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Reciprocity in the Formation of Intergenerational Coresidence

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Abstract Children play a key role in supporting elderly parents, and the literature has consistently found reciprocity whereby parents compensate their children for providing care and attention. To understand how the mode of compensation is related to the characteristics of parents and children, we studied the determinants of transitions to parent–child coresidence in Japan. The results conformed to the hypothesis that the mode of reciprocity depends on the costs and benefits of coresidence for each family member. Parental assets and care needs were associated with coresidence. Additionally, transitions to coresidence with married parents were characterized by young, unmarried children and the presence of parental housing assets, whereas transitions to coresidence with widowed mothers were characterized by mothers' non-housing assets.

Keywords Transition analysis · Latent class model · Informal care · Parent–child coresidence · Aged care

Introduction

In aging societies, care and attention provided by adult children remains an important source of support in old age. Although the demand for aged care in general is growing at an unprecedented rate, in the early 2000s, approximately 80 % of the hours of care were provided informally, with children providing 41 % of all informal care in the US, 43 % in the UK, and 60 % in Japan (OECD 2005). Informal care places a heavy burden on children mentally, physically, and economically, especially in modern societies in which the elderly live longer with disabilities, families have fewer children, and each generation lives more independently compared with previous generations (e.g., Carmichael et al. 2010; Fast et al. 1999; Hall et al. 2007). Not surprisingly, the provision of informal care by children is not "unconditional." As the burden increases, parents may need to increase compensation for care provision. Indeed, the literature has accumulated evidence on the reciprocal nature of intergenerational transfers between elderly parents and their adult children (Bernheim et al. 1985; Chan 2005; Cox 1987; Henretta et al. 1997; Horioka 2002; Johar and Maruyama 2011; Kim 2004; Koh and Macdonald 2006; Nakamura and Maruyama 2012; Norton and Van Houtven 2006; Tabuchi 2008; Takagi and Silverstein 2011; Yamada 2006).

Parents can compensate their children for the provision of care and attention in various ways. Bernheim et al. (1985) found that parents used their bequeathable wealth as an incentive to induce their children to provide care and attention. Norton and Van Houtven (2006) proposed that inter vivos transfers were better suited to inducing exchanges than bequests. In addition to monetary transfers, deeding a house to children was found to be an important means of making an inter vivos transfer to secure care from children (Henretta et al. 1997). A study on living arrangements by Brown et al. (2002) found that unmarried adult children were more likely to coreside with their parents, suggesting economic support from parents to children in a shared household. Non-monetary time-related services may be another channel of transfers; in particular,

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parents can reward children by providing childcare for grandchildren (Kim 2004; Wolff 2001; Yamada 2006).[1] However, very little is known about the way these channels are chosen.

To advance the literature, we explored how the mode of compensation is related to the characteristics of parents and children. To our knowledge, no study has examined the conditions for intergenerational coresidence for elderly parents in different health and economic situations or examined how widowhood and parental health alter the reciprocal nature of intergenerational coresidence. Detailed knowledge about the nature of reciprocity between elderly parents and adult children could have considerable policy implications in relation to public support for frail or disabled elderly parents and their families.

To better understand how the mode of compensation is related to the characteristics of elderly parents and their children, we investigated the determinants of parent–child coresidence in Japan. We focused on intergenerational coresidence—a comprehensive form of hands-on care and support for elderly parents with a long-term commitment (Konrad et al. 2002; Kureishi and Wakabayashi 2009; Pezzin and Schone 1999; Sloan et al. 2002; Wakabayashi and Horioka 2009; Yamada 2006). Especially in Japan, informal care provided by children has overlapped closely with parent–child coresidence. According to the Ministry of Health, Labour and Welfare (2008), for elderly Japanese receiving any nursing care, the most common primary caregiver was a coresident child or a coresident child's spouse (32 %); only 11 % were cared for by non-coresident family members.[2] In addition, Japan retains one of the highest intergenerational coresidence rates among developed countries, thus providing ample observations for this study.[3]

Using the Nihon University Japanese Longitudinal Study of Aging (NUJLSOA), we investigated the determinants of the *transition* to coresidence by elderly Japanese parents and their children, building on demographic and sociological studies that focus on transitions in the living arrangements of the elderly (Brandon 2012; Brown et al. 2002; Dostie and Léger 2005; Hays et al. 2003; Takagi et al. 2007). We applied binary choice models in which the dependent variable was whether an elderly parent without coresident children began coresidence with an adult child by the next observation point. Our definition of "the transition to coresidence" included all three possible cases: children moving in with parents, parents moving in with children, and both children and parents moving to begin living together. We did not distinguish among them because in the vast majority of cases in Japan, elderly parents do not move and instead accommodate the child moving into their house. We exploited the detailed information in the NUJLSOA on elderly parents and their children.

The focus on transition offers us two significant advantages. First, transition analysis provides a clearer interpretation of estimated relationships than cross-sectional analysis. For example, a cross-sectional association between coresidence and parental ill health may be explained by the effect of coresidence on health. Several studies reported that living arrangements influenced the health of the elderly, suggesting that a reverse causal effect may exist (e.g., Johar and Maruyama 2013; Maruyama 2012; Michael et al. 2001; Sarwari et al. 1998). Second, transition analysis provides a clearer framework to study the consequences of the heightened needs of elderly parents. Unlike a static framework, transition analysis allows us to exclude life-long coresidence in which a child has never left the parental home and to focus on new coresidence in which families that live independently start coresiding. These two types of intergenerational coresidence may arise from very different motives (Takagi et al. 2007). We focused on the transition to rather than the transition from coresidence because the latter is rare.

