Bequest Motives, Inheritance Tax, and Housing Choice: A Problem of Inefficient Empty Nests[†]

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Miki Seko[*], Kazuto Sumita[**], Jiro Yoshida[***]

Abstract

The housing stock is underutilized in empty nests, which can be caused by the low mobility of elderly households and early renovations for their heirs. This study sheds light on the cause of inefficient empty nests by focusing on a bequest motive and inheritance tax. Japanese household panel data show that empty nests are more pronounced for elderly, non-moving, and renovating households. The motive to bequeath housing makes moving less likely but capacity-increasing renovations more likely. The motive to bequeath housing is influenced by the inheritance-tax benefit of housing in addition to income, wealth, and better housing structures. Thus, the inheritance-tax benefit of housing exacerbates a long-term empty nest problem by distorting housing choices.

Keywords: underutilized housing stock, tax distortions, mobility, renovation, aging society, IV probit model, Japan
JEL: J14, H21, R21

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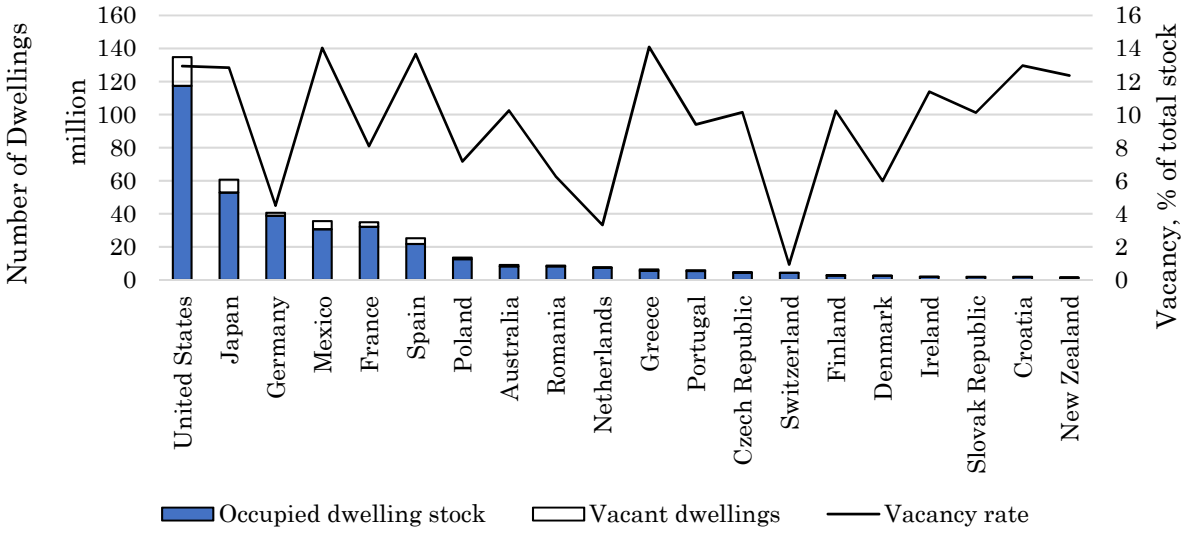
[*] Musashino University and Keio University. seko@econ.keio.ac.jp.
[**] Toyo University. sumita@toyo.jp.
[***] The Pennsylvania State University and the University of Tokyo. jiro@psu.edu.

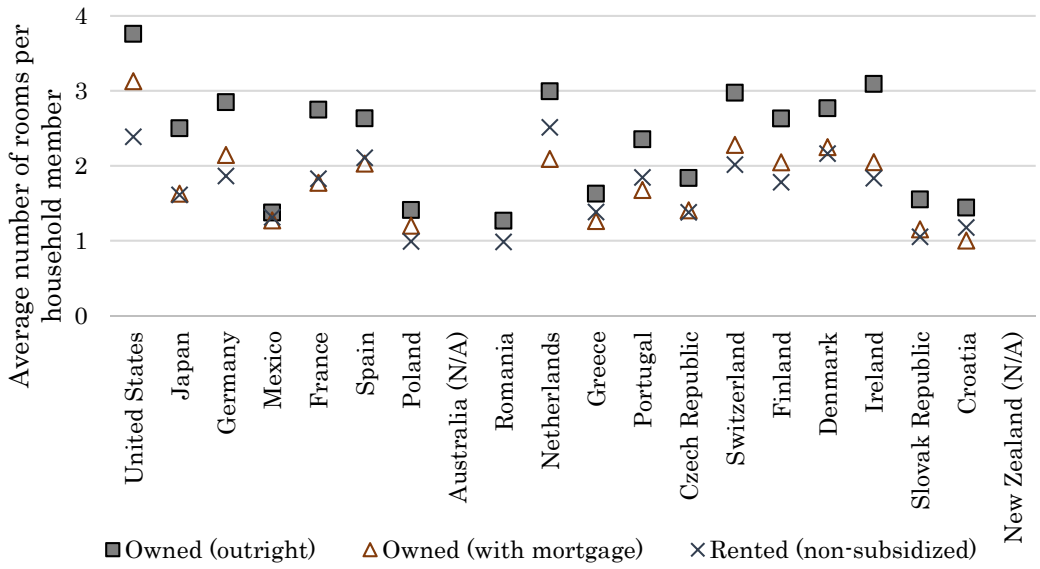
1 Introduction

The housing stock is underutilized if the accumulated housing stock is not efficiently allocated to those who can make the best use of it. A well-documented inefficiency is vacant houses. Another type of overlooked inefficiencies is vacant rooms. In an aging society, an increasing fraction of houses has become empty nests where only a parent or parents live after children left a house. In standard life-cycle and housing-choice models, empty nesters should extract home equity to support consumption by moving to a smaller house that better satisfies their needs (e.g., Artle and Varaiya, 1978; Yang, 2009; Bajari et al., 2013; Bayer et al., 2016; Nakajima and Telyukova, 2017). However, many households continue to live in their original houses by keeping rooms vacant (Venti and Wise, 1989, 2004).

Figure 1 shows OECD data regarding the proportion of vacant dwellings and dwelling capacities for 20 countries. The average vacancy rate is 10.9% (Panel A). For occupied dwellings, the average number of rooms per household member is 2.8 for outright owners, 2.2 for mortgage-financed owners, and 1.9 for renters (Panel B). These capacity statistics imply that the household with an average family size owns 9.5 rooms for 2.5 members in the US and 5.8 rooms for 2.3 members in Japan. Part of these excess rooms can represent underutilized vacant rooms. If one of the excess rooms is vacant for a seven-room house, the vacancy rate for occupied houses is 14.3%. Then, the implied total vacancy rate for both unoccupied and occupied houses is significantly higher: $0.109 + (1 - 0.109) \times \frac{1}{7} = 23.6\%$.



Panel A: Vacancy Rates



Panel B: Average Number of Rooms per Household Member

Figure 1 Vacant Dwellings and Dwelling Capacities

Note: Data are obtained from Organisation for Economic Co-operation and Development (OECD). For Panel A, years of reference are 2010 for Mexico; 2011 for Australia, the Czech Republic, Germany, Greece, Malta, Poland, Romania, the Slovak Republic, and Spain; 2013 for Croatia, Ireland, Japan, and New Zealand; 2014 for France and Switzerland. Panel B is based on European Survey on Income and Living Conditions (EU SILC) 2014 except Germany; the Household, Income and Labour Dynamics Survey (HILDA) for Australia (2014); Encuesta de Caracterización Socioeconómica Nacional (CASEN) for Chile (2013); the German Socioeconomic Panel (GSOEP) for Germany (2014); the Korean Housing Survey (2015); Japan Household Panel Study (JHPS) for Japan (2014); Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) for Mexico (2014); American Community Survey (ACS) for the United States (2014).

Of course, households may maintain some excess rooms for a reason. A family theater or study may provide significant marginal utility. Parents may maintain empty nests only for a short period before moving out or accommodating a coresident child, have an attachment to their house, enjoy occasional family gatherings in their empty nests, or rationally maintain a real option to accommodate uncertain coresidence needs. Parents may also view housing wealth as insurance against uncertain financial needs and rental costs (Skinner, 1996; Davidoff, 2010; Lockwood, 2018; Sinai and Souleles, 2001). However, regardless of a reason, underutilized housing stock indicates an inefficient resource allocation. Moreover, the inheritance tax system may unintentionally cause inefficiency for an extended period by distorting parental housing choices.

This study sheds light on the cause of empty nests by using data for Japan, which leads other countries in aging by having the lowest potential support ratio (Age 25-64 / Age 65+) of 1.8 (United Nations, 2019). We hypothesize that the motive to bequeath real estate, which is influenced by inheritance tax, impacts empty nests through parental mobility and renovation decisions. Extant studies show that taxes influence bequest motives (e.g., Page, 2003; Joulfaian, 2005; Piketty and Saez, 2013; Stark and Nicinska, 2015; Deboer and Hoang, 2017), and bequest motives influence consumption and savings (e.g., Kotlikoff and Summers, 1981; Bernheim, 1991; Kopczuk, 2007; Kopczuk and Lupton, 2007). However, whether bequest motives impact the elderly's mobility is an important empirical question (Venti and Wise, 1989).

As we outline in Data Section, the Japanese inheritance and property tax codes significantly favor owned houses over other assets. Thus, if a household sells a house before bequeathing it, the household wealth will be significantly reduced by transaction costs and a

large inheritance tax on the liquidated assets. Under the current tax code, a household may choose to remain in an empty nest for years until bequeathing it to its heirs.

Our objective is to analyze how the intention to bequeath housing impacts empty nests through its effect on household mobility and renovation. By using the Japanese household panel data (JHPS/KHPS), we first estimate the number of excess rooms as a function of household and housing characteristics as well as indicators for recent moving and renovation. Recent moving reduces 1.1 excess rooms, whereas recent renovation adds 0.3 excess rooms on average. More specifically, a capacity-increasing renovation adds 1.7 excess rooms while a capacity-decreasing renovation reduces 0.5 excess rooms.

Our main goal is to identify the causal effect of bequest motives on mobility, renovation, and empty nests. However, bequest motives may be endogenous to housing choices due to reverse causality. For example, recent movers and renovators may become more likely to bequeath a house. Thus, we exploit the 2015 change in the inheritance tax code as an exogenous shock to household decisions. The Japanese inheritance tax code favors housing by reducing the assessed house value by 80% up to a certain size limit. This tax change increased the threshold lot size from 240 m^2 to 330 m^2, which certainly impacts the intention to bequeath a house but does not directly impact a mobility or renovation decision because this threshold size is used only for inheritance tax. Thus, we instrument the intention to bequeath housing by a set of variables representing this change in the threshold lot size.

We estimate an IV linear probability model and an IV probit model.[1] In the first stage regression, we find that the favorable treatment of residential land in the inheritance tax code increases bequest motives for real estate. The bequest motive for real estate also increases with income, wealth, home equity, house quality, household head's age, and a male household head. Regarding children, one child is associated with the largest probability of having housing-bequest motives. As the number of children increases, the intention to bequeath indivisible real estate decreases.

In the second stage, the instrumented bequest motive for housing decreases the probability to move by 7.2 percentage points, supporting our hypothesis. Thus, a household that has the intention to bequeath housing tends to remain in the same house even if its housing needs can be better satisfied elsewhere. Mobility is also lower for financially constrained working-age households that have either no male child or many children. In contrast, housing-bequest motives increase the probability to renovate a house by 16.2 percentage points. Housing-bequest motives have the largest impact on the capacity-increasing renovation. This result explains why renovators tend to have more excess rooms. The renovation probability is generally higher if a household in a large city has a working-age head (especially in the late forties) and has either no child or many children.

Last, we estimate the number of excess rooms as a linear function of the instrumented bequest motive and other attributes. We confirm our hypothesis that empty nests are increased by the motive to bequeath housing, which is enhanced by the inheritance tax favoring housing.

[1] We also estimate as a robustness check an IV Heckman model by controlling for the sample selection regarding the intention to bequeath some assets. We obtain consistent results although statistical power of the test and the significance of coefficients are slightly different.

This study makes four contributions to the literature. First, this is the first study, to the best of our knowledge, to point out the inefficiency of bequest-motivated empty nests. This inefficiency issue will become more prevalent in all developed countries as the average potential support ratio is expected to decrease to the current Japanese level by 2045. Although a growing number of studies incorporate bequest motives and housing in the life-cycle model, they are not concerned about how housing capital is utilized because their objective is to incorporate housing values to resolve the retirement savings puzzle (e.g., Nakajima and Telyukova, 2017). The inefficient use of capital undermines welfare and economic growth because intergenerational transfers significantly contribute to capital formation (Kotlikoff and Summers, 1981; Barrett et al., 2015; Yukutake et al., 2015).

Second, this study identifies a new kind of tax distortions. This study demonstrates the unintended inefficiencies in housing-capital utilization due to the preferential treatment of housing in the inheritance tax system. Furthermore, our finding that an inheritance-tax change has a significant impact on bequest motives is the evidence of a significant elasticity of bequest motives with respect to inheritance tax. This finding serves as an important building block for the discussion of the optimal inheritance tax (e.g., Piketty and Saez, 2013).

Third, this study expands our understanding of housing vacancy. Housing vacancies are predominantly defined by the difference between the number of housing units and the number of households. Vacant rooms in occupied housing units are usually omitted, although this type of vacancy is commonly used for commercial real estate such as offices and warehouses. Adding vacant rooms of occupied housing to housing vacancy statistics will significantly increase vacancy rates in many countries as we discussed in Figure 1.

