriptive statistics for region, city size, and survey year dummies not shown.

Table 2: Annual financial assistance from adult children to parents

	With heritability	Without heritability
Mean (10,000 yen)	11.67	4.98
	(81.25)	(22.04)
Positive assistance (%)	16.64	10.79
Observations	6,760	7,444

Note: Standard deviation in parentheses.

Table 3: Estimation results of the first-stage probit model

Variables	Coef.	Robust Std. Err.
Eldest son	0.478***	0.025
Only child	0.452***	0.050
Age	−0.012***	0.001
Child's income	0.021***	0.003
Nonworker	0.027	0.046
Household size	0.088***	0.008
LTC capacity	0.023	0.033
Home helper	−0.094***	0.033
Constant	−0.186	0.129
Pseudo R^2	0.050	

Note: Number of observations is 14,204.

Model controls for region, city size, and survey year (estimates not shown).

*** denotes significance at the 1% level.

Table 4: Estimation results of the second-stage OLS and Tobit models

Variables	OLS		Tobit	
	Coef.	Bootstrap Std. Err.	Coef.	Bootstrap Std. Err.
Housing inheritance	70.650*	40.309	745.531*	303.193
Eldest son	−10.491	8.495	−105.806**	63.082
Only child	−10.267	7.726	−108.225**	56.222
Age	0.258*	0.146	1.783	1.144
Child's income	0.059	0.268	−0.715	1.889
Nonworker	−1.268	1.950	−2.507	16.604
Household size	−3.542***	1.364	−34.205***	10.795
Constant	−21.037	16.124	−541.079***	141.986
R^2	0.006			
Pseudo R^2			0.008	

Note: Number of observations is 14,204.

Housing inheritance is the generated regressor obtained from the first-stage probit model.

Child's income is divided by 100.

Models control for region and survey year (estimates not shown).

Bootstrap Std. Err. obtained by bootstrap approximation using 500 resamples.

***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 5: Estimation results of the subsamples according to child's income

Variables	High-income child		Low-income child	
	Coef.	Bootstrap Std. Err.	Coef.	Bootstrap Std. Err.
Housing inheritance	968.678**	400.128	−40.185	300.073
Eldest son	−151.055*	82.099	38.966	72.133
Only child	−133.046*	72.133	1.646	82.099
Age	2.081	1.499	−0.144	1.086
Child's income	−2.486	2.467	−0.708	4.086
Nonworker	12.022	25.922	−10.457	15.131
Household size	−44.345	14.413	−1.081	10.349
Constant	−630.499***	184.615	−128.288	119.606
Pseudo R^2	0.009		0.008	
Observations	10,655		3,549	

Note: Housing inheritance is the generated regressor obtained from the first-stage probit model.

Child's income is divided by 100.

Models control for region and survey year (estimates not shown).

High-income child is defined as a child whose household income is at or above the 25th percentile.

Low-income child is defined as a child whose household income is below the 25th percentile.

Bootstrap Std. Err. obtained by bootstrap approximation using 500 resamples.

***, **, * denote significance at the 1%, 5%, 10% level, respectively.

Table 6: Estimation results of the OLS and Tobit models

Variables	OLS Coef.	Robust Std. Err.	Tobit Coef.	Robust Std. Err.
Housing inheritance dummy	6.281***	1.113	47.282***	11.788
Eldest son	1.273	1.004	22.196**	6.518
Only child	0.180	2.044	3.986	10.580
Age	−0.032	0.028	−1.375***	0.401
Child's income	0.545**	0.146	4.572***	1.232
Nonworker	−0.573	1.334	5.148	10.370
Household size	−1.352***	0.514	−10.534***	3.540
Constant	4.236	2.630	−263.258***	65.025
R^2	0.008			
Pseudo R^2			0.010	

Note: Number of observations is 14,204.

Child's income is divided by 100.

Models control for region and survey year (estimates not shown).

***, ** denote significance at the 1%, 5% level, respectively.

Table 7: Estimation results of the second-stage IV regression and IV Tobit models

Variables	IV regression Coef.	Robust Std. Err.	IV Tobit Coef.	Robust Std. Err.
Housing inheritance dummy	47.444**	20.708	502.358***	168.732
Eldest son	−6.268	4.061	−61.072**	29.522
Only child	−6.720	4.873	−71.399**	30.973
Age	0.226	0.234	0.688	0.72
Child's income	0.154	0.102	1.074	1.347
Nonworker	−1.089	1.47	−0.439	12.931
Household size	−2.745***	0.788	−25.987***	7.766
Constant	−11.878	8.921	−442.013***	111.108
Tests of endogeneity [p-value]	4.566	[0.033]	15.964	[0.001]

Note: Number of observations is 14,204.

Housing inheritance dummy is the generated IV obtained from the first-stage probit model.

Child's income is divided by 100.

Models control for region and survey year (estimates not shown).

The null hypothesis that all independent variables including housing inheritance dummy are exogenous in the IV regression model is tested using a Wooldridge (1995) robust regression-based test.

The null hypothesis that housing inheritance dummy is exogenous in the IV Tobit model is tested using the Wald test.

***, ** denote significance at the 1%, 5% level, respectively.

Table 8: Estimation results of the probit models

Variables	[1] Probit (2nd stage)	[2] Probit	[3] IV probit (2nd stage)
Housing inheritance	4.105**		
	(2.008)		
Housing inheritance dummy		0.223***	1.747***
		[0.028]	[0.172]
Eldest son	–0.578	0.133***	–0.210***
	(0.420)	[0.031]	[0.057]
Only child	–0.601	0.024	–0.250***
	(0.374)	[0.057]	[0.058]
Age	0.008	–0.009***	0.001
	(0.008)	[0.001]	[0.002]
Child's income	–0.004	0.025***	0.003
	(0.013)	[0.003]	[0.005]
Nonworker	0.003	0.044	0.009
	(0.107)	[0.059]	[0.046]
Household size	–0.184***	–0.052***	–0.087***
	(0.065)	[0.011]	[0.008]
Constant	–2.784***	–1.251***	–1.420***
	(0.845)	[0.122]	[0.119]
Pseudo R^2	0.028	0.032	
Tests of endogeneity			18.630
			{0.000}

Note: Number of observations is 14,204.

Housing inheritance in Model [1] is the generated regressor obtained from the first-stage probit model.

Housing inheritance dummy in Model [3] is the generated IV obtained from the first-stage probit model.

Child's income is divided by 100.

Models control for region and survey year (estimates not shown).

The null hypothesis that housing inheritance dummy is exogenous in the IV probit model is tested using the Wald test.

Bootstrap Std. Err. in parentheses, Robust Std. Err. in brackets, p-value in braces.

Bootstrap Std. Err. obtained by bootstrap approximation using 500 resamples.

***, ** denote significance at the 1%, 5% level, respectively.