We conducted two types of transition analysis. First, we estimated a conditional logit model to study the transition to coresidence for each parent–child pair. This child-level analysis allowed us to investigate not only parental characteristics but also the characteristics of individual children that make them more likely to start coresidence with the parent relative to their siblings. We exploited the richness of the NUJLSOA data, which contains information about all children, whether coresident or non-coresident. We estimated separate conditional logit models for the full sample and for sub-samples of married parents and widowed mothers. The latter has been a policy target in many countries. The United Nations and the World Health Organization have characterized elderly women as individuals who typically live alone for a long period of time with scarce financial resources (WHO 2007). Knowledge about the compensation mechanism at work in this vulnerable population may aid in the design and implementation of a targeted welfare program. In the second part, we analyzed the transition to coresidence at the family level by employing a Heckman and Singer (1984)-type binary logit

[1] The literature has also noted that social norms and traditions might play a role in providing incentives for children to look after their parents (Takagi et al. 2007; Wakabayashi and Horioka 2009; Wolff 2001).

[2] Approximately 18 and 14 % were cared for primarily by a coresident child and a coresident child's spouse, respectively, whereas 25 % were cared for primarily by a coresident spouse.

[3] We do not argue that intergenerational coresidence and aged care are equivalent. Aged care takes a variety of forms, including formal care, community care, and distant informal care. Neither do we advocate maintaining or promoting informal care by coresident children.

model with finite mixture components. This model identified *latent* types of families by an empirical distribution of the data rather than by a priori grouping (such as married and widowed parents). Although the information regarding each child was aggregated at the family level, this model allowed us to study unobserved family heterogeneity that may be related to the mode of compensation. This model also had the advantage of reducing potential attrition bias due to unobserved factors.

Our main findings are as follows. First, our results are consistent with the widely documented reciprocity in intergenerational coresidence. On the one hand, the transition to coresidence is often associated with parents' health deterioration and the loss of a spouse, confirming that coresidence is motivated by parental care needs. On the other hand, our estimates underscore the relevance of the costs and benefits of coresidence to children. On average, coresidence is more likely to start when a child is young and unmarried, lives nearby, and has small children and when a parent owns a house and possesses assets other than the house.

Second, families engage in two distinct modes of reciprocity. The majority of families tend to start coresidence that involves young unmarried children and married parents. In this type of family, the main mode of intergenerational compensation appears to be housing assets. The other type of family tends to start coresidence that involves a widowed parent, typically a widowed mother. This type of family has a higher tendency to start coresidence, and the primary mode of transfer is non-house wealth. For the parents of this group, wealth accumulation is important for safeguarding old age support. Overall, our results are consistent with the hypothesis that the mode of reciprocity depends on the costs and benefits of coresidence to each family member.

Data

The data were derived from the NUJLSOA, a nationally representative survey of Japanese aged 65 and over. The survey was designed primarily to investigate the health status of the Japanese elderly and changes in health status over time and to provide data comparable to those collected in the US and other countries. The format of the initial questionnaire was created following the US Longitudinal Study of Aging II (LSOAII) and the Study of Assets and Health Dynamics Among the Oldest Old (AHEAD) sample of the Health and Retirement Study (HRS).[4] The four waves of the survey were conducted in 1999, 2001, 2003, and 2006, and new, younger individuals were recruited for each wave so that it remained representative of the population in each wave. In the first wave, the sample response rate was 74.6 %, and the data set had 4,997 respondents. Wave 2 consisted of 4,623 observations. Of 4,997 respondents in Wave 1, 327 (6.5 %) died by the next wave, 946 (18.9 %) were lost, and 3,724 (74.5 %) were interviewed again in Wave 2. Added to Wave 2 were 899 observations in the additional cohorts. The attrition rate became slightly higher in later waves due to the older sample. Waves 3 and 4 had 4,507 and 3,414 respondents, respectively.

Table 1 provides background information on the prevalence of the different types of living arrangements of the Japanese elderly. The first column, titled "all," includes all elderly observations, and the figures in the other columns are based on elderly individuals with at least one surviving child. Living with a child was most common, with approximately 50 % of elderly Japanese living with a child. The second most common living arrangement was living with a spouse only. Across waves, a steadily declining proportion of elderly parents lived with a child, and an increasing proportion of elderly parents lived either alone or with a spouse only.[5] Married parents were more likely to live without children than were widowed parents. Widowed mothers were more likely to live with children than were widowed fathers.

Table 2 shows the transition in living arrangements between waves. The large italicised entries reflect the stability of the living arrangements of the elderly. The living arrangements during the period between 2003 and 2006 were less stable because this longer 3-year interval led to higher probabilities of changes. For both singles and couples, living with a child tended to be associated with a higher probability of transitioning to death in comparison to living without a child. This observation highlights the important role children play in supporting sick or disabled elderly parents. From the states "living alone" and "spouse only," the most common transitional change other than death was to initiate living with a child by the next wave. The elderly parents living with "others" (i.e., individuals other than the spouse and children, such as siblings) were less likely to begin living with a child by the next wave, suggesting that there was no child available or willing to live with the parent. Among the different types of living arrangements, living with others was relatively unstable. This pattern indicates the different nature of parent–child

[4] For details of the NUJLSOA, see http://www.usc.edu/dept/gero/CBPH/nujlsoa/.

[5] The coresidence rate in Japan is also declining in the longer term. In 1986, among households with at least one elderly individual, 31 % consisted of only one elderly individual or an elderly couple. This number steadily increased to 52 % in 2007 (Ministry of Health, Labour and Welfare 2008).