Fourth, this is one of a small number of studies on parental housing choices regarding mobility and renovations (e.g., Painter and Lee, 2009; Lee and Painter, 2014). Parental

housing choices have been studied less than inheriting heirs' housing choices because the proportion of the elderly was small. However, as many developed countries age quickly, parental housing choices will have first-order importance. For example, the ratio of the working-age population peaked in 1992 in Japan, 2008 in the US and Europe, and 2010 in China (United Nations, 2019).

The rest of this paper is organized as follows. Section 2 describes the data set and variables used in the analysis. Section 3 presents our preliminary analysis of empty nests. Section 4 presents our empirical strategy, followed by the discussion of estimation results in Section 5. Section 6 concludes the paper.

2 Data

We use Japan Household Panel Survey (JHPS) and Keio Household Panel Survey (KHPS), which are jointly conducted. The KHPS began in 2004 surveying 4005 households whereas JHPS began in 2009 surveying 4,022 households without an overlap. In both surveys, households are selected through stratified two-stage sampling. The demographic characteristics of the survey respondents are reasonably representative of Japanese households except that the subjects are of ages between 20 to 69 for KHPS and 20 or above for JHPS. These two surveys are combined since 2014 as Japan Household Panel Survey (JHPS/KHPS).[2]

We use data on households from the JHPS/KHPS between 2004 and 2018. We exclude the self-employed because their bequest motives can be driven by business strategy and alternative tax codes. Regarding housing decisions, we use residential mobility and

[2] See Seko and Sumita (2007), Seko, Sumita, and Naoi (2012, 2019), and Sumita, Seko, and Yoshida (2019) for more detailed explanation of the survey.

renovation of current housing. A dummy variable for a residential move takes one if the household moved its housing and takes zero otherwise. A renovation dummy variable takes one if the household experienced change its housing without changing address of its housing.

Household attributes include the household head's age, income, financial wealth, housing wealth, household size, and the number of children. They also include indicators of whether a household head is married, employment status, and has a college degree. Location characteristics include indicators for eight regions and city size categories.

2.1 Defining an Inheritance-Tax Variable

We use a major change in the inheritance tax code in 2015. The 2015 change includes an increase of the maximum tax rate from 50% to 55%, a decrease of the basic exemption from 50 million JPY to 30 million JPY, and a decrease of the variable exemption limit from 10 million JPY per heir to 6 million JPY per heir. At the same time, this tax change increased the maximum size of residential lots from 240 m^2 to 330 m^2 to be eligible for an 80% reduction in the tax assessment. Although its impact is not uniform, this change generally increases an inheritance tax amount.

We define the variable indicating that the household asset is subject to the inheritance tax:

$$I_{it}^{tax} \equiv \begin{cases} 1 & if\ HH\ i's\ taxable\ asset > exemption\ limit, \\ 0 & otherwise. \end{cases}$$

Due to tax code changes, the exemption limit and the method of calculating taxable assets are different before and after 2015. We assume that the tax-assessed property value is 80% of the reported property value based on the common understanding that the land valuation used for inheritance tax calculation (Rosenka) equals approximately 80% of the fair

assessment of land value for selected locations (Koji Chika). The taxable asset value and exemption limit are:

Before 2015:

$$Taxable\ asset = 0.8H \times (1 - 0.8 \times Min(240/L, 1)) + F - D$$

where H denotes the reported housing asset value, F denotes the reported financial asset value, and D denotes debt outstanding.

$$Exemption\ limit = 50\ million\ JPY + 10\ million\ JPY \times Number\ of\ heirs.$$

From 2015:

$$Taxable\ asset = 0.8H \times (1 - 0.8 \times Min(330/L, 1)) + F - D$$

$$Exemption\ limit = 30\ million\ JPY + 6\ million\ JPY \times Number\ of\ heirs.$$

2.2 Defining Bequest Motive Variables

In surveys for 2007-2009 and 2018, subjects answered the intention to bequeath their assets, the anticipated inheritance of housing, and the plan of using the inherited houses. We define two variables for bequest motives based on the following question: "Would you like to leave the asset of yours and your spouse's to heirs excluding your spouse?" However, the survey structure is different between the 2007-2009 surveys and the 2018 survey. The previous surveys ask about the bequest motive about real estate and financial assets conditional on the intention to bequeath some assets. In contrast, the recent survey asks about real estate and financial assets unconditionally. Thus, we construct two bequest-motive dummy variables: conditional and unconditional. For the conditional bequest-motive variable, we treat a household as missing (i.e., exclude from analysis) if it indicates no bequest motive for either real estate or financial assets. The unconditional bequest-motive variable takes the value of zero if a household indicates no bequest motives. We primarily use the unconditional variable because it gives us a larger sample without a selection issue. When we use the

conditional variable, we address the sample selection issue by controlling for the inverse mill's ratio by Heckman's method.

Table 1 contrasts bequest motives from the 2007-2009 surveys before the 2015 tax change and those from the 2018 survey. Panels A and B show the unconditional and conditional bequest-motive variables, respectively. Based on the unconditional variable (Panel A), the proportion of households with bequest motives is approximately 29% for real estate and 26% for financial assets before the tax change. In the 2018 survey, bequest motives increased by 14.35 percentage points for real estate (43.18%) and 11.03 points for financial assets (38.46%). A larger increase in real estate may be caused by the increased tax benefit for real estate. The conditional variable (Panel B) also shows that the bequest motive about real estate increased after the inheritance-tax change. These descriptive statistics give indirect evidence of a positive bequest elasticity mobility tax, which Piketty and Saez (2013) consider a critical factor determining the optimal inheritance tax rate. We test the effect of inheritance tax on bequest motives in our empirical analysis.

Table 1: Bequest Motives by Survey Years.

A. Unconditional

Real Estate

Year	Yes	No	Total
2007	594	1,651	2,245
	(26.46)	(73.54)	(100.00)
2008	930	2,214	3,144
	(29.58)	(70.42)	(100.00)
2009	848	2,093	2,941
	(28.83)	(71.17)	(100.00)
2018	1,621	2,133	3,754
	(43.18)	(56.82)	(100.00)
Total	3,993	8,091	12,084
	(33.04)	(66.96)	(100.00)

Pearson's Chi2 = 258.956, p=0.000

Financial Assets

Year	Yes	No	Total
2007	534	1,711	2,245
	(23.79)	(76.21)	(100.00)
2008	835	2,307	3,142
	(26.58)	(73.42)	(100.00)
2009	807	2,135	2,942
	(27.43)	(72.57)	(100.00)
2018	1,446	2,314	3,760
	(38.46)	(61.54)	(100.00)
Total	3,622	8,467	12,089
	(29.96)	(70.04)	(100.00)

Pearson's Chi2 = 196.2818 , p=0.000

B. Conditional

Real Estate

Year	Yes	No	Total
2007	594	127	721
	(82.39)	(17.61)	(100.00)
2008	930	186	1,116
	(83.33)	(16.67)	(100.00)
2009	848	171	1,019
	(83.22)	(16.78)	(100.00)
2018	1,609	236	1,845
	(87.21)	(12.79)	(100.00)
Total	3,981	720	4,701
	(84.68)	(15.32)	(100.00)

Pearson's Chi2 = 15.2599, p=0.002

Financial Assets

Year	Yes	No	Total
2007	534	187	721
	(74.06)	(25.94)	(100.00)
2008	835	279	1,114
	(74.96)	(25.04)	(100.00)
2009	807	213	1,020
	(79.12)	(20.88)	(100.00)
2018	1,435	410	1,845
	(77.78)	(22.22)	(100.00)
Total	3,611	1,089	4,700
	(76.83)	(23.17)	(100.00)

Pearson's Chi2 = 9.2285 , p= 0.026

Note: This table contrasts bequest motives regarding real and financial assets for different survey years. The unconditional variable treats no intention as zero, whereas the conditional variable treats no intention as missing. In parentheses are proportions of responses for each year. Each panel also shows Pearson χ^2 test on the null hypothesis that the response does not vary by year.

2.3 Descriptive Statistics

Table 2 shows the descriptive statistics of three subsamples: (i) households that did not move or renovate housing, (ii) households that changed housing in the previous year, (iii) households that renovated their houses in the previous year. Household income, savings, and home equity are deflated by the consumer price index (2015=100).

A majority of households did not move or renovate housing, confirming the low mobility of Japanese households.[3] Based on the average statistics in this sample, the number of rooms is 5.8, the average lot area is 233.8 m^2, 89% of houses are detached, 55% of houses are located in Kanto (Tokyo) and Kinki (Osaka) areas, and 69% of houses were built after 1981 when the building code incorporated the modern earthquake resistance requirement. The age of household head is 52 years old, real income is 7 million JPY, and real financial wealth is 11 million JPY in the 2015 JPY. 34% of household heads have college degrees, 80% are married, 36% are full-time workers, and the average household size is 3.4 persons. The proportion of households that have the intention to bequeath is 39% for housing and 33% for financial assets from the unconditional measure. A quarter of households are subject to inheritance tax based on the housing size and total net asset value.

The sample of movers is characterized by smaller lot size (159m^2), smaller real financial wealth (9 million JPY), younger age (41 years old), fewer children (0.7 coresident and 0.3 non-coresident children), a smaller proportion of being married (49%), a larger proportion of female household head (30%), and a larger proportion of full-time workers (48%). The proportions of households that have the intention to bequeath real estate and financial assets are smaller (28% and 29%, respectively) from the unconditional measure.

The sample of renovators is characterized by a larger number of rooms (6.4), detached houses (92%), an older age (55 years old), fewer co-resident children (0.8) and more non-coresident children (0.9), higher real income (7.6 million JPY), and larger real financial

[3] Attrition can be an issue because respondents who moved between two waves may drop out of the sample. To alleviate this problem, we checked the original interviewer's survey data and identified movers from stayers in the dropped sample.

wealth (14 million JPY). The proportions with bequest motives are larger (52% for housing and 42% for financial assets) based on the unconditional measure.

Table 2: Descriptive Statistics

Sample	(i) Households that did not move or renovate housing in 2006-2009 or 2017-2018		(ii) Households that moved in 2006-2009 or 2017-2018			(iii) Households that renovated housing in 2006-2009 or 2017-2018		
Variable	Mean	Std. Dev.	Mean	Std. Dev.	(ii)-(i)	Mean	Std. Dev.	(iii)-(i)
Mover (t+1) (=1)	0	0	1	0				
Renovation (t+1) (=1)						1	0	
Bequest motive for real estate (conditional)(t+1) (=1)	0.906	0.292	0.745	0.441	**	0.940	0.238	
Bequest motive for real estate (unconditional)(t+1) (=1)	0.391	0.488	0.276	0.449	***	0.524	0.501	***
Bequest motive for estate (unconditional)(excluding inter vivos) (t+1) (=1)	0.393	0.489	0.289	0.455	**	0.520	0.501	***
Bequest motive for financial asset (conditional)(t+1) (=1)	0.764	0.424	0.787	0.414		0.750	0.435	
Bequest motive for financial asset (unconditional)(t+1) (=1)	0.329	0.470	0.291	0.456		0.416	0.494	**
Bequest motive for financial asset (unconditional)(excluding inter vivos) (t+1) (=1)	0.344	0.475	0.306	0.463		0.429	0.496	**
# of rooms	5.803	1.866	5.614	1.741		6.375	2.210	***
Detached house (=1)	0.888	0.315	0.843	0.366		0.924	0.266	*
Town house (=1)	0.010	0.100	0.024	0.152		0.010	0.097	
Condominium (=1)	0.127	0.333	0.157	0.366		0.076	0.266	***
Wooden apartment (=1)	0.001	0.035	0.000	0.000	***	0.005	0.069	
Other types of houses (=1)	0.001	0.037	0.000	0.000	***	0.000	0.000	***
Lot area, m2	233.8	405.4	159.1	201.6	***	295.2	313.1	***
Lot area, m2 [0,100] (=1)	0.734	0.442	0.835	0.373	***	0.576	0.495	***
Lot area, m2 (240,330] (=1)	0.116	0.320	0.102	0.304		0.176	0.382	**
Lot area, m2 (>330) (=1)	0.150	0.357	0.063	0.244	***	0.248	0.433	***
Ground lease (=1)	0.026	0.159	0.024	0.152		0.010	0.097	**
Real housing equity (10,000JPY)	1,548	2,115	1,553	2,403		1,621	2,136	
Built after 1981 (=1)	0.687	0.464	0.685	0.466		0.600	0.491	**
Age of household head	52.4	13.8	41.4	14.9	***	54.8	13.1	**
Real Income (10,000JPY)	701	461	750	456		759.1	465.1	*
Real financial wealth (10,000JPY)	1,123	1,950	947	1,925		1,362	1,862	*
College graduate (=1)	0.343	0.475	0.394	0.491		0.333	0.473	
Married (=1)	0.791	0.406	0.488	0.502	***	0.781	0.415	
Female household head (=1)	0.156	0.363	0.299	0.460	***	0.176	0.382	

Single (=1)	0.044	0.206	0.063	0.244		0.052	0.223	
Full-time worker (=1)	0.358	0.480	0.480	0.502	***	0.300	0.459	*
Part-time worker (=1)	0.128	0.334	0.197	0.399	*	0.138	0.346	
Retired (=1)	0.144	0.351	0.047	0.213	***	0.157	0.365	
# of family members	3.430	1.382	3.441	1.384		3.243	1.317	**
Family decreased since 2004 (=1)	0.091	0.287	0.150	0.358	*	0.110	0.313	
Subject to inheritance tax (=1)	0.250	0.433	0.213	0.411		0.214	0.411	
# of non-coresident children	0.635	1.007	0.283	0.712	***	0.881	1.268	***
# of coresident children	1.053	1.053	0.717	0.991	***	0.790	0.920	***
Male children (=1)	0.532	0.499	0.394	0.491	***	0.462	0.500	**
No child (=1)	0.227	0.419	0.488	0.502	***	0.233	0.424	
Hokkaido (=1)	0.044	0.206	0.031	0.175		0.038	0.192	
Tohoku (=1)	0.058	0.233	0.031	0.175	*	0.033	0.180	*
Kanto (=1)	0.339	0.473	0.362	0.483		0.305	0.461	
Chubu (=1)	0.165	0.371	0.142	0.350		0.176	0.382	
Kinki (=1)	0.210	0.407	0.252	0.436		0.171	0.378	
Chugoku (=1)	0.052	0.222	0.024	0.152	**	0.081	0.273	
Shikoku (=1)	0.031	0.172	0.031	0.175		0.043	0.203	
Kyushuu/Okinawa (=1)	0.102	0.303	0.126	0.333		0.152	0.360	**
Year 2006 (=1)	0.181	0.385	0.228	0.421		0.219	0.415	
Year 2007 (=1)	0.256	0.436	0.276	0.449		0.286	0.453	
Year 2008 (=1)	0.245	0.430	0.244	0.431		0.276	0.448	
Year 2017 (=1)	0.319	0.466	0.252	0.436	*	0.219	0.415	***
Number of observations	7,999		127			210		

Note: ***, **, and * indicate the result of a paired t-test of equal means between two samples at the 1%, 5%, and 10% significance levels, respectively. We use Welch's method to test the difference of averages under the hypothesis of heteroskedasticity.

3 Preliminary Analysis of Empty Nests

As a preliminary analysis of empty nests, we run the following regression for different subsamples:

$$r_{\mathrm{it}}^{e} = \boldsymbol{x}_{it-1}'\boldsymbol{\delta}_1 + J_j + T_t + \varepsilon_{1it}, \tag{1}$$

where r_{it}^{e} denotes the number of excess rooms defined by the difference between the number of rooms and the number of persons for household i in year t.[4] Vector $\boldsymbol{x}_{it-1}$ includes a constant, household attributes such as household head's age categories, household size, the number of children, real income quartiles, and real financial wealth quartiles. Fixed effects are also included for region j, J_j $(j = 1, \cdots, 8)$, and year t, T_t.

Table 3 shows the estimation result. The numbers of family members and children have negative coefficients. Larger income and financial wealth are associated with more excess rooms, possibly because of their preferences for greater consumption of housing. High-income and wealthier households may be less sensitive to the opportunity cost of maintaining excess rooms. An opportunity-cost explanation is also consistent with the result that the more expensive Kanto (Tokyo) region has fewer excess rooms.

Constants for homeowners (column 2) and renters (column 3) indicate that homeowners tend to have more excess rooms. The larger number of excess rooms can be caused by homeowners' higher costs of adjusting housing either by moving or renovating. Homeowners may maintain a suboptimal amount of housing even when the household size changes because re-optimization requires the expenses associated with moving, buying a house, and selling the current house.

Non-movers (column 4) tend to hold more excess rooms than movers (column 5). Since movers already re-optimized housing consumption, unused housing space should be smaller, ceteris paribus. In addition to a larger constant for non-movers, their age coefficients are also significantly larger for all age groups.

[4] A child under ten years old is counted as a half.

Table 3: Excess-Room Regression Result

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
# of Excess rooms	Whole Sample	Home-owners	Renters	No Move	Moved	Renovated
# of family members	-0.410***	-0.542***	-0.520***	-0.448***	-0.252***	-0.603***
	(0.00721)	(0.00805)	(0.0143)	(0.00784)	(0.0215)	(0.0256)
# of Children	-0.0751***	-0.0504***	-0.0321**	-0.0490***	-0.249***	0.0337
	(0.00752)	(0.00809)	(0.0144)	(0.00803)	(0.0229)	(0.0245)
Real income:	0.183***	0.0217	0.160***	0.191***	0.0989***	0.203***
2nd and 3rd quartiles (=1)	(0.0183)	(0.0204)	(0.0295)	(0.0206)	(0.0373)	(0.0769)
Real income:	0.454***	0.248***	0.404***	0.454***	0.381***	0.131*
4th quartile (=1)	(0.0204)	(0.0219)	(0.0465)	(0.0223)	(0.0487)	(0.0761)
Real financial wealth:	0.316***	0.165***	0.0487*	0.341***	0.136***	0.238***
2nd and 3rd quartiles (=1)	(0.0179)	(0.0197)	(0.0292)	(0.0200)	(0.0374)	(0.0734)
Real financial wealth:	0.702***	0.479***	0.252***	0.723***	0.435***	0.733***
4th quartile (=1)	(0.0201)	(0.0217)	(0.0461)	(0.0218)	(0.0496)	(0.0681)
Household head age (Reference: [40, 44])						
[20, 24] (=1)	0.190***	0.435***	-0.300***	0.318***	-0.561***	0.684**
	(0.0548)	(0.0627)	(0.0762)	(0.0585)	(0.152)	(0.346)
[25, 29] (=1)	-0.0528	0.388***	-0.343***	0.176***	-0.567***	0.404**
	(0.0409)	(0.0508)	(0.0485)	(0.0491)	(0.0668)	(0.187)
[30, 34] (=1)	-0.387***	-0.157***	-0.308***	-0.263***	-0.487***	0.0651
	(0.0327)	(0.0413)	(0.0435)	(0.0414)	(0.0523)	(0.184)
[35, 39] (=1)	-0.298***	-0.229***	-0.265***	-0.242***	-0.324***	-0.678***
	(0.0288)	(0.0331)	(0.0444)	(0.0349)	(0.0493)	(0.163)
[45, 49] (=1)	0.254***	0.197***	0.175***	0.253***	0.116**	0.267*
	(0.0286)	(0.0322)	(0.0466)	(0.0331)	(0.0546)	(0.143)
[50, 54] (=1)	0.524***	0.437***	0.219***	0.501***	0.286***	0.854***
	(0.0294)	(0.0329)	(0.0478)	(0.0332)	(0.0674)	(0.144)
[55, 59] (=1)	0.815***	0.681***	0.270***	0.783***	0.389***	0.956***
	(0.0304)	(0.0336)	(0.0501)	(0.0338)	(0.0774)	(0.139)
[60, 64] (=1)	1.111***	0.932***	0.342***	1.080***	0.446***	0.800***
	(0.0315)	(0.0347)	(0.0516)	(0.0349)	(0.0803)	(0.128)
[65, 69] (=1)	1.270***	1.010***	0.527***	1.222***	0.581***	0.881***
	(0.0321)	(0.0354)	(0.0559)	(0.0354)	(0.0885)	(0.128)
[70, 74] (=1)	1.358***	1.044***	0.629***	1.292***	0.655***	0.843***
	(0.0347)	(0.0378)	(0.0645)	(0.0382)	(0.0990)	(0.128)
[75, 79] (=1)	1.447***	1.115***	0.657***	1.371***	0.576***	0.596***
	(0.0428)	(0.0461)	(0.0797)	(0.0463)	(0.131)	(0.149)
[80 and above) (=1)	1.717***	1.428***	0.866***	1.675***	0.399**	0.843***
	(0.0673)	(0.0718)	(0.110)	(0.0701)	(0.156)	(0.169)
Regional fixed effects (Reference: Kanto area)						
Hokkaido (=1)	0.415***	0.397***	0.400***	0.441***	0.223***	0.665***
	(0.0283)	(0.0312)	(0.0411)	(0.0309)	(0.0628)	(0.0865)
Tohoku (=1)	1.171***	1.145***	0.624***	1.193***	0.811***	1.085***
	(0.0352)	(0.0378)	(0.0704)	(0.0377)	(0.0935)	(0.109)

Chubu (=1)	0.979***	0.980***	0.540***	1.014***	0.668***	1.004***
	(0.0221)	(0.0237)	(0.0423)	(0.0241)	(0.0517)	(0.0799)
Kinki (=1)	0.553***	0.544***	0.346***	0.575***	0.381***	0.942***
	(0.0197)	(0.0220)	(0.0298)	(0.0221)	(0.0398)	(0.0811)
Chugoku (=1)	0.906***	0.975***	0.554***	0.918***	0.629***	1.139***
	(0.0351)	(0.0399)	(0.0463)	(0.0381)	(0.0860)	(0.127)
Shikoku (=1)	0.843***	0.922***	0.361***	0.890***	0.604***	0.392***
	(0.0434)	(0.0471)	(0.0679)	(0.0487)	(0.0851)	(0.145)
Kyushuu/Okinawa (=1)	0.434***	0.489***	0.229***	0.487***	0.215***	0.718***
	(0.0230)	(0.0255)	(0.0342)	(0.0253)	(0.0501)	(0.0836)
Constant	2.226***	3.211***	1.790***	2.346***	1.970***	3.035***
	(0.0392)	(0.0458)	(0.0583)	(0.0444)	(0.0824)	(0.180)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
# of observations	71,960	57,804	12,613	60,718	10,771	6,114
R-squared	0.274	0.285	0.325	0.268	0.196	0.237

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

Figure 2 depicts the age profile of excess rooms for movers, non-movers, and renovators. Older household heads tend to have more excess rooms. This result is consistent with the empty nest phenomenon. The number of excess rooms is generally increasing in age for all household types. However, non-movers have more excess rooms than movers for all ages. Furthermore, the rate of increase by age is larger for non-movers than for movers. Thus, the empty nest problem is more pronounced in non-mover households.

Interestingly, renovators tend to have even more excess rooms. Renovations include modernization and changing the number of rooms, either positively or negatively. Thus, forward-looking capacity expansion can result in more excess rooms until they are actually used. However, after 50 years old, the number of excess rooms does not increase with age. This may suggest that relatively old household heads renovate their houses to decrease the number of rooms by combining excess rooms or to increase the household size by accommodating coresident children.

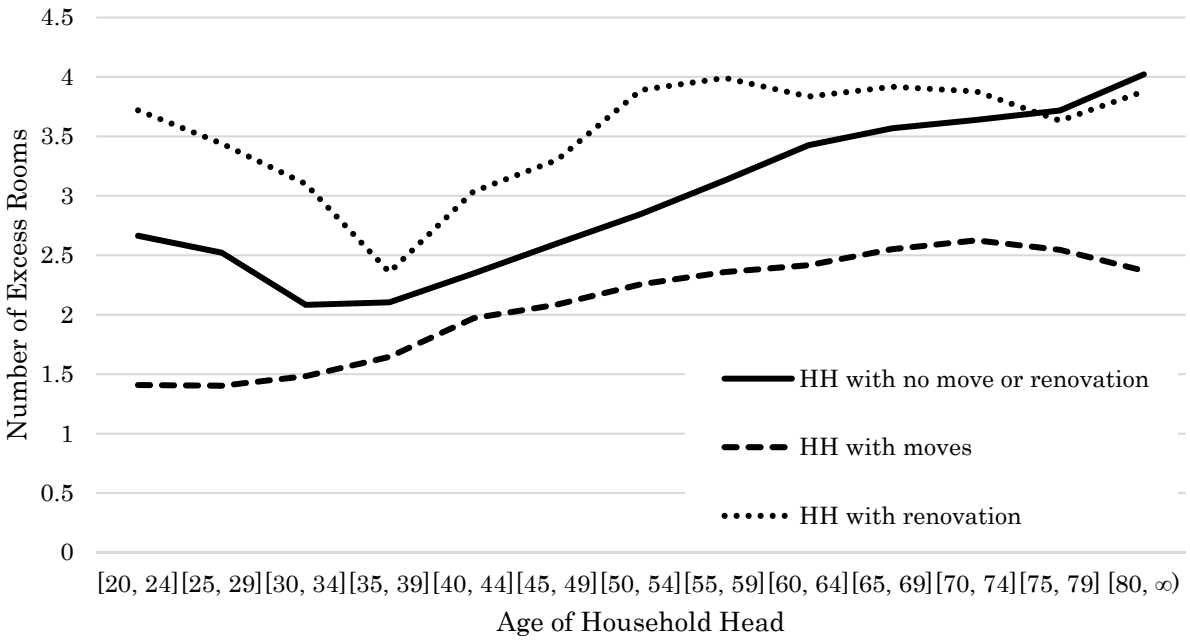


Figure 2: Excess rooms

Note: This figure depicts the coefficients for age groups in columns (4), (5), and (6) of Table 3. The constant for each regression is added.

To better understand the relation between the number of excess rooms and moving and renovations, we run the following regressions:

$$r_{\mathrm{it}}^{e} = \alpha_2 m_{it-1} + \boldsymbol{r}'_{it-1}\boldsymbol{\gamma_2} + \boldsymbol{x}'_{it-1}\boldsymbol{\delta_2} + J_j + T_t + \varepsilon_{2it}, \quad (2)$$

where m_{it-1} denotes the dummy variable for moving, and $\boldsymbol{r}_{it-1}$ denotes the vector of dummy variables for different types of renovations (capacity-increasing, maintaining, and decreasing renovations).

Table 4 shows the estimation result. When we do not control for an attribute or fixed effects, moving during the previous year is associated with 1.345 fewer excess rooms on average, suggesting the optimization of housing consumption at the time of move (Column 1). Renovation on average is associated with 0.708 more excess rooms (Column 2), mainly driven by a capacity-increasing renovation adding 1.968 rooms (Column 4). When we control

for housing and household attributes and fixed effects for region and year, estimated coefficients slightly decrease in magnitude, but the main conclusion is unchanged. Based on column (8), moving is subsequently associated with 1.1 fewer excess rooms, whereas a capacity-increasing renovation is associated with 1.7 more excess rooms. Thus, empty nests are negatively correlated with household mobility and positively correlated with renovations on average.