Table 1 Living arrangements across socio-demographic groups

	All (%)	Parents (%)	Married (%)	Widowed fathers (%)	Widowed mothers (%)
Wave 1 (1999)					
Living alone	12.0	9.8	0.2	32.8	25.7
Spouse only	31.5	31.0	47.5		
Spouse and child	29.0	31.2	47.7		
Spouse and others	2.8	2.7	4.2		
Single and child	21.6	23.2	0.4	62.3	68.6
Single and others	3.2	2.1	0.1	5.0	5.7
Total	100	100	100	100	100
Wave 4 (2006)					
Living alone	14.8	12.6	0.6	39.6	32.7
Spouse only	35.2	34.9	53.3		
Spouse and child	26.3	27.9	42.6		
Spouse and others	1.9	2.0	3.1		
Single and child	19.3	20.5	0.3	54.3	61.4
Single and others	2.6	2.1	0.1	6.1	5.9
Total	100	100	100	100	100

Data from the NUJLSOA, based on 4,997 and 3,414 respondents in Waves 1 and 4, respectively, with sampling weights applied. Except for the first column titled "all," the figures are based on individuals with at least one surviving child. Parents classified as "living with a child" may also live with other family members. "Others" include anyone other than the parent's own child and spouse

and parent–other interactions, with the latter being relatively provisional and unstructured.

The NUJLSOA asked elderly parents who began coresidence with a child within the previous 2 years the reasons for the coresidence, which is the main focus of this study. The question had multiple-choice responses, and parents could indicate more than one reason. The results reported in Table 3 highlight two important facts. First, we observed considerable heterogeneity across families. There were many common answers that were of a completely different nature and large gender differences. Specifically, compared to fathers, mothers were less likely to answer "It's what I want" and "To financially support my child," but they were more likely to answer "Being with my child supports me mentally" and "My spouse passed away." Second, Table 3 suggests a complex mixture of both parties' interests rather than pure and one-sided altruism of children or parents. Further interpretation is difficult because responses were self-reports, multiple responses were allowed, and the meanings of some choices were ambiguous. Hence, we conducted a further quantitative analysis based on the revealed choice. Nevertheless, the two findings in this table—the considerable heterogeneity and reciprocity in intergenerational exchange—motivated the design of our empirical analysis below.

Our population of interest was elderly individuals aged 65 years and older with at least one surviving child. We used three comparison periods: 1999/2001, 2001/2003, and 2003/2006. Our population consisted of elderly parents who completed two consecutive surveys and had at least one surviving child in both surveys.[6] The definition of a child included biological, step-, and adopted children, but not children-in-law. This was because we did not have information on widowed children-in-law unless they lived with their parents-in-law and because the parental relationship with children-in-law is different in many aspects from the relationship with one's own children (Hanaoka and Norton 2008). Furthermore, because our focus was on the transition to coresidence, we required that an elderly parent did not live with any child or child-in-law in the base year. We also restricted the sample to elderly parents who had no surviving parent throughout the period to avoid the complications of elderly parents who were also in the position of being a "child." In addition, a few elderly parents who lived with someone other than a spouse, such as siblings, grandchildren (but not children), and other relatives, were excluded. We also excluded observations of those in a hospital or jail at any time during the period or those in a nursing home during the base year. Nursing homes are growing in Japan as in other developed countries, but the number of users in our data period was small. In our data, we observed the transition to a nursing home for less than 0.5 % of elderly parents between two consecutive surveys. Those with critical missing values or

[6] Hence, people who died before the second interview were not included in our analysis. This exclusion is a potential source of selection bias, particularly given that Table 2 shows slightly higher mortality for those who lived with children compared to those who lived without children. However, this difference was small and unlikely to significantly affect our main conclusions.

Table 2 Changes in the living arrangements of elderly parents

	1999					
	Living alone (%)	Spouse only (%)	Spouse and child (%)	Spouse and others (%)	Single and child (%)	Single and others (%)
2001						
Living alone	*83.85*	3.04	0.27	4.58	3.61	21.90
Spouse only	1.01	*84.30*	6.36	27.62	0.38	0.00
Spouse and child	0.00	5.27	*80.46*	15.67	0.31	0.00
Spouse and others	0.00	0.95	1.75	*38.06*	0.07	0.00
Single and child	9.38	0.75	5.75	2.59	*84.09*	11.69
Single and others	1.25	0.00	0.05	0.60	4.16	*40.07*
Death	4.51	5.68	5.37	10.89	7.39	26.33
Total	100	100	100	100	100	100
	2001					
	Living alone (%)	Spouse only (%)	Spouse and child (%)	Spouse and others (%)	Single and child (%)	Single and others (%)
2003						
Living alone	*86.46*	4.30	0.37	0.68	3.25	14.74
Spouse only	1.20	*87.41*	7.88	25.34	0.00	0.00
Spouse and child	0.00	3.53	*80.68*	16.47	0.49	0.00
Spouse and others	0.00	0.69	1.71	*41.87*	0.00	0.00
Single and child	5.19	0.16	4.87	0.85	*84.03*	12.67
Single and others	2.18	0.06	0.00	3.37	4.51	*40.34*
Death	4.97	3.86	4.49	11.42	7.72	32.25
Total	100	100	100	100	100	100
	2003					
	Living alone (%)	Spouse only (%)	Spouse and child (%)	Spouse and others (%)	Single and child (%)	Single and others (%)
2006						
Living alone	*81.14*	5.43	0.30	1.42	4.75	18.13
Spouse only	0.43	*81.20*	8.90	30.66	0.18	0.00
Spouse and child	0.36	4.90	*77.91*	9.38	0.52	0.00
Spouse and others	0.00	1.08	1.78	*40.77*	0.00	0.00
Single and child	8.38	1.01	3.82	0.00	*77.52*	16.16
Single and others	1.22	0.18	0.22	1.51	4.68	*28.33*
Death	8.46	6.18	7.07	16.27	12.34	37.37
Total	100	100	100	100	100	100

Data from the NUJLSOA, weighted using sampling weights. The population studied is elderly parents with at least one surviving child in the base year. "Others" include anyone other than the parent's own child and spouse

inconsistent answers and those labeled by interviewers as "unreliable" respondents were also excluded.

We conducted the analysis at two levels, the child level and the family level, as explained in the next section. For the family-level model, imposing the above restrictions led to a final sample of 3,513 elderly parent periods. In the child-level model, the sample was expanded due to multiple-child families. For example, a family with three children would have one observation in the family-level model in a given period and three observations in the child-level model. The final sample size was 9,140 parent-period-child observations based on 2,841 family-period observations. The number of family-period observations in the child-level analysis was smaller than that in the family-level analysis because detailed information about every child was sometimes not available, and a small number of

Table 3 Parental reasons for living with their children

Reasons (multiple answers allowed)	Male	Female
1. It's what my child wants	22.70 %	20.14 %
2. My child is not married	19.22 %	14.13 %
3. To have my child take care of me	18.57 %	23.04 %
4. It's what I want	18.17 %	9.67 %
5. I can provide a house for my child	14.62 %	13.50 %
6. To financially support my child	13.12 %	5.83 %
7. To receive financial support from my child	13.01 %	11.03 %
8. Being with my child supports me mentally	11.72 %	16.46 %
9. I can give my child advice	9.70 %	8.90 %
10. To help raise grandchildren	8.61 %	6.00 %
11. I can receive advice from my child	7.22 %	3.31 %
12. My child is not independent yet	6.08 %	4.01 %
13. To help with housework	5.46 %	6.69 %
14. Because I want to be there for my child	5.10 %	2.78 %
15. I have a newly built house	3.55 %	5.54 %
16. My spouse passed away	1.26 %	11.08 %
17. Other reasons	20.44 %	17.80 %
Number of observations	125	186

From the NUJLSOA data (Waves 1–4), weighted by sampling weights. Respondents are those who began coresidence with a child within the last 2 years

parents coresided with multiple children. We verified that our findings were robust with respect to this sample restriction.

Our dependent variable was a binary variable for the transition of an elderly parent to coresidence between consecutive surveys. In the child-level analysis, *C_CoresNext* was a binary variable for starting coresidence by the next period with a particular child. In the family-level analysis, *CoresNext* was a binary variable for starting coresidence by the next period with at least one child in the family.

Table 4 reports the sample size and frequency of the transition at the family level in the three periods. Between 1999 and 2006, 229 parent-period observations (6.5 %) began coresidence. Of the parents who began coresidence, approximately 90 % accommodated the child who moved into their house. The remaining parents moved geographically.[7]

Two sets of variables, parent and child characteristics, were used in the following analysis and are defined in Table 5. Their summary statistics are reported in Table 6.

The parent characteristics included shock, health status, and socio-economic variables. The shock variables were dummy variables constructed to capture major negative events and health deterioration between two consecutive waves. These variables included the loss of a spouse, adverse health shocks in physical ability and in the ability to perform the activities of daily life (ADL), and deterioration in spousal ability to care for others. All explanatory variables except the shock variables were defined in terms of the base years.

For parental health measures in the base year, we considered the ability to perform a series of activities. We constructed two indices, one for physical ability and another for the ability to perform ADL. Each index was constructed as an average of values between 0 and 10 that were assigned to individual tasks based on the level of difficulty. Each index was valued at 0 if all tasks could be performed without difficulty and at 10 if none of them was possible.[8] We also included an index variable for subjective health. Although mental health and cognitive impairments were also likely determinants of coresidence, it was difficult to incorporate them because our data were self-reported. Individuals with severe impairments in mental health or cognitive ability were likely omitted from our sample because it would have been difficult for them to participate in the survey and because we excluded individuals reported as "unreliable" by the interviewers. Nevertheless, the effects of mental health and cognitive ability were captured to some degree by our measures of ADL and subjective health (Dodge et al. 2005; Pinquart 2001). All health variables were defined such that they took smaller values when the parent was healthier and physically stronger.

Parental demographic and economic characteristics may have affected coresidence because these characteristics indicate the degree of economic independence and support available from non-child sources. They may also have reflected the resources available to children. With regard to demographics, one of the most relevant variables was the presence of a spouse. Of the sampled elderly parents, 74.3 % lived with a spouse, and 5.4 % of these married parents lost a spouse by the following wave (Table 6). The eldest-son status of the father is another family structure variable of interest for testing the significance of the primogenital family system in modern Japan. In Japanese tradition, the eldest son's family is the main family that

[7] This figure may be biased if the re-contact rate was significantly lower for those who moved. However, even using our most conservative estimates, the vast majority of parents (75–80 %) who started coresidence did not move and accommodated children.

[8] Physical activities used to construct the index included (1) walking 200 or 300 m; (2) climbing 10 stairs without resting; (3) standing for 2 h; (4) continuing to sit for 2 h; (5) squatting and kneeling; (6) raising hands above head; (7) extending arms out in front; (8) grasping with fingers or using fingers easily; and (9) lifting a heavy load of 10 kg. ADL included (1) taking a bath/shower; (2) dressing; (3) eating; (4) standing up from a bed or chair and sitting down; (5) walking around the house; (6) going outside; and (7) going to the bathroom.

Table 4 The number of observations used in the family-level analysis

Year	All parents		Married parents		Widowed mothers	
	Total	Began coresidence	Total	Began coresidence	Total	Began coresidence
1999–2001	1,231	85 (6.9 %)	910	56 (6.2 %)	251	20 (8.0 %)
2001–2003	1,097	49 (4.5 %)	799	32 (4.0 %)	245	15 (6.1 %)
2003–2006	1,185	95 (8.0 %)	901	62 (6.9 %)	226	27 (12.0 %)
Total	3,513	229 (6.5 %)	2,610	150 (5.8 %)	722	62 (8.6 %)

succeeds the family headship and is responsible for the family's continuation. According to the format of the survey question, this eldest-son dummy variable was defined as whether the parent, or the spouse if the parent was a mother, was an eldest son. For economic variables, we included the current working status, the primary career occupation, and wealth. Given the limited information on wealth from the NUJLSOA, we used a dummy variable of house ownership. For those who owned a house, we estimated the value of the house using information on the land area of the house owned by the parent.[9] Regarding other asset components, we constructed a dummy variable that indicated the possession of substantial non-house assets because the limited information did not allow us to compute an accurate wealth value. This variable covered real estate assets other than the house in which the parent lived, marketable securities (e.g., stocks, bonds, loan trusts), savings, and life insurance. The dummy variable took a value of one if the income of the parent, including spousal income, was above the median income and if one of the top two income sources was from one of the asset types listed above. Income was not included as an explanatory variable because in the NUJLSOA, income included withdrawal from savings, so its interpretation was unclear. In general, wealth was a more appropriate measure of the elderly's economic status.