Table 4: Number of excess rooms, mobility, and renovation

Dependent Variable: # of Excess rooms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Moving (=1)	-1.345***		-1.327***	-1.327***	-1.105***		-1.099***	-1.102***
	(0.139)		(0.139)	(0.139)	(0.164)		(0.164)	(0.164)
Renovation (=1)		0.708***	0.689***			0.271*	0.257*	
		(0.149)	(0.149)			(0.139)	(0.139)	
Capacity-increasing renovation (=1)				1.968***				1.652***
				(0.334)				(0.312)
Capacity-maintaining renovation (=1)				0.558***				0.0106
				(0.180)				(0.155)
Capacity-decreasing renovation (=1)				-0.263				-0.548**
				(0.287)				(0.279)
Constant	2.522***	2.484***	2.504***	2.504***	-1.267***	-1.381***	-1.254***	-1.268***
	(0.0225)	(0.0225)	(0.0227)	(0.0227)	(0.328)	(0.327)	(0.328)	(0.326)
Housing and household attributes	No	No	No	No	Yes	Yes	Yes	Yes
Region and year fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Observations	9,253	9,253	9,253	9,245	8,293	8,293	8,293	8,291
R-squared	0.005	0.003	0.008	0.011	0.457	0.454	0.457	0.461

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1.

4 Empirical Strategy

We analyze household decisions of moving and renovation with a focus on bequest motives and the inheritance tax. To address the issue that bequest motives may be

endogenous to moving and renovation decisions, we estimate three models that use instrumental variables.

We first estimate the IV Linear Probability Model by using the unconditional measure of bequest motives. A linear probability model has several advantages, including the ease of interpreting the estimated coefficients (Angrist and Pischke, 2009). However, the non-linearity may play a crucial role especially when the proportion of movers and renovators is small. Thus, we also estimate the IV Probit Model based on the unconditional measure of bequest motives by the maximum likelihood estimation. In an IV bivariate probit model with a binary endogenous explanatory variable, parameters can be identified by the nonlinearity in the bivariate probit model rather than an exclusion restriction (Wooldridge, 2010). Thus, this model can provide us with a better estimate when instruments are somewhat contaminated.

As a robustness check, we use the conditional measure of bequest motives for real estate by focusing on the subsample of households that intend to bequeath some assets. To address the selection issue, we estimate the IV Heckman Linear Probability Model; in the bequest and outcome equations, we control for the inverse Mills ratio calculated from the selection equation. We present the estimation result of this model in Appendix B.

Last, we estimate the IV linear model for empty nests using the same set of covariate and instrumental variables. Although we demonstrate in the previous section a negative correlation between empty nests and mobility and a positive correlation between empty nests and renovation, we directly estimate the relation between the instrumented bequest motive for housing and empty nests in this model.

4.1 IV Linear Probability Model

We estimate the IV Linear Probability Model by the two-stage least square (2SLS): the bequest motive equation in the first stage and the mobility or renovation equation in the second stage. The first-stage equation for bequest motives is:

$$B^H{}_{\text{it}} = \boldsymbol{z}'_{it-1}\boldsymbol{\theta_3} + \boldsymbol{x}'_{it-1}\boldsymbol{\delta_3} + J_j + T_t + \varepsilon_{3it}, \tag{3}$$

where $B^H{}_{\text{it}}$ denotes the indicator for household i's bequest motives for real estates, $\boldsymbol{z}_{it-1}$ denotes the vector of instrumental variables, $\boldsymbol{x}_{it-1}$ denotes the covariate vector related to households and housing characteristics, and J_j and T_t denote region and year fixed effects, respectively. The second-stage equation for mobility or renovation is:

$$y_{it} = \beta_4 \hat{B}^H{}_{it} + \boldsymbol{x}'_{it-1}\boldsymbol{\delta_4} + J_j + T_t + \varepsilon_{4it}, \tag{4}$$

where y_{it} denotes the indicator for moving or renovation at time t, and $\hat{B}^H{}_{it}$ denotes the instrumented bequest motives from the first stage.

The instrument vector $\boldsymbol{z}_{it-1}$ includes variables related to bequest motives but not directly related to outcomes. We employ one set of instrumental variables that capture exogenous variation by inheritance-tax code. The set includes lot-size dummy variables that are relevant only for inheritance tax. The inheritance tax code uses lot size thresholds of 240 m^2 and 330 m^2. The maximum size for the reduced tax assessment of a residential lot was 240 m^2 before 2015 but 330 m^2 from 2015. Thus, lot size is classified into small ($\leq$ 240 m^2), medium (240 m^2 < lot size $\leq$ 330 m^2), and large (> 330 m^2).[5] We interact these dummies with a post-2014 dummy.

[5] The housing built on the leased land is included in group of zero lot size. Because a right to live on the land is admitted as an asset to bequeath in the inheritance tax law and the right is evaluated as 60 - 70 percent of the value of the land.

The covariate vector $\boldsymbol{x}_{it-1}$ includes child-related variables in both stages. Different types of children help us distinguish alternative hypotheses about bequest motives: selfish, altruistic, and dynastic motives. Horioka (2002, 2014) and Hamaaki et al. (2018) study bequest motives in Japan and conclude that they are consistent with selfish and dynastic motives. Selfish parents will not bequeath assets to their children unless they live together and take care of parents. Thus, we separately include the number of coresident and non-coresident children. For dynastic motives, we use a dummy variable for a male child.

4.2 IV Probit Model

We estimate the IV Probit model considering the non-linear relationship between bequest motives and the probability of moving and renovation decisions. We simultaneously estimate the following bequest and outcome equations by maximum likelihood:

$$B_{it}^{H} = 1\left[\boldsymbol{z}_{it-1}'\boldsymbol{\theta}_{\boldsymbol{3}'} + \boldsymbol{x}_{it-1}'\boldsymbol{\delta}_{\boldsymbol{3}'} + J_j + T_t + \varepsilon_{\boldsymbol{3}'it} > 0\right] \tag{3'}$$

$$y_{it} = 1\left[\beta_{4'}B_{it}^{H} + \boldsymbol{x}_{it-1}'\boldsymbol{\delta}_{\boldsymbol{4}'} + J_j + T_t + \varepsilon_{\boldsymbol{4}'it} > 0\right] \tag{4'}$$

A benefit of this model is that identification may not require an exclusion restriction for an instrumental vector unlike for a linear model because the model is identified by the nonlinearity (Wooldridge, 2010). Thus, we can have a consistent estimate even if instruments are contaminated (i.e., if an exclusion restriction is not satisfied).

4.3 IV Linear Model for Empty Nests

We estimate the IV Linear Model for empty nests by the two-stage least square (2SLS). The first stage is identical to equation (3). In the second stage, we use the number of excess rooms for the outcome variable y_{it} in equation (5).

$$y_{it} = \beta_5\hat{B}_{it}^{H} + \boldsymbol{x}_{it-1}'\boldsymbol{\delta}_{\boldsymbol{5}} + J_j + T_t + \varepsilon_{5it} \tag{5}$$

5 Results

5.1 Bequest Motives

The estimation result of the bequest equation is effectively identical for all IV models, except for small variations stemming from sample differences. Thus, we show the first-stage result for bequest motives only in columns 1 and 3 of Tables 5 and 8 based on IV Linear Probability Models.

Households owning large residential lots (> 330 m^2) increased bequest motives for real estate by 8.3 percentage points after the inheritance-tax change. Compared to a household with a small lot (≤ 240 m^2), those with large lots are 11.4 percentage points more likely to have bequest motives after the tax change. Although the tax change also increased benefits for lots between 240 and 330 m^2, the coefficient is not statistically significant. These size thresholds are only relevant for inheritance tax because we separately control for lot size. Thus, this result provides evidence that the elasticity of bequest motives with respect to the effective tax rates is positive and significant, contributing to the discussion of the optimal inheritance tax rate (e.g., Piketty and Saez, 2013).

The "subject to inheritance tax" dummy is statistically insignificant. Thus, the non-housing aspect of the inheritance tax code does not influence the motive to bequeath housing. This result suggests that the preferential treatment of real estate relative to other assets is more important than overall tax rates. In contrast, household income and wealth play essential roles. Bequest motives for real estate increase with the log real home equity (0.43 percentage points), log real income (1.46 percentage points), and log real financial wealth (1.87 percentage points).

Table 5: IV Linear Probability Model for Mobility

Dependent Variable	1. Bequest Motives for Real Estate	2. Moving	3. Bequest Motives for Real Estate	4. Moving
Variables	(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
Bequest motive for real estate (unconditional)(t+1) (=1)		-0.0686**		-0.0688**
		(0.0324)		(0.0324)
Lot area, m2 (240,330] (=1)	0.0234		0.0232	
	(0.0290)		(0.0291)	
Lot area, m2 (>330) (=1)	0.0312		0.0308	
	(0.0297)		(0.0298)	
Lot area, m2 (240,330] ×After tax change (=1)	-0.0261		-0.0258	
	(0.0345)		(0.0346)	
Lot area, m2 (>330) ×After tax change (=1)	0.0829**		0.0833**	
	(0.0326)		(0.0327)	
# of rooms [4 or over] (=1)	0.00157	-0.00123	0.00147	-0.00126
	(0.0233)	(0.00759)	(0.0233)	(0.00760)
Subject to inheritance tax (=1)			0.00276	0.000744
			(0.0174)	(0.00400)
Lot area, 100m2	0.00220	-0.000128	0.00220	-0.000129
	(0.00145)	(0.000221)	(0.00145)	(0.000222)
Condominium (=1)	-0.0890***	-0.00115	-0.0891***	-0.00119
	(0.0175)	(0.00641)	(0.0175)	(0.00641)
Ground lease (=1)	-0.0326	-0.0129	-0.0326	-0.0129
	(0.0321)	(0.0101)	(0.0321)	(0.0101)
Real housing equity, ln	0.00430***	0.000725*	0.00426***	0.000714*
	(0.00128)	(0.000404)	(0.00130)	(0.000408)
Built after 1981 (=1)	0.0401***	0.00146	0.0401***	0.00146
	(0.0118)	(0.00385)	(0.0118)	(0.00386)
Age of household head	-0.0125***	-0.00511***	-0.0125***	-0.00510***
	(0.00277)	(0.00110)	(0.00278)	(0.00110)
Age of household head squared/100	0.0144***	0.00436***	0.0143***	0.00434***
	(0.00278)	(0.00103)	(0.00279)	(0.00104)
Real income, ln	0.0146*	0.00376	0.0146*	0.00376
	(0.00799)	(0.00275)	(0.00799)	(0.00276)
Real financial wealth, ln	0.0187***	0.00146	0.0187***	0.00146
	(0.00201)	(0.000896)	(0.00201)	(0.000897)
College graduate (=1)	0.0152	0.00300	0.0152	0.00299
	(0.0114)	(0.00326)	(0.0114)	(0.00326)
Married (=1)	0.0271	-0.00676	0.0272	-0.00673
	(0.0202)	(0.00667)	(0.0203)	(0.00669)
Female household head (=1)	-0.0694***	-0.00344	-0.0693***	-0.00345
	(0.0162)	(0.00673)	(0.0162)	(0.00674)
Single (=1)	0.0452	0.00721	0.0452	0.00721
	(0.0300)	(0.00994)	(0.0300)	(0.00994)
Full-time worker (=1)	0.0173	0.00565*	0.0173	0.00565*

	(0.0115)	(0.00315)	(0.0115)	(0.00315)
Part-time worker (=1)	-0.0118	0.00364	-0.0118	0.00363
	(0.0157)	(0.00509)	(0.0157)	(0.00509)
Retired (=1)	-0.0209	-0.00377	-0.0211	-0.00381
	(0.0203)	(0.00383)	(0.0203)	(0.00380)
# of family members	-0.00263	0.00122	-0.00262	0.00122
	(0.00616)	(0.00191)	(0.00617)	(0.00191)
Male children (=1)	0.0124	0.00548*	0.0123	0.00546*
	(0.0138)	(0.00291)	(0.0138)	(0.00292)
# of non-coresident children	-0.0245***	-0.00307*	-0.0245***	-0.00308*
	(0.00728)	(0.00179)	(0.00728)	(0.00179)
# of coresident children	-0.0146	-0.00721***	-0.0146	-0.00721***
	(0.0103)	(0.00276)	(0.0103)	(0.00276)
No child (=1)	-0.278***	-0.0185*	-0.278***	-0.0186*
	(0.0208)	(0.0108)	(0.0208)	(0.0108)
Family decreased since 2004 (=1)	0.0544***	0.0147**	0.0543***	0.0147**
	(0.0184)	(0.00611)	(0.0184)	(0.00610)
City-size fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.343***	0.149***	0.342***	0.149***
	(0.0912)	(0.0351)	(0.0912)	(0.0351)
# of observations	8,126	8,126	8,126	8,126
R-squared	0.135	-0.039	0.135	-0.039
# of events		127		127
Kleibergen-Paap rk LM		32.65		32.65
p-value		1.41e-06		0.0246
Stock_Yogo_Kleibergen-Paap Wald rk F		8.433		8.433
Hansen J		4.884		4.874
p-value		0.180		0.0201

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

Not surprisingly, children also impact bequest motives. Households with no children have a 27.8 percentage-point lower probability of having a bequest motive. An additional number of coresident children does not significantly impact the bequest-motive probability. Thus, if parents have at least one coresident child, they already have a high probability of bequeathing housing. In contrast, an additional non-coresident child decreases the bequest-motive probability by 2.45 percentage points; i.e., the bequest-motive probability is highest with only one child. Parents are willing to bequeath housing if they have only one child,

regardless of the current coresidence status. However, parents lose their motives to bequeath housing when they have more than one child because an indivisible housing asset can become a source of disputes between multiple heirs. These results are consistent with altruistic and selfish bequest motives. The coefficient on male children is small and statistically insignificant. Contrary to Wakabayashi and Horioka (2009), the primogeniture system may not be dominant in Japan any longer.

Age and several other household characteristics are also associated with bequest motives. The relationship between bequest motives and age is u-shaped with a minimum at 43 years old. Because bequest motives expressed by young household are noisy, we can conclude that the probability of having bequest motives increase at an increasing rate after their forties. Female household head has a 6.9 percentage-point smaller probability of bequest motives.

Housing characteristics also matter. Condominiums are associated with a smaller probability (−8.90 percentage points), whereas houses built after 1981 with significantly improved earthquake resistance standards are associated with a larger probability (4.01 percentage points). These results suggest that households with housing bequest motives tend to own less depreciating assets; detached housing (as opposed to condominiums) have a larger proportion of non-depreciating land, and newer structures with improved building standards depreciate less. Condominiums also require large capital expenditures later in a building life.

5.2 Mobility

5.2.1 IV Linear Probability Model

Columns 2 and 4 of Table 5 show the second-stage result for moving decisions. The instrumented bequest motive has a statistically significant negative coefficient (−0.0686 in

Model 2). Thus, bequest motives for real estate make a household less likely to move. When parents intend to bequeath a house, moving is often a suboptimal decision because of large transaction costs. A 6% brokerage fee is the highest among many developed countries. Thus, the low mobility of households is reasonable for households that have the intention to bequeath real estate. A consequence is more pronounced empty nests because low mobility is a cause of empty nests.

The IV estimate is larger in the absolute value than the OLS estimate (−0.0008) shown in Appendix A. This difference suggests positive reverse causality; i.e., those who decided to move are more likely to bequeath their houses. We validate our IV model by three tests. By the Kleibergen-Paap rk LM test (Kleibergen and Paap, 2006), we can reject the null hypothesis of under-identification. By the Kleibergen-Paap Wald rk F statistic, we reject the null of weak instruments at least twenty percent based on the critical values provided by Stock and Yogo (2005). By Hansen's over-identification J test, we do not reject the null of orthogonality condition.

A no-child dummy is associated with 1.9 percentage-point lower mobility, whereas the male children variable is associated with 0.5 percentage-point higher mobility. Additional coresident children also decrease parents' mobility. These results suggest that some parents move to their non-coresident male child's location. Indeed, we do find that mobility increases in age after retirement age around 60 years old.[6] The estimated age profile of mobility exhibits a U-shape bottoming at 59 years old. However, the positive coefficient on the log real home equity (0.0007) suggests that negative home equity makes moving more difficult.

[6] The mandatory retirement age is 60 years old for 81% of firms according to Ministry of Health, Labour, and Welfare, General Survey on Working Conditions in 2016, http://www.mhlw.go.jp/toukei/itiran/roudou/jikan/syurou/16/index.html (accessed on April 14, 2017)

The u-shaped age profile also suggests that households do not tend to move before retirement. Working-age households may find it difficult to move when they have children. The negative coefficient on the number of coresident children(−0.0072) may be partly driven by the low mobility of working-age households.

Another trigger of moving other than retirement seems to be the loss of a family member. The coefficient is significantly positive (0.0147) on the "Family decreased since 2004" dummy. Households that experienced a family loss, such as death or divorce, are more likely to move their residence. Death of the family member is the most common reason accounting for 18 percent of such households in the sample. This result, similar to that of Venti and Wise (2004), may imply that households move to smaller housing after a family loss. Our results are also consistent with the study by Bonnet et al. (2010), who find that widowhood significantly increases residential mobility in France, especially for those with older ages and with children.

Table 6 shows the result of a subsample analysis. The estimates are mostly statistically insignificant because of a lack of statistical power. When we exclude the households intending to make inter vivos transfers from the 2018 sample, the depressing effect of bequest motives on mobility increases by 7.9 percentage points (Row 1). Although we do not have the same information for the earlier sample, this negative effect may be even larger if we exclude all inter vivos transfer intentions. Rows 2 and 3 show subsamples by the age of household heads. The negative effect seems to be larger for the working-age population although the result is not conclusive. Rows 4 and 5 show subsamples by region. The negative effect of bequest motives seems to be concentrated in rural regions without large metropolitan areas. However, standard errors are large to make a conclusion.

Table 6: Subsample Analysis of the Effect of Bequest Motives on Mobility

Subsamples	Estimates	(S.E.)	# of Obs.	# of events
1.Excluding the intention of inter vivos in 2018 sample	-0.0793**	(0.0332)	7,776	121
2. The working-age household head (<60)	-0.0568	(0.0515)	5,425	107
3. The elderly household head (>=60)	-0.0221	(0.0280)	2,701	20
4. Rgions with large metropolitan areas	0.0234	(0.0676)	4,514	78
5. Regions without large metropolitan areas	-0.0586	(0.0364)	3,612	49

Note: The estimate is the coefficient β_4 on the instrumented bequest motives for real estate in the second-stage linear mobility regression (equation (4)). Regions with large metropolitan areas are Tokyo, Kanagawa, Chiba, Saitama, Aichi, Osaka, Kyoto, Hyogo, and Fukuoka. Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of other variables are suppressed.

5.2.2 IV Probit Model

Table 7 shows the IV Probit estimation result and the average partial effect (APE) for interpretations. The instrumented bequest motive for real estate has a statistically significant negative coefficient. The partial effect of bequest motive on mobility at average is -11.3 percentage points.. We use this result of the IV Probit as our main estimate because of the additional advantage of the model in identification as we discuss in Empirical Strategy Section. Other statistically significant coefficients are also large in magnitude than in the linear model as suggested by literature that Probit estimates tend to show larger marginal effects on probability than the linear model (Wooldridge, 2010, Chapter 15). For example, the APE is -4.3 percentage points for a no-child dummy and 2.7 percentage points for a family-decrease dummy.

Table 7: IV Probit Model for Mobiltiy

Dependent Variable	1. Bequest Motives for Real Estate	2. Moving		3. Bequest Motives for Real Estate	4. Moving	
Variable	(1st stage)	(2nd stage)	APE	(1st stage)	(2nd stage)	APE
Bequest motive for real estate (unconditional)(t+1) (=1)		-1.265***	-0.113*		-1.267***	-0.114*
		(0.294)	(0.062)		(0.295)	(0.063)
Lot area, m2 (240,330] (=1)	0.0226			0.0212		
	(0.0811)			(0.0812)		
Lot area, m2 (>330) (=1)	0.0657			0.0632		
	(0.0835)			(0.0838)		
Lot area, m2 (240,330] ×After tax change (=1)	-0.0202			-0.0185		
	(0.0982)			(0.0984)		
Lot area, m2 (>330) ×After tax change (=1)	0.261***			0.263***		
	(0.0911)			(0.0914)		
# of rooms [4 or over] (=1)	-0.00540	-0.0110	-0.001	-0.00598	-0.0114	-0.001
	(0.0737)	(0.142)	(0.013)	(0.0737)	(0.142)	(0.013)
Subject to inheritance tax (=1)				0.0175	0.0114	0.001
				(0.0490)	(0.112)	(0.010)
Lot area, 100m2	0.00718	-0.0271	-0.002	0.00716	-0.0271	-0.002
	(0.00464)	(0.0204)	(0.002)	(0.00464)	(0.0204)	(0.002)
Condominium (=1)	-0.268***	-0.0266	-0.002	-0.268***	-0.0273	-0.002
	(0.0546)	(0.112)	(0.010)	(0.0546)	(0.112)	(0.010)
Ground lease (=1)	-0.151	-0.313	-0.028	-0.151	-0.313	-0.028
	(0.116)	(0.237)	(0.023)	(0.116)	(0.237)	(0.023)
Real housing equity, ln	0.012***	0.0125	0.001	0.011***	0.0123	0.001
	(0.00371)	(0.00802)	(0.001)	(0.00380)	(0.00820)	(0.001)
Built after 1981 (=1)	0.121***	-0.0130	-0.001	0.121***	-0.0129	-0.001
	(0.0356)	(0.0774)	(0.007)	(0.0356)	(0.0774)	(0.007)
Age of household head	-0.032***	-0.062***	-0.006**	-0.032***	-0.062***	-0.006**
	(0.00909)	(0.0176)	(0.002)	(0.00913)	(0.0176)	(0.002)
Age of household head squared/100	0.0383***	0.0505***	0.005**	0.038***	0.0503***	0.005**
	(0.00884)	(0.0183)	(0.002)	(0.00889)	(0.0183)	(0.002)
Real income, ln	0.0355	0.0672	0.006	0.0355	0.0673	0.006
	(0.0249)	(0.0527)	(0.005)	(0.0249)	(0.0527)	(0.005)
Real financial wealth, ln	0.0574***	0.0268**	0.002	0.057***	0.0268**	0.002
	(0.00616)	(0.0132)	(0.002)	(0.00618)	(0.0133)	(0.002)
College graduate (=1)	0.0328	0.0544	0.005	0.0326	0.0543	0.005
	(0.0336)	(0.0718)	(0.007)	(0.0337)	(0.0718)	(0.007)
Married (=1)	0.101	-0.0884	-0.008	0.102	-0.0878	-0.008
	(0.0661)	(0.129)	(0.011)	(0.0662)	(0.129)	(0.011)
Female household head (=1)	-0.240***	-0.0974	-0.009	-0.240***	-0.0974	-0.009
	(0.0569)	(0.101)	(0.010)	(0.0569)	(0.101)	(0.010)
Single (=1)	0.153	0.266	0.024	0.153	0.266	0.024

	(0.0934)	(0.176)	(0.018)	(0.0934)	(0.176)	(0.018)
Full-time worker (=1)	0.0486	0.123*	0.011	0.0487	0.123*	0.011
	(0.0338)	(0.0733)	(0.007)	(0.0338)	(0.0732)	(0.007)
Part-time worker (=1)	-0.0471	0.0599	0.005	-0.0473	0.0597	0.005
	(0.0497)	(0.0989)	(0.009)	(0.0497)	(0.0988)	(0.009)
Retired (=1)	-0.0573	-0.140	-0.013	-0.0581	-0.141	-0.013
	(0.0569)	(0.169)	(0.016)	(0.0570)	(0.169)	(0.016)
# of family members	-0.0197	0.0148	0.001	-0.0197	0.0148	0.001
	(0.0191)	(0.0381)	(0.003)	(0.0191)	(0.0381)	(0.003)
Male children (=1)	0.0320	0.155	0.014	0.0315	0.154	0.014
	(0.0369)	(0.0995)	(0.009)	(0.0370)	(0.0995)	(0.009)
# of non-coresident children	-0.070***	-0.113**	-0.01*	-0.070***	-0.113**	-0.01*
	(0.0201)	(0.0563)	(0.006)	(0.0201)	(0.0563)	(0.006)
# of coresident children	-0.0150	-0.154**	-0.014*	-0.0149	-0.153**	-0.014*
	(0.0299)	(0.0719)	(0.007)	(0.0299)	(0.0719)	(0.007)
No child (=1)	-0.841***	-0.480***	-0.043*	-0.842***	-0.481***	-0.043*
	(0.0629)	(0.172)	(0.026)	(0.0629)	(0.172)	(0.026)
Family decreased since 2004 (=1)	0.172***	0.301***	0.027**	0.171***	0.300***	0.027**
	(0.0547)	(0.103)	(0.013)	(0.0547)	(0.103)	(0.013)
City-size fixed effects	Yes	Yes		Yes	Yes	
Region fixed effects	Yes	Yes		Yes	Yes	
Year fixed effects	Yes	Yes		Yes	Yes	
Constant	-0.520*	-0.228		-0.523*	-0.230	
	(0.284)	(0.568)		(0.284)	(0.568)	
ρ	0.899***				0.901***	
	(0.269)				(0.270)	
# of observations	8,126	8,126		8,126	8,126	
Log-likelihood	-5408.041			-5403.74		

Note: Standard errors of APE are calculated by the delta method. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

5.3 Renovation

5.3.1 IV Linear Probability Model

Columns 2 and 4 in Table 8 show the second-stage estimation results for the renovation equation. The instrumented bequest motive has a statistically significant positive coefficient (0.157 in column 2). Thus, households with bequest motives are more likely to renovate their houses. For example, parents may renovate their house to add rooms when they expect to live with the child inheriting the house.

The IV estimate is larger than the OLS estimate (0.013 in Table A.1). The difference implies negative reverse causality: i.e., some households renovated their houses and lost motives to bequeath real estate. For example, parents may spend money on renovations to meet their needs and leave no bequest if they do not expect their heirs to return to their hometown (e.g., Baker and Kaul, 2002). Thus, the type and objective of renovations can be different for two directions of causality. We will distinguish three types of renovations (expansion, contraction, and no change in size) in the next subsection and gain additional insights.

The age profile is a concave function with a peak at 46 years old. It seems reasonable that elderly households are less likely to make renovations. Children also play a role in renovation decisions. A no-child dummy has a positive coefficient (0.0390), but the number of non-coresident children also has a positive coefficient (0.00663). This V-shaped profile may imply that households without a child renovate houses for their needs while those with more children expand houses. If a house is built after 1981 under the new building code, the probability of renovation is smaller by 1.1 percentage points.