The NUJLSOA provided child information regardless of whether a child lived with the parent. We included children's age, family structure, years of education, geographical proximity to parents (whether living in the same municipality), health, and coresidence status with parents-in-law.

[9] Because this land area information was available for Wave 2 and after, the land area for the Wave 1 sample was obtained from Wave 2. This approach required us to drop elderly parents who moved between Waves 1 and 2. The land price was constructed from a government source as an average land price of residential properties sampled in each municipal area (Public notice of land prices, Ministry of Land, Infrastructure, Transport and Tourism). Assuming that the land price constituted approximately three-quarters of house wealth (Ando et al. 1986), the total house wealth was computed as house wealth = land area × unit land price/0.75. When a parent lived in an owned house with a land-lease right, one-third of the land price was used as the house wealth.

Table 6 also reports the summary statistics by parental marital status and coresidence status. Compared with elderly couples, widowed mothers were more likely to be older, have less education, be out of the labor force, have more physical limitations, and have low house wealth. They were also more likely to live in a rented house or a family house that had already been bequeathed to a child. Turning to the comparison between those who started new coresidence and those who did not, on average, all shocks were observed more frequently for parents who started coresidence. These parents also tended to be older and have less education. In addition, Table 6 highlights the differential contributions of health and economic factors to the transition to coresidence between married parents and widowed mothers. Married parents who started coresidence had more health limitations but had a greater tendency to work and owned better housing assets than non-coresiding married parents. In contrast, widowed mothers who started coresidence were healthier but were less likely to work and owned more non-house assets than their non-coresiding counterparts.

Empirical Strategy

We conducted two econometric analyses. First, we estimated a conditional logit model at the child level utilizing the characteristic variables of each child. Second, we conducted a family-level analysis to study the coresidence decision of families. In particular, we estimated a finite mixture binary logit model to incorporate unobserved family heterogeneity and to address potential bias from irregular time intervals and attrition over time. Although we do not report the results here, a standard binary logit model without finite mixture components was also estimated at the family level, and the results were consistent with the other models.

Conditional Logit Model

New coresidence begins when a family reaches the decision to coreside according to latent family bargaining or an authoritative family member. To analyze this coresidence transition at the parent–child level, we denoted the transition to coresidence of parent i and child k between two

Table 5 Definitions of variables

Dependent variable	
CoresNext	=1 if parent begins coresidence with at least one child; 0 otherwise (family-level model)
C_CoresNext	=1 if parent begins coresidence with a particular child; 0 otherwise (child-level model)
Explanatory variables: shocks between the base and following periods	
Lostspouse	=1 if spouse departs; 0 otherwise. Divorce and separation included (though extremely rare)
HS_physical	=1 if major deterioration in the ability to perform any of the interviewed physical activities; 0 otherwise
HS_ADL	=1 if major deterioration in the ability to perform any of the interviewed ADL activities; 0 otherwise
HS_spouse	=1 if deterioration in the caring ability of the spouse living together; 0 otherwise
Explanatory variables: characteristics of the elderly parent at the base period	
Age	Age of the elderly parent
Female	=1 if mother; 0 otherwise
1stson	=1 if the parent or the spouse is an eldest son; 0 otherwise
Spouse	=1 if living with spouse; 0 otherwise
YearEducation	Number of years in school
Rural	=1 if living in a rural area; 0 otherwise
Physical	Index 0–10 of 9 physical activity items (the larger the weaker)
ADL	Index 0–10 of 7 basic activities of daily living (ADL) items (the larger the weaker)
SubjectiveHealth	=0 if very healthy/healthy; 1 if average; 2 if unhealthy/very unhealthy
Work	=1 if working; 0 otherwise
Farmer	=1 if either the parent or the spouse is a farmer, or was a farmer if retired
SelfEmployed	=1 if either the parent or the spouse is self-employed, or was self-employed if retired
HouseWealth[a]	Estimated value of the house that is owned by the parent or the spouse (in 1,000,000 Japanese Yen)
HouseFamily[a]	=1 if living in a house owned by someone else in the family or relatives; 0 otherwise
HouseRent	=1 if living on a rent basis
AssetOther	=1 if the parental income is above the median income and one of the top two sources of income is real estate properties, marketable securities, savings, or benefits from life insurance
Explanatory variables: individual child characteristics at the base period[b] (child-level model)	
C_Age	Age of child
C_NumSibling	Number of siblings
C_Onechild	=1 if child is the only child; 0 otherwise
C_1stchild, C_1stson	=1 if child is the first child/the first son; 0 otherwise
C_MarrDtr	=1 if child is a married daughter; 0 otherwise
C_UnmarrSon, C_UnmarrDtr	=1 if child is an unmarried son/daughter; 0 otherwise
C_CaresInLaw	=1 if coresides with parent-in-law; 0 otherwise
C_CaresInLawMarrMiss	=1 if marital information is missing (in-law information is also missing); 0 otherwise
C_YearEduc	Years of education of child
C_Near	=1 if child lives in the same municipality; 0 otherwise
C_Sick	=1 if child is described by the parent as "not healthy enough to take care of someone"; 0 otherwise
C_NumGrandChild	Number of children
C_NumGrandChildSmall	Number of children of preschool age
Explanatory variables: aggregate child characteristics at the base period[b] (family-level model)	
AC_AvgAge	Average age of children
AC_Onechild	=1 if parent has only one surviving child; 0 otherwise
AC_NumChild	Number of surviving children
AC_UnmarSon, AC_UnmarDtr	=1 if there is an unmarried son/daughter; 0 otherwise
AC_YearEduc	Average number of years of education of children