Table 8: IV Linear Probability Model for Renovation

Dependent Variable	1. Bequest Motives for Real Estate	2. Renovation	3. Bequest Motives for Real Estate	4. Renovation
Variable	(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
Bequest motive for real estate (unconditional)(t+1) (=1)		0.157**		0.157**
		(0.0674)		(0.0674)
Lot area, m2 (240,330] (=1)	0.0358		0.0358	
	(0.0289)		(0.0289)	
Lot area, m2 (>330) (=1)	0.0350		0.0350	
	(0.0294)		(0.0296)	
Lot area, m2 (240,330] ×After tax change (=1)	-0.0330		-0.0330	
	(0.0342)		(0.0343)	
Lot area, m2 (>330) ×After tax change (=1)	0.0919***		0.0919***	
	(0.0323)		(0.0324)	
# of rooms [4 or over] (=1)	0.00702	0.00440	0.00702	0.00446
	(0.0233)	(0.00745)	(0.0234)	(0.00746)
Subject to inheritance tax (=1)			0.000192	-0.00187
			(0.0173)	(0.00594)
Lot area, 100m2	0.00205	-0.000640	0.00205	-0.000634
	(0.00145)	(0.000434)	(0.00145)	(0.000435)
Condominium (=1)	-0.0867***	0.00995	-0.0867***	0.0100
	(0.0176)	(0.00832)	(0.0176)	(0.00832)
Ground lease (=1)	-0.0389	-0.00658	-0.0389	-0.00659
	(0.0322)	(0.0101)	(0.0322)	(0.0101)
Real housing equity, ln	0.00421***	-0.000987*	0.00421***	-0.000959*
	(0.00127)	(0.000534)	(0.00130)	(0.000544)
Built after 1981 (=1)	0.0414***	-0.0109**	0.0414***	-0.0109**
	(0.0118)	(0.00526)	(0.0118)	(0.00527)
Age of household head	-0.0122***	0.00289**	-0.0122***	0.00286**
	(0.00278)	(0.00123)	(0.00279)	(0.00124)
Age of household head squared/100	0.0142***	-0.00312**	0.0142***	-0.00309**
	(0.00278)	(0.00133)	(0.00279)	(0.00135)
Real income, ln	0.0140*	0.00366	0.0140*	0.00366
	(0.00801)	(0.00330)	(0.00801)	(0.00330)
Real financial wealth, ln	0.0182***	-0.000273	0.0182***	-0.000260
	(0.00202)	(0.00144)	(0.00202)	(0.00144)
College graduate (=1)	0.0144	-0.00470	0.0144	-0.00467
	(0.0114)	(0.00443)	(0.0114)	(0.00443)
Married (=1)	0.0217	-0.00527	0.0217	-0.00534
	(0.0203)	(0.00770)	(0.0203)	(0.00771)
Female household head (=1)	-0.0729***	0.0131	-0.0729***	0.0131
	(0.0162)	(0.00853)	(0.0162)	(0.00853)
Single (=1)	0.0471	-0.00285	0.0471	-0.00286
	(0.0300)	(0.0119)	(0.0300)	(0.0119)

Full-time worker (=1)	0.0179	-0.00927**	0.0179	-0.00927**
	(0.0115)	(0.00435)	(0.0115)	(0.00435)
Part-time worker (=1)	-0.0185	0.00281	-0.0185	0.00283
	(0.0156)	(0.00628)	(0.0156)	(0.00628)
Retired (=1)	-0.0235	-0.000626	-0.0235	-0.000532
	(0.0200)	(0.00800)	(0.0200)	(0.00799)
# of family members	-0.000893	0.00231	-0.000892	0.00230
	(0.00614)	(0.00244)	(0.00614)	(0.00244)
Male children (=1)	0.00614	-0.00641	0.00614	-0.00635
	(0.0136)	(0.00501)	(0.0136)	(0.00502)
# of non-coresident children	-0.0232***	0.00663*	-0.0232***	0.00665*
	(0.00711)	(0.00356)	(0.00711)	(0.00356)
# of coresident children	-0.0160	-0.00416	-0.0160	-0.00416
	(0.0102)	(0.00397)	(0.0102)	(0.00397)
No child (=1)	-0.283***	0.0390*	-0.283***	0.0391*
	(0.0206)	(0.0208)	(0.0206)	(0.0208)
Family decreased since 2004 (=1)	0.0586***	-0.00468	0.0586***	-0.00459
	(0.0183)	(0.00848)	(0.0184)	(0.00849)
City-size fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.332***	-0.0932**	0.332***	-0.0928**
	(0.0916)	(0.0379)	(0.0916)	(0.0380)
# of observations	8,209	8,209	8,209	8,209
R-squared	0.137	-0.158	0.137	-0.157
# of events		210		210
Kleibergen-Paap rk LM		40.68		40.68
p-value		3.13e-08		0.0342
Stock_Yogo_Kleibergen-Paap Wald rk F		10.62		10.62
Hansen J		3.353		3.342
p-value		0.0341		0.342

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

Table 9 shows the result of a subsample analysis. The exclusion of inter vivos transfers in the 2018 sample significantly change the coefficient on bequest motives. However, decomposing the sample into the working-age and elderly household heads makes a significant impact. The effect of bequest motives is significantly larger for younger households (21.2 percentage points). Considering that 44 yeas old is the most active age for renovation activities, bequest motives can drive renovations, especially for households in

their fifties. The effect of bequest motives is also larger in regions with large metropolitan areas. Because young households generally prefer large cities, parents will find it easier to live with a child's family if their house is located in a large city. Then, the major type of bequest-driven renovations can be an expansion to accommodate the inheriting child family in a large city.

Table 9: Subsample Analysis of the Effect of Bequest Motives on Renovation

Subsample	Estimates	(S.E.)	# of Obs.	# of events
1.Excluding the intention of inter vivos in 2018 sample	0.149**	(0.0695)	7,859	204
2. The working-age household head (<60)	0.212**	(0.0963)	5,443	125
3. The elderly household head (>=60)	0.0509	(0.0876)	2,766	85
4. Rgions with large metropolitan areas	0.208*	(0.112)	4,533	97
5. Regions without large metropolitan areas	0.0812	(0.0902)	3,676	113

Note: The estimate is the β_{4}' coefficient on the instrumented bequest motive for housing in the second-stage linear renovation regression (equation (4')). Regions with large metropolitan areas are Tokyo, Kanagawa, Chiba, Saitama, Aichi, Osaka, Kyoto, Hyogo, and Fukuoka. Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of other variables are suppressed.

5.3.1.1 Decomposing Renovations

We distinguish three types of renovations: capacity-increasing, capacity-maintaining, and capacity-decreasing renovations. We decompose the dummy variable for renovation into three: $y_{it} = y_{it}^{increasing} + y_{it}^{maintaining} + y_{it}^{decreasing}$. Then, we estimate equation (4) for each of the decomposed dependent variables. Thus, the estimated coefficients from the decomposed equations add up to the original coefficient for the aggregate renovation equation.

Panel A of Table 10 demonstrates that the effect of bequest motives is largest for capacity-increasing renovations (9.7 percentage points), particularly by the elderly (10.4

percentage points). At the same time, bequest motives also drive working-age households' capacity-increasing renovations (8.2 percentage points) and capacity-maintaining renovations (13.4 percentage points). By contrast, the effect of bequest motives is insignificant for capacity-decreasing renovations (Panel C). Thus, the positive impact of bequest motives on renovation is mainly driven by parents' renovations to increase the number of rooms, possibly to accommodate a child's family to reside together. This result explains more excess rooms for renovators (see Tables 3 and 4 and Figure 2) and confirms that parents renovate their house to add rooms when they expect to live with the child inheriting the house. However, working-age households' capacity-increasing renovations may result in long-term inefficiency to maintain vacant rooms until they start to live with a child. This inefficiency is primarily caused by inheritance tax but exacerbated by imperfect financial markets where households need to arrange mortgage financing for renovations before retirement. The capacity-maintaining renovation by working-age households is likely seismic reinforcement and the repair of walls and roofs.

Table 10: Decomposed coefficients on the instrumented bequest motives for renovation

Subsample	Coef.	(s.e.)	# of Observations	# of events
A. Capacity-Increasing Renovations				
Whole sample	0.0970**	(0.0407)	8,045	46
Subsample: Working population	0.0824*	(0.0488)	5,341	23
Subsample: Elderly population	0.104*	(0.0628)	2,704	23
B. Capacity-Maintaining Renovations				
Whole sample	0.0555	(0.0499)	8,115	116
Subsample: Working population	0.134*	(0.0786)	5,391	73
Subsample: Elderly population	-0.0446	(0.0605)	2,724	43
C. Capacity-Decreasing Renovations				
Whole sample	0.00102	(0.0283)	8,045	46
Subsample: Working population	0.00530	(0.0406)	5,346	28
Subsample: Elderly population	-0.00985	(0.0352)	2,699	18

Note: Coefficients are the estimated β_4 in equation (4). Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1.

5.3.2 IV Probit Model

By the IV Probit model in Table 11, the estimated average partial effect of bequest motives is more moderate (6.9 percentage points) than the effect estimated by the IV linear model. Considering the advantage of the IV probit model when an exclusion restriction is imperfect, we regard the probit estimate as our main result. Other coefficients are mostly consistent with those in the linear model.

Table 11: IV Probit Model for Renovation

Dependent Variable	1. Bequest Motives for Real Estate	2. Renovation		3. Bequest Motives for Real Estate	4. Renovation	
Variable	(1st stage)	(2nd stage)	APE	(1st stage)	(2nd stage)	APE
Bequest motive for real estate (unconditional)(t+1) (=1)		0.897***	0.069*		0.900***	0.070*
		(0.311)	(0.039)		(0.312)	(0.039)
Lot area, m2 (240,330] (=1)	0.102			0.102		
	(0.0817)			(0.0818)		
Lot area, m2 (>330) (=1)	0.0917			0.0914		
	(0.0833)			(0.0836)		
Lot area, m2 (240,330] ×After tax change (=1)	-0.0788			-0.0784		
	(0.0981)			(0.0982)		
Lot area, m2 (>330) ×After tax change (=1)	0.277***			0.278***		
	(0.0906)			(0.0909)		
# of rooms [4 or over] (=1)	0.0102	0.0993	0.008	0.0100	0.0998	0.008
	(0.0737)	(0.167)	(0.013)	(0.0737)	(0.167)	(0.013)
Subject to inheritance tax (=1)				0.00355	-0.0214	-0.002
				(0.0489)	(0.102)	(0.008)
Lot area, 100m2	0.00616	-0.00129	0	0.00615	-0.00124	0
	(0.00461)	(0.00739)	(0.001)	(0.00461)	(0.00739)	(0.001)
Condominium (=1)	-0.256***	-0.0123	-0.001	-0.256***	-0.0115	-0.001
	(0.0546)	(0.122)	(0.009)	(0.0546)	(0.122)	(0.009)
Ground lease (=1)	-0.177	-0.263	-0.02	-0.177	-0.262	-0.02
	(0.116)	(0.282)	(0.022)	(0.116)	(0.281)	(0.022)
Real housing equity, ln	0.0113***	-0.00779	-0.001	0.0113***	-0.00752	-0.001
	(0.00370)	(0.00803)	(0.001)	(0.00378)	(0.00813)	(0.001)
Built after 1981 (=1)	0.126***	-0.109	-0.008	0.126***	-0.109*	-0.008
	(0.0353)	(0.0665)	(0.006)	(0.0353)	(0.0665)	(0.006)
Age of household head	-0.0310***	0.0289	0.002	-0.0309***	0.0287	0.002
	(0.00912)	(0.0185)	(0.002)	(0.00915)	(0.0185)	(0.002)

Age of household head squared/100	0.0374***	-0.0291	-0.002	0.0373***	-0.0288	-0.002
	(0.00885)	(0.0180)	(0.002)	(0.00890)	(0.0181)	(0.002)
Real income, ln	0.0344	0.0912*	0.007*	0.0344	0.0913*	0.007*
	(0.0248)	(0.0525)	(0.004)	(0.0248)	(0.0525)	(0.004)
Real financial wealth, ln	0.0544***	0.0376**	0.003***	0.0543***	0.0378**	0.003***
	(0.00615)	(0.0156)	(0.001)	(0.00616)	(0.0157)	(0.001)
College graduate (=1)	0.0300	-0.0461	-0.004	0.0300	-0.0457	-0.004
	(0.0335)	(0.0670)	(0.005)	(0.0335)	(0.0670)	(0.005)
Married (=1)	0.0760	-0.0646	-0.005	0.0761	-0.0655	-0.005
	(0.0658)	(0.126)	(0.010)	(0.0658)	(0.126)	(0.010)
Female household head (=1)	-0.255***	0.0915	0.007	-0.255***	0.0918	0.007
	(0.0567)	(0.103)	(0.008)	(0.0567)	(0.103)	(0.008)
Single (=1)	0.158*	0.0265	0.002	0.158*	0.0255	0.002
	(0.0935)	(0.178)	(0.014)	(0.0935)	(0.178)	(0.014)
Full-time worker (=1)	0.0513	-0.129*	-0.01*	0.0513	-0.129*	-0.01*
	(0.0336)	(0.0685)	(0.006)	(0.0336)	(0.0685)	(0.006)
Part-time worker (=1)	-0.0713	0.0239	0.002	-0.0713	0.0237	0.002
	(0.0495)	(0.0925)	(0.007)	(0.0495)	(0.0925)	(0.007)
Retired (=1)	-0.0687	-0.0496	-0.004	-0.0689	-0.0485	-0.004
	(0.0563)	(0.106)	(0.008)	(0.0563)	(0.106)	(0.008)
# of family members	-0.0117	0.0457	0.004	-0.0117	0.0455	0.004
	(0.0189)	(0.0354)	(0.003)	(0.0189)	(0.0354)	(0.003)
Male children (=1)	0.0126	-0.0773	-0.006	0.0125	-0.0770	-0.006
	(0.0366)	(0.0735)	(0.006)	(0.0367)	(0.0735)	(0.006)
# of non-coresident children	-0.0670***	0.0585	0.005	-0.0670***	0.0587	0.005
	(0.0198)	(0.0368)	(0.003)	(0.0198)	(0.0368)	(0.003)
# of coresident children	-0.0229	-0.125**	-0.01**	-0.0229	-0.125**	-0.01**
	(0.0297)	(0.0627)	(0.005)	(0.0297)	(0.0627)	(0.005)
No child (=1)	-0.855***	0.154	0.012	-0.855***	0.154	0.012
	(0.0624)	(0.141)	(0.012)	(0.0624)	(0.141)	(0.012)
Family decreased since 2004 (=1)	0.184***	0.0218	0.002	0.184***	0.0223	0.002
	(0.0546)	(0.104)	(0.008)	(0.0546)	(0.104)	(0.008)
City-size fixed effects	Yes	Yes		Yes	Yes	
Region fixed effects	Yes	Yes		Yes	Yes	
Year fixed effects	Yes	Yes		Yes	Yes	
Constant	-0.564**	-3.476***		-0.564**	-3.475***	
	(0.285)	(0.594)		(0.285)	(0.594)	
ρ		-0.410**			-0.412**	
		(0.205)			(0.206)	
# of observations	8,209	8,209		8,209	8,209	
Log-likelihood	-5807.77			-5807.75		

Note: Standard errors of APEs are calculated by the delta method. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income and financial wealth.