Table 5 continued

AC_Near	=1 if at least one child lives in the same municipality; 0 otherwise
AC_NumGrandChild	Number of grandchildren
AC_NumGrandChildSmall	Number of grandchildren of preschool age

Two dummy variables are also used for the periods 2001–2003 and 2003–2006, with the 1999–2001 period being the reference group

[a] House ownership includes condominiums and townhouses. Joint ownership is included. The difference between regular ownership and *HouseFamily* is whether the parent or the spouse has ownership

[b] Children include step- and foster children but not children-in-law (i.e., children's spouses)

observation periods by an indicator function, $y_{ik} \in (0, 1)$ $i = 1, \ldots, N$, $k = 1, \ldots, K_i$, where N was the total number of families in the sample and K_i was the number of children, which varied by family. Each child represented an alternative to the parent. The parent could also choose to live independently of children ("outside option"). The size of the choice set for family i, therefore, was $K_i + 1$.

Assume that y_{ik} is generated by the latent construct, y^*_{ik}, specified as

$$y^*_{ik} = X_{ik}\beta + \varepsilon_{ik} \quad (1)$$

where X_{ik} is a vector that includes (1) family i's characteristics that are constant across children within a family, such as the parent's age and family wealth, and (2) child k's characteristics, such as the child's age and education. β is a vector of parameters measuring the effect of these characteristics on the transition probability. As a discrete choice model, only the relative difference of y^*_{ik} across alternatives is relevant, so we normalized the outside option as our reference alternative in which y^*_{ik} takes a value of zero. The impact of any covariate, therefore, was interpreted as relative to living without a child.

The logit model arises when ε_{ik} is assumed to follow a type I extreme value distribution independently, conditional on X_{ik}. The probability that child k in family i begins coresidence is given by

$$\Pr(y_{ik} = 1 | X_{ik}, K_i) = \frac{e^{X_{ik}\beta}}{\sum_{m=1}^{K_i} e^{X_{im}\beta}} \quad (2)$$

Notice that (2) is conditional on sibling size, K_i. In other words, we assumed that sibling size was given, and we abstracted away from a family's fertility decision. Although it is possible that parents make fertility decisions expecting a child to provide future informal care, we expected that bias due to such behavior was less of an issue because we focused on the transition to coresidence.

Finite Mixture Binary Logit Model (Family Level)

Next, we studied the transition to coresidence at the family level. In this analysis, the child information was aggregated to the family level (e.g., the children's average age and years of education). Although the above conditional logit model at the child level provided useful insights on the characteristics of individual children that influence the transition to coresidence, the family-level analysis had several advantages over the child-level analysis. First, the restriction on the substitution pattern among alternatives imposed in the child-level logit model was no longer necessary in the family-level analysis. This restrictive property, known as the Independence of Irrelevant Alternatives (IIA), may not be appropriate given the interdependency of siblings' location decisions (Maruyama and Johar 2013). Second, we could include elderly parents who started to live with more than one child in the family-level analysis. Third, families in which detailed information regarding individual children was missing were included in the family-level analysis. For these reasons, the estimation of the family-level model provided an opportunity to examine the robustness of our results.

Instead of a standard binary logit model at the family level, we estimated a Heckman and Singer (1984)-type finite mixture logit model for the following two reasons. First, by non-parametrically incorporating unobservable family-level heterogeneity, this model allowed us to gain insights into the heterogeneity of families without imposing a priori sub-grouping. Second, the model reduced potential bias due to unobserved heterogeneity, which may occur even when unobserved heterogeneity is not correlated with any regressors. This potential bias is due to the sample selection that arises from attrition. Consider families with unobserved lower tendencies of coresidence. In our framework, all families lived independently of children in the base year, and families with a low tendency to coreside appeared in the data more often in later periods than did families with higher coresidence tendencies because the latter were more likely to begin coresidence and thus drop out of the sample in earlier periods. In a fairly general setting, the neglect of such unobserved heterogeneity may lead to an underestimation of the coefficients (Cameron and Trivedi 2005, pp. 617–618).[10] By

[10] The use of random and fixed effects models is the standard approach to overcome this bias. This approach, however, is not feasible in our framework because it requires the removal of a large number of observations that appear only once.

Table 6 Summary statistics

	All		Couples				Widowed mothers			
			No coresidence		New coresidence		No coresidence		New coresidence	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
CoresNext	0.065	0.247								
*C_CoresNext**	0.028	0.166								
Shocks										
Lostspouse	0.040	0.197	0.050	0.217	0.133	0.341	0.000	0.000	0.000	0.000
HS_physical	0.053	0.223	0.046	0.210	0.107	0.310	0.055	0.227	0.161	0.371
HS_ADL	0.017	0.131	0.016	0.125	0.053	0.225	0.008	0.087	0.113	0.319
SpHS_careable	0.105	0.307	0.139	0.346	0.193	0.396	0.000	0.000	0.000	0.000
Parent										
Female	0.483	0.500	0.371	0.483	0.413	0.494				
Age	74.831	5.911	73.991	5.583	74.491	5.962	77.196	6.182	78.044	5.567
Istson	0.422	0.494	0.436	0.496	0.480	0.501	0.355	0.479	0.452	0.502
Educ	9.770	2.729	10.108	2.768	9.840	2.507	8.815	2.308	8.081	2.638
Rural	0.311	0.463	0.317	0.465	0.360	0.482	0.282	0.450	0.274	0.450
Wspouse	0.743	0.437	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
Physical	0.584	1.184	0.498	1.121	0.585	1.181	0.877	1.378	0.857	1.162
ADL	0.146	0.692	0.127	0.661	0.219	0.992	0.197	0.747	0.180	0.497
Subhealth	0.907	0.764	0.891	0.756	0.913	0.794	0.965	0.773	0.935	0.765
Work	0.236	0.425	0.258	0.437	0.307	0.463	0.150	0.357	0.129	0.338
Farmer	0.156	0.363	0.171	0.376	0.200	0.401	0.097	0.296	0.161	0.371
SeljEmp	0.212	0.409	0.235	0.424	0.313	0.465	0.130	0.337	0.097	0.298
HouseWealth	34.099	51.161	37.018	52.413	49.055	59.029	23.703	46.786	22.172	43.435
FamilyHouse	0.044	0.206	0.016	0.125	0.087	0.282	0.115	0.319	0.274	0.450
HouseRent	0.161	0.368	0.135	0.342	0.033	0.180	0.258	0.438	0.210	0.410
AssetOther	0.223	0.416	0.440	0.430	0.293	0.457	0.135	0.342	0.226	0.422
Children*										
C_Age	45.709	6.866	44.555	6.251	44.586	6.791	50.225	6.950	50.113	7.321
CJlumSibling	1.591	1.006	1.520	0.885	1.325	0.839	1.843	1.320	1.583	1.217
C_Onechild	0.088	0.283	0.076	0.266	0.111	0.316	0.121	0.327	0.208	0.410
CJstchild	0.451	0.500	0.452	0.498	0.530	0.501	0.443	0.497	0.479	0.505
CJstson	0.334	0.472	0.336	0.472	0.564	0.498	0.307	0.461	0.521	0.505
CJAarrDtr	0.462	0.499	0.464	0.500	0.249	0.434	0.473	0.500	0.375	0.489
CJJnmarrSon	0.067	0.250	0.066	0.249	0.162	0.370	0.053	0.224	0.021	0.144
CJJnmarrDtr	0.048	0.213	0.043	0.202	0.128	0.336	0.059	0.236	0.063	0.245
C_CoresInLaw	0.061	0.240	0.062	0.241	0.026	0.159	0.061	0.239	0.042	0.202
C_CoresInLawMarrMiss	0.331	0.471	0.330	0.470	0.282	0.452	0.342	0.475	0.292	0.459
CJearEduc	13.523	2.153	13.694	2.124	13.718	2.266	12.982	2.151	12.396	1.854
CJlear	0.342	0.475	0.328	0.470	0.590	0.494	0.377	0.485	0.646	0.483
C_Sick	0.031	0.174	0.031	0.173	0.051	0.222	0.030	0.172	0.063	0.245
C_NumGrandChild	1.735	1.056	1.714	1.059	1.316	1.164	1.870	1.009	1.854	0.850
C_NumGrandChildSmall	0.201	0.526	0.234	0.560	0.239	0.567	0.071	0.329	0.188	0.491

Based on 3,513 parent-period observations (family level), except for the variables with *, which are based on 9,140 parent-period-child observations (child level)

explicitly incorporating the unobserved heterogeneity, the finite mixture model alleviated selection bias.

Let an indicator variable,$y_{it} \in (0,1)$, denote the transition to coresidence between wave years t and $t+1$ by parent i with any of his/her children (hence, the child subscript k is dropped). Recall that the NUJLSOA surveys were conducted in 1999, 2001, 2003, and 2006, with a longer interval between the last two waves. To adjust for the higher probability of new coresidence when survey intervals are longer, let I_t denote the number of years between the current and the next waves. Denoting the 1-year transition probability under a binary logistic distribution by $\Lambda(\mathrm{X}_i\beta) = \frac{e^{\mathrm{X}_i\beta}}{1+e^{\mathrm{X}_i\beta}}$, the individual likelihood function can be written as

$$l_{it}(\beta|y_{it},X_{it}) = \left[1-(1-\Lambda(X_{it}\beta))^{I_t}\right]^{y_{it}} \cdot [1-\Lambda(X_{it}\beta)]^{I_t\cdot(1-y_{it})}. \tag{3}$$

The first square bracket term represents the probability that coresidence begins in *any* year between the two waves. Note that if I_t equals 1, this likelihood becomes the likelihood of a standard logit model with annual panel data. The estimates of β are interpreted as the effect of the covariates on the 1-year transition probability.

We now introduce a two-component mixture into the likelihood function. We assume two unobserved types, or latent classes of families, across which β may vary. For simplicity of presentation, assume that the types affect only the intercept term, such that the types affect the probability of the transition to coresidence as an additive random shock, $(v_1, v_2) \in \Re^2$. Let π_j be the probability associated with type j (mixing probability) and satisfying $0<\pi_j<1$ and $\pi_1+\pi_2=1$. The likelihood of family i in type j at time t is defined as

$$l_{itj}(\beta, v_j|y_{it},X_{it}) = \left[1-\left(1-\Lambda(X_{it}\beta+v_j)\right)^{I_t}\right]^{y_{it}} \cdot \left[1-\Lambda(X_{it}\beta+v_j)\right]^{I_t\cdot(1-y_{it})} \tag{4}$$

.

The individual likelihood contribution of a two-component finite mixture model is

$$l_i(y_{i1},\ldots,y_{iT_i}|X_{i1},\ldots,X_{iT_i};\beta,v_1,v_2,\pi_1,\pi_2) = \sum_{j=1}^{2}\pi_j\prod_{t=1}^{T_i} l_{itj}(\beta,v_j|y_{it},X_{it}) \tag{5}$$

where T_i is the last observational period of family i. Because the constant term in $X_{it}\beta$ is not identified, it is normalized to 0. This model can be estimated by solving $\max_{\{\beta,v,\pi\}} \ln L = \sum_{i=1}^{N}\ln l_i$. Introducing heterogeneity in other coefficient terms is a straightforward extension.[11]

[11] We wrote our own likelihood function in STATA. The code is available upon request.