5.4 Empty Nests

Table 12 shows the result of directly estimating the equation for empty nests by two-stage least square. The table shows only the second-stage result because the first-stage estimation is identical to the previous IV models. We confirm that bequest motives significantly increase the number of excess rooms, presumably through both mobility and renovation channels.

Table 12: IV Linear Model for Empty Nests

Dependent Variable	1. Bequest Motives for Real Estate	2. # of vacant rooms	3. Bequest Motives for Real Estate	4. # of vacant rooms
Variable	(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
Bequest motive for real estate (unconditional)(t+1) (=1)		8.322***		8.326***
		(1.422)		(1.422)
Lot area, m2 (240,330] (=1)	0.0239		0.0240	
	(0.0288)		(0.0288)	
Lot area, m2 (>330) (=1)	0.0411		0.0412	
	(0.0295)		(0.0296)	
Lot area, m2 (240,330] ×After tax change (=1)	-0.0190		-0.0191	
	(0.0342)		(0.0342)	
Lot area, m2 (>330) ×After tax change (=1)	0.0869***		0.0867***	
	(0.0323)		(0.0324)	
Subject to inheritance tax (=1)			-0.000711	0.103
			(0.0173)	(0.150)
# of rooms [4 or over] (=1)	0.00350	2.467***	0.00352	2.463***
	(0.0232)	(0.204)	(0.0232)	(0.204)
Lot area, m2	2.05e-05	0.000125	2.05e-05	0.000122
	(1.46e-05)	(0.000162)	(1.46e-05)	(0.000162)
Condominium (=1)	-0.0866***	0.000897	-0.0866***	-0.00178
	(0.0174)	(0.192)	(0.0174)	(0.192)
Ground lease (=1)	-0.0377	0.920***	-0.0377	0.921***
	(0.0317)	(0.284)	(0.0317)	(0.284)
Real housing equity, ln	0.00446***	-0.0200	0.00447***	-0.0216*
	(0.00127)	(0.0128)	(0.00129)	(0.0130)
Built after 1981 (=1)	0.0404***	-0.744***	0.0404***	-0.744***
	(0.0117)	(0.117)	(0.0117)	(0.117)
Age of household head	-0.0121***	0.144***	-0.012***	0.145***
	(0.00275)	(0.0291)	(0.00276)	(0.0292)

Age of household head squared	0.00014***	-0.0014***	0.00014***	-0.0014***
	(2.75e-05)	(0.000306)	(2.76e-05)	(0.000308)
Real income, ln	0.0146*	-0.000143	0.0146*	8.92e-05
	(0.00789)	(0.0746)	(0.00789)	(0.0747)
Real financial wealth, ln	0.0188***	-0.127***	0.0188***	-0.127***
	(0.00200)	(0.0321)	(0.00200)	(0.0321)
College graduate (=1)	0.0103	-0.00806	0.0104	-0.00957
	(0.0113)	(0.100)	(0.0113)	(0.100)
Married (=1)	0.0286	-0.432**	0.0286	-0.428**
	(0.0201)	(0.182)	(0.0201)	(0.182)
Female household head (=1)	-0.0690***	0.549***	-0.0690***	0.550***
	(0.0160)	(0.174)	(0.0160)	(0.174)
Single (=1)	0.0508*	-0.259	0.0508*	-0.259
	(0.0298)	(0.271)	(0.0298)	(0.271)
Full-time worker (=1)	0.0154	-0.162	0.0154	-0.162
	(0.0114)	(0.102)	(0.0114)	(0.102)
Part-time worker (=1)	-0.0125	0.0796	-0.0125	0.0787
	(0.0156)	(0.140)	(0.0156)	(0.141)
Retired (=1)	-0.0193	0.109	-0.0193	0.103
	(0.0200)	(0.175)	(0.0200)	(0.175)
# of family members	-0.000828	-0.330***	-0.000830	-0.330***
	(0.00608)	(0.0567)	(0.00608)	(0.0567)
Male children (=1)	0.00873	-0.0601	0.00875	-0.0628
	(0.0136)	(0.118)	(0.0136)	(0.118)
# of non-coresident children	-0.0231***	0.358***	-0.0231***	0.357***
	(0.00710)	(0.0702)	(0.00710)	(0.0702)
# of coresident children	-0.0157	-0.116	-0.0157	-0.116
	(0.0102)	(0.0948)	(0.0102)	(0.0948)
No child (=1)	-0.279***	2.655***	-0.279***	2.654***
	(0.0206)	(0.441)	(0.0206)	(0.441)
Family decreased since 2004 (=1)	0.0506***	0.291	0.0506***	0.286
	(0.0182)	(0.177)	(0.0182)	(0.177)
City-size fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Constant	0.322***	-3.810***	0.322***	-3.831***
	(0.0907)	(0.904)	(0.0907)	(0.905)
# of observations	8,287	8,287	8,287	8,287
R-squared	0.138	-2.632	0.138	-2.634
Kleibergen-Paap rk LM		40.69		40.69
p-value		3.12e-08		0.0173
Stock_Yogo_Kleibergen-Paap Wald rk F		10.66		10.66
Hansen J		24.61		24.43
p-value		1.86e-05		0

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

6 Conclusion

This study sheds light on the cause of empty nests in the aging society by focusing on a bequest motive and inheritance tax. Our objective is to analyze how the intention to bequeath housing impacts empty nests through its effect on household mobility and renovation. By using the Japanese household panel data (JHPS/KHPS), we demonstrate that (1) the favorable treatment of residential land in the inheritance tax code increases bequest motives for real estate, (2) bequest motives for housing decrease the probability to move but increase the probability to renovate a house, and (3) the motive to bequeath housing increases empty nests through lower mobility and more renovations. Our study is the first to point out the inefficiency of bequest-motivated empty nests. Parental housing choices are more important than ever as many developed countries age quickly. We also identify a new kind of tax distortions, contributing to the discussion of the optimal inheritance tax. Our study also calls for a new definition of housing vacancy rate that incorporates empty nests.

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Appendix A: OLS Regressions of Mobility and Renovation

Table A 1 shows the OLS estimation results to demonstrate correlations between moving/renovation and various house and household characteristics in a multivariate setting. We estimate the following linear model by the ordinary least square (OLS):

$$y_{it} = \beta_{A1} B_{it}^{H} + \boldsymbol{x}'_{\boldsymbol{it-1}} \boldsymbol{\delta_{A1}} + J_j + T_t + \varepsilon_{A1it}, \qquad (A.1)$$

where y_{it} denotes the indicator for moving or renovating of homeowner i in the following year, B_{it}^{H} denotes the indicator for the intention to bequeath real estate, $\boldsymbol{x_{it-1}}$ denotes the covariate vector including the variables related to households and housing characteristics, and $J_j (j = 1, \cdots, 8)$ and T_t are region and year fixed effects, respectively.

Table A 1: Preliminary OLS regressions for Moving and Renovation

Dependent Variable	1. Moving	2. Moving	3. Renovation	4. Renovation
Variables				
Bequest motive for real estate (unconditional)(t+1) (=1)	-0.000817	-0.000817	0.0132***	0.0132***
	(0.00275)	(0.00275)	(0.00383)	(0.00383)
Lot area, m2 (240,330] (=1)	0.00789	0.00788	0.0123	0.0125
	(0.00847)	(0.00849)	(0.0101)	(0.0101)
Lot area, m2 (>330) (=1)	-0.00206	-0.00207	0.00473	0.00497
	(0.00646)	(0.00657)	(0.00967)	(0.00968)
Lot area, m2 (240,330] ×After tax change (=1)	-0.0169*	-0.0169*	0.00396	0.00378
	(0.00949)	(0.00950)	(0.0131)	(0.0131)
Lot area, m2 (>330) ×After tax change (=1)	-0.00872	-0.00871	0.0165	0.0163
	(0.00672)	(0.00686)	(0.0114)	(0.0114)
# of rooms [4 or over] (=1)	-0.00133	-0.00133	0.00542	0.00548
	(0.00739)	(0.00739)	(0.00667)	(0.00669)
Subject to inheritance tax (=1)		8.88e-05		-0.00156
		(0.00395)		(0.00534)
Lot area, 100m2	-0.000190	-0.000190	-0.000424	-0.000421
	(0.000174)	(0.000174)	(0.000350)	(0.000350)
Condominium (=1)	0.00475	0.00475	-0.00153	-0.00148

	(0.00565)	(0.00566)	(0.00532)	(0.00533)
Ground lease (=1)	-0.0109	-0.0109	-0.0127	-0.0128
	(0.00974)	(0.00974)	(0.00863)	(0.00864)
Real housing equity, ln	0.000466	0.000465	-0.000430	-0.000406
	(0.000360)	(0.000362)	(0.000428)	(0.000438)
Built after 1981 (=1)	-0.00138	-0.00138	-0.00497	-0.00497
	(0.00355)	(0.00355)	(0.00449)	(0.00449)
Age of household head	-0.00419***	-0.00419***	0.00111	0.00109
	(0.00101)	(0.00102)	(0.000911)	(0.000922)
Age of household head squared/100	0.00331***	0.00331***	-0.00107	-0.00104
	(0.000918)	(0.000926)	(0.000930)	(0.000946)
Real income, ln	0.00287	0.00287	0.00550*	0.00550*
	(0.00266)	(0.00266)	(0.00301)	(0.00301)
Real financial wealth, ln	0.000208	0.000207	0.00229***	0.00230***
	(0.000601)	(0.000600)	(0.000603)	(0.000607)
College graduate (=1)	0.00193	0.00193	-0.00274	-0.00272
	(0.00317)	(0.00318)	(0.00394)	(0.00394)
Married (=1)	-0.00869	-0.00869	-0.00197	-0.00203
	(0.00658)	(0.00660)	(0.00702)	(0.00703)
Female household head (=1)	0.00120	0.00120	0.00270	0.00269
	(0.00629)	(0.00629)	(0.00628)	(0.00628)
Single (=1)	0.00421	0.00421	0.00417	0.00417
	(0.00983)	(0.00983)	(0.0105)	(0.0105)
Full-time worker (=1)	0.00426	0.00426	-0.00662*	-0.00662*
	(0.00302)	(0.00302)	(0.00388)	(0.00388)
Part-time worker (=1)	0.00440	0.00440	0.000269	0.000287
	(0.00500)	(0.00501)	(0.00581)	(0.00582)
Retired (=1)	-0.00247	-0.00248	-0.00400	-0.00393
	(0.00353)	(0.00351)	(0.00755)	(0.00753)
# of family members	0.00155	0.00155	0.00195	0.00195
	(0.00189)	(0.00189)	(0.00233)	(0.00233)
Male children (=1)	0.00462*	0.00462*	-0.00558	-0.00554
	(0.00267)	(0.00269)	(0.00461)	(0.00462)
# of non-coresident children	-0.00137	-0.00137	0.00321	0.00323
	(0.00154)	(0.00155)	(0.00307)	(0.00307)
# of coresident children	-0.00649**	-0.00649**	-0.00612*	-0.00612*
	(0.00261)	(0.00260)	(0.00342)	(0.00342)
No child (=1)	0.000254	0.000252	-0.00159	-0.00155
	(0.00573)	(0.00574)	(0.00773)	(0.00774)
Family decreased since 2004 (=1)	0.0109*	0.0109*	0.00357	0.00363
	(0.00625)	(0.00624)	(0.00700)	(0.00700)
City-size fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Constant	0.125***	0.125***	-0.0449	-0.0447
	(0.0324)	(0.0325)	(0.0283)	(0.0283)
# of observations	8,126	8,126	8,209	8,209
R-squared	0.023	0.023	0.013	0.013
# of events	127	127	210	210

Note: Heteroskedasticity consistent standard errors over households are calculated in parenthesis. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

Appendix B: IV Heckman Linear Model based on the Conditional Measure

We analyze the conditional measure of bequest motives for real estate using the sample of households that intend to bequeath some assets. The conditional bequest motive can have a larger effect on housing decisions because we contrast households that intend to bequeath real estate with those that intend to bequeath non-real assets. We control for a selectivity issue by using a three-stage IV Heckman linear model (Wooldridge, 2010). The first-stage Probit model specifies the sample-selection function B_{it}^{a}, which takes one if a household has bequest motives in any form and zero otherwise:

$$B_{it}^{a} = 1\left[\boldsymbol{z}_{it-1}'\boldsymbol{\theta_{B1}} + \boldsymbol{x}_{it-1}'\boldsymbol{\delta_{B1}} + J_j + T_t + \varepsilon_{B1it} > 0\right]. \qquad (B.1)$$

After computing the inverse Mill's ratio, $\text{IMR} = \phi(\widehat{B_{it}^{a}})/\Phi(\widehat{B_{it}^{a}})$, we estimate equations (3) and (4) in two stages by controlling for IMR.

Moving

Table B 1 shows the estimation result based on the conditional measure of bequest motives. The inverse Mill's ratio is statistically significant, indicating the importance of controlling for a selectivity issue. An advantage of using this conditional measure is that a housing bequest is contrasted with a financial bequest. A disadvantage is reduced statistical power due to the smaller sample size.

The estimated effect of bequest motives is -17.1 percentage points, which is larger in magnitude than the estimate based on the unconditional measure although it is not

significant. The estimated coefficients on other variables are also qualitatively consistent with the previous result.

Table B 1: IV Heckman Linear Model of Moving based on the Conditional Measure

Dependent Variable	1. Bequest Motives for Any Asset	2. Bequest Motives for Real Estate	3. Moving	4. Bequest Motives for Real Estate	5. Moving
Variable		(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
Bequest motive for real estate (conditional)(t+1) (=1)			-0.171		-0.186
			(0.148)		(0.155)
Lot area, m2 (240,330] (=1)	0.0375	0.0106		0.0106	
	(0.0747)	(0.0253)		(0.0252)	
Lot area, m2 (>330) (=1)	0.0548	0.0336		0.0337	
	(0.0787)	(0.0240)		(0.0240)	
Lot area, m2 (240,330] ×After tax change (=1)	-0.0846	0.0101		0.0100	
	(0.0925)	(0.0380)		(0.0383)	
Lot area, m2 (>330) ×After tax change (=1)	0.258***	0.173**		0.173**	
	(0.0866)	(0.0815)		(0.0848)	
Inverse Mills ratio		2.704*	0.159	2.710*	0.151
		(1.535)	(0.119)	(1.594)	(0.119)
Subject to inheritance tax (=1)	0.0215			0.000381	-0.00494
	(0.0470)			(0.0155)	(0.00645)
# of rooms [4 or over] (=1)	-0.0304	-0.0123	-0.00136	-0.0124	-0.00124
	(0.0705)	(0.0330)	(0.0155)	(0.0332)	(0.0155)
Lot area, m2	5.72e-05	2.98e-05*	2.95e-06	2.99e-05	3.16e-06
	(4.17e-05)	(1.78e-05)	(3.67e-06)	(1.83e-05)	(3.66e-06)
Condominium (=1)	-0.170***	-0.186***	-0.0215	-0.187***	-0.0227
	(0.0511)	(0.0568)	(0.0156)	(0.0586)	(0.0163)
Ground lease (=1)	-0.0520	-0.119*	-0.0168	-0.119*	-0.0183
	(0.106)	(0.0652)	(0.0301)	(0.0653)	(0.0304)
Real housing equity, ln	0.0139***	0.00639	0.000779	0.00640	0.000828
	(0.00363)	(0.00455)	(0.000809)	(0.00463)	(0.000794)
Built after 1981 (=1)	0.123***	0.0630*	-0.00166	0.0631	-0.00177
	(0.0339)	(0.0382)	(0.00689)	(0.0393)	(0.00691)
Age of household head	-0.0223***	-0.00838	-0.00349*	-0.00840	-0.00350*
	(0.00850)	(0.00742)	(0.00199)	(0.00756)	(0.00199)
Age of household head squared	0.000231***	0.000126*	3.10e-05*	0.000126*	3.18e-05*
	(8.24e-05)	(7.45e-05)	(1.62e-05)	(7.59e-05)	(1.63e-05)
Real income, ln	0.00450	0.0133	-0.00218	0.0133	-0.00205
	(0.0241)	(0.00940)	(0.00557)	(0.00941)	(0.00571)
Real financial wealth, ln	0.0639***	0.0292	0.00293	0.0292	0.00284
	(0.00592)	(0.0195)	(0.00217)	(0.0202)	(0.00219)
College graduate (=1)	0.0479	0.0157	-0.00101	0.0158	-0.00117

	(0.0319)	(0.0181)	(0.00545)	(0.0186)	(0.00546)
Married (=1)	0.122*	0.0611	-0.00362	0.0613	-0.00407
	(0.0622)	(0.0420)	(0.0110)	(0.0434)	(0.0111)
Female household head (=1)	-0.215***	-0.154**	-0.0121	-0.154**	-0.0124
	(0.0527)	(0.0660)	(0.0135)	(0.0683)	(0.0135)
Single (=1)	0.140	0.0841*	0.00794	0.0843	0.00767
	(0.0878)	(0.0507)	(0.0165)	(0.0522)	(0.0168)
Full-time worker (=1)	0.0154	0.0357***	0.00774	0.0358***	0.00812
	(0.0321)	(0.0126)	(0.00582)	(0.0127)	(0.00597)
Part-time worker (=1)	-0.00984	-0.0238	0.00632	-0.0238	0.00606
	(0.0470)	(0.0177)	(0.00978)	(0.0177)	(0.00983)
Retired (=1)	-0.0700	-0.0206	-0.000750	-0.0207	-0.000192
	(0.0546)	(0.0240)	(0.00711)	(0.0246)	(0.00715)
# of family members	-0.00348	-0.00786	0.00159	-0.00786	0.00144
	(0.0179)	(0.00645)	(0.00322)	(0.00646)	(0.00328)
Male children (=1)	0.0177	0.0171	0.0116**	0.0171	0.0118***
	(0.0355)	(0.0125)	(0.00454)	(0.0125)	(0.00457)
# of non-coresident children	-0.0627***	-0.0397**	-0.00468	-0.0398**	-0.00462
	(0.0192)	(0.0193)	(0.00319)	(0.0201)	(0.00321)
# of coresident children	-0.0398	-0.0131	-0.00891	-0.0132	-0.00864
	(0.0283)	(0.0163)	(0.00578)	(0.0167)	(0.00588)
No child (=1)	-0.795***	-0.502**	-0.0315*	-0.503**	-0.0315*
	(0.0596)	(0.238)	(0.0182)	(0.247)	(0.0182)
Family decreased since 2004 (=1)	0.184***	0.0872	0.00469	0.0874	0.00452
	(0.0510)	(0.0541)	(0.00915)	(0.0558)	(0.00913)
City-size fixed effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-0.335	-0.896	0.166	-0.900	0.181
	(0.273)	(0.887)	(0.160)	(0.922)	(0.166)
Observations	8,635	3,489	3,489	3,489	3,489
R-squared		0.071	-0.119	0.071	-0.148
mover	127		47		47
Kleibergen-Paap rk LM			11.23		10.95
p-value			0.0241		0.0256
Stock_Yogo_Kleibergen-Paap Wald rk F			2.868		2.797
Hansen J			5.489		4.741
p-value			0.0389		0.192

Note: Heteroskedasticity consistent standard errors over households for models 2 and 4 are calculated in parenthesis. Bootstrap standard errors based on 500 replications are calculated for models of 3 and 5. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.

Renovation

Table B 2 shows the result based on the conditional measure of bequest motives. By contrasting housing bequest motives with financial bequest motives, we obtain a larger

coefficient on bequest motives (0.337) although it is not significant. Other coefficients are mainly consistent with the previous estimation results although statistical power lacks due to smaller sample size.

Table B 2: IV Heckman Linear Model of Renovation based on the Conditional Measure

Dependent Variable	1. Selection (Bequest Motives)	2. Bequest Motives for Real Estate	3. Renovation	4. Bequest Motives for Real Estate	5. Renovation
Variables		(1st stage)	(2nd stage)	(1st stage)	(2nd stage)
Bequest motive for real estate (conditional)(t+1) (=1)			0.337		0.322
			(0.256)		(0.252)
Lot area, m2 (240,330] (=1)	0.0375	0.0117		0.0115	
	(0.0747)	(0.0244)		(0.0244)	
Lot area, m2 (>330) (=1)	0.0548	0.0298		0.0297	
	(0.0787)	(0.0239)		(0.0240)	
Lot area, m2 (240,330] ×After tax change (=1)	-0.0846	0.0126		0.0133	
	(0.0925)	(0.0368)		(0.0372)	
Lot area, m2 (>330) ×After tax change (=1)	0.258***	0.171**		0.168**	
	(0.0866)	(0.0802)		(0.0840)	
Inverse Mills Ratio		2.594*	-0.348	2.534	-0.356
		(1.516)	(0.247)	(1.580)	(0.246)
Subject to inheritance tax (=1)	0.0215			-0.00359	-0.00570
	(0.0470)			(0.0153)	(0.0108)
# of rooms [4 or over] (=1)	-0.0304	-0.00267	0.00131	-0.00229	0.00155
	(0.0705)	(0.0329)	(0.0191)	(0.0331)	(0.0185)
Lot area, m2	5.72e-05	2.97e-05*	-8.72e-06	2.92e-05	-8.49e-06
	(4.17e-05)	(1.76e-05)	(8.40e-06)	(1.81e-05)	(8.51e-06)
Condominium (=1)	-0.170***	-0.177***	0.0375	-0.175***	0.0365
	(0.0511)	(0.0561)	(0.0258)	(0.0581)	(0.0256)
Ground lease (=1)	-0.0520	-0.128**	0.0311	-0.128**	0.0294
	(0.106)	(0.0648)	(0.0426)	(0.0649)	(0.0419)
Real housing equity, ln	0.0139***	0.00623	-0.00115	0.00613	-0.00109
	(0.00363)	(0.00450)	(0.00121)	(0.00459)	(0.00118)
Built after 1981 (=1)	0.123***	0.0612	-0.0137	0.0599	-0.0139
	(0.0339)	(0.0375)	(0.0104)	(0.0387)	(0.0105)
Age of household head	-0.0223***	-0.00722	0.00261	-0.00703	0.00260
	(0.00850)	(0.00731)	(0.00282)	(0.00746)	(0.00272)
Age of household head squared	0.000231***	0.000114	-3.80e-05	0.000112	-3.72e-05
	(8.24e-05)	(7.34e-05)	(2.33e-05)	(7.49e-05)	(2.27e-05)

Real income, ln	0.00450	0.00823	-0.00131	0.00814	-0.00126
	(0.0241)	(0.00869)	(0.00767)	(0.00870)	(0.00760)
Real financial wealth, ln	0.0639***	0.0276	-0.000513	0.0269	-0.000598
	(0.00592)	(0.0192)	(0.00410)	(0.0199)	(0.00405)
College graduate (=1)	0.0479	0.0128	-0.00604	0.0123	-0.00623
	(0.0319)	(0.0179)	(0.00949)	(0.0184)	(0.00941)
Married (=1)	0.122*	0.0411	-0.00376	0.0396	-0.00454
	(0.0622)	(0.0410)	(0.0185)	(0.0425)	(0.0182)
Female household head (=1)	-0.215***	-0.152**	0.0317	-0.150**	0.0314
	(0.0527)	(0.0653)	(0.0193)	(0.0679)	(0.0191)
Single (=1)	0.140	0.0749	-0.0183	0.0732	-0.0188
	(0.0878)	(0.0492)	(0.0238)	(0.0509)	(0.0238)
Full-time worker (=1)	0.0154	0.0390***	-0.0194*	0.0389***	-0.0190*
	(0.0321)	(0.0123)	(0.0115)	(0.0124)	(0.0115)
Part-time worker (=1)	-0.00984	-0.0298*	-0.000524	-0.0296*	-0.000866
	(0.0470)	(0.0173)	(0.0144)	(0.0174)	(0.0144)
Retired (=1)	-0.0700	-0.0213	-0.0101	-0.0204	-0.00952
	(0.0546)	(0.0237)	(0.0141)	(0.0244)	(0.0138)
# of family members	-0.00348	-0.00675	0.00890	-0.00678	0.00875
	(0.0179)	(0.00615)	(0.00576)	(0.00615)	(0.00574)
Male children (=1)	0.0177	0.0161	-0.0147	0.0160	-0.0145
	(0.0355)	(0.0122)	(0.00969)	(0.0122)	(0.00960)
# of non-coresident children	-0.0627***	-0.0376**	0.0119**	-0.0368*	0.0120**
	(0.0192)	(0.0191)	(0.00553)	(0.0199)	(0.00552)
# of coresident children	-0.0398	-0.0147	-0.0112	-0.0142	-0.0109
	(0.0283)	(0.0160)	(0.00842)	(0.0165)	(0.00846)
No child (=1)	-0.795***	-0.482**	0.0752*	-0.472*	0.0754*
	(0.0596)	(0.236)	(0.0408)	(0.245)	(0.0408)
Family decreased since 2004 (=1)	0.184***	0.0843	-0.00804	0.0824	-0.00821
	(0.0510)	(0.0534)	(0.0157)	(0.0552)	(0.0156)
City-size fixed effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	-0.335	-0.820	-0.0760	-0.785	-0.0595
	(0.273)	(0.875)	(0.250)	(0.914)	(0.248)
# of observations	8,635	3,559	3,559	3,559	3,559
R-squared		0.069	-0.252	0.069	-0.228
# of events	210		117		117
Kleibergen-Paap rk LM			12.37		11.90
p-value			0.616		0.0621
Stock_Yogo_Kleibergen-Paap Wald rk F			3.163		3.041
Hansen J			1.797		1.992
p-value			0.0412		0.0214

Note: Heteroskedasticity consistent standard errors over households for models 2 and 4 are calculated in parenthesis. Bootstrap standard errors based on 500 replications are calculated for models of 3 and 5. Significant level: *** p<0.01, ** p<0.05, * p<0.1. Coefficients of missing categories are suppressed for the number of rooms, housing wealth, income, and financial wealth.