Results

Conditional Logit: Full Sample Analysis

The conditional logit results for the entire sample are shown in the first column of Table 7. All shock variables were significant and increased the transition probability of coresidence. In addition to health deterioration and the loss of a spouse, the deterioration of spousal caring capability triggered coresidence, implying an important role of the spouse as a caregiver.

Estimated coefficients on parent characteristics revealed that housing was an important predictor of coresidence. This strong housing effect was consistent with previous Japanese studies (Brown et al. 2002; Endo and Yoshida 2001; Iwamoto and Fukui 2001; Kim 2004; Tabuchi 2008; Takagi et al. 2007; Takagi and Silverstein 2011; Yamada 2006). Future coresidence was more likely when a parent lived either in a self-owned (omitted category) or family-owned house than in a rented property.[12] This house effect may capture the physical disadvantages of rental properties over owned houses for beginning coresidence, such as restrictions on renovation and a low availability of rental properties in Japan that can accommodate large, multi-generational families.[13] The *HouseFamily* dummy indicated that the house was owned by a family member, but not by the parent or the spouse. Coresidence was more likely with this type of house than with a parent-owned house. Upon closer examination of the NUJLSOA, it was found that the majority of these houses, approximately 60 %, were owned by a child. Hence, a plausible interpretation of this large effect of family-owned houses is pre-arranged coresidence as an inter vivos transfer. In Japan, houses are often purchased with substantial financial assistance from parents (Tabuchi 2008). Non-house wealth also had a positive effect on coresidence, suggesting additional compensation for children.

The single marital status of a parent was associated with the transition to coresidence. Elderly fathers who were the eldest son and elderly mothers whose husbands were an eldest son were also more likely to begin coresidence. This

[12] Rented properties did not include assisted-living facilities because individuals living in these facilities were not included in our sample.

[13] Another explanation for the low propensity of coresidence of those who lived in rented properties is attrition bias because these parents were more likely to move when they started coresidence with children. Because the re-contact rate was lower for those who moved, the new coresidence by these parents was underrepresented. Our investigation of the relationship between rental property status, mobility, and the re-contact rate found that this attrition bias was highly likely to exist, but the size of bias appeared much smaller than the size necessary to fully explain the estimated coefficient even if we used the most conservative estimates. We found no indication of such bias for *AssetOther*.

Table 7 Conditional logit

	All		Married		Widowed mothers	
	Coeff	*t* stat	Coeff	*t* stat	Coeff	*t* stat
Shocks						
Lostspouse	1.330	4.13***	1.376	4.17***		
HS_physical	0.601	1.88†	0.452	1.12	0.840	1.18
HS_ADL	1.186	2.53*	0.723	1.25	3.378	2.87**
HS_spouse	0.492	1.84†	0.539	2.00*		
Parent						
Age	0.069	2.89**	0.075	2.52*	0.012	0.23
Female	0.150	0.76	0.250	1.08		
1stson	0.327	1.97*	0.310	1.51	0.687	1.84†
Spouse	−0.763	−3.44***				
YearEducation	−0.086	−2.34*	−0.043	−1.02	−0.261	−3.07**
Rural	−0.125	−0.61	0.212	0.86	−0.765	−1.72†
Physical	−0.234	−2.07*	−0.140	−1.04	−0.547	−1.95†
ADL	0.371	2.73**	0.325	2.09*	0.493	1.11
SubjectiveHealth	−0.087	−0.72	−0.013	−0.09	−0.291	−1.11
Work	−0.091	−0.41	0.051	0.19	−0.529	−0.94
Farmer	0.473	1.84†	0.080	0.25	0.792	1.43
SelfEmployed	0.108	0.5	0.082	0.33	0.131	0.19
HouseWealth	0.002	1.5	0.002	1.58	0.005	1.3
HouseFamily	1.394	4.92***	1.853	4.40***	1.992	3.99***
HouseRent	−0.937	−2.96**	−1.956	−3.17**	0.019	0.04
AssetOther	0.485	2.45*	0.252	1.06	1.059	2.22*
Child variables						
C_Age	−0.058	−2.74**	−0.056	−2.07*	−0.032	−0.74
C_NumSibling	−0.170	−1.48	−0.261	−1.58	0.114	0.56
C_onlychild	−0.136	−0.44	−0.230	−0.57	0.932	1.48
C_1stchild	0.008	0.04	0.124	0.51	−0.480	−1.16
C_1stson	1.467	4.40***	1.539	3.57***	2.103	2.61**
C_MarrDtr	0.670	1.93*	0.709	1.56	1.151	1.42
C_UnmarrSon	0.659	2.03*	1.011	2.71**	−2.174	−1.54
C_UnmarrDtr	1.559	3.58***	2.212	4.12***	0.145	0.11
C_CaresInLaw	−0.546	−1.15	−0.546	−0.89	0.103	0.13
C_CaresInLawMarrMiss	−0.415	−1.12	0.026	0.06	−2.210	−1.77†
C_YearEduc	−0.062	−1.43	−0.056	−1.06	−0.167	−1.69†
C_Near	1.120	6.59***	1.142	5.44***	0.995	2.77**
C_Sick	0.422	1.11	0.507	1.11	0.801	0.99
C_NumGrandChild	−0.214	−2.44*	−0.270	−2.37*	−0.108	−0.63
C_NumGrandChildSmall	0.317	1.92†	0.349	1.77*	0.681	1.94†
Time						
wave2	−0.936	−2.61**	−0.437	−1.05	−2.483	−1.98*
wave3	−0.194	−0.57	0.030	0.08	−1.035	−0.85
Constant	−4.968	−3.14**	−7.289	−3.81***	1.184	0.34
N	9,140		6,932		1,784	
Log *L*	−681.13		−455.01		−149.559	
Pseudo R^2	0.788		0.814		0.757	

Robust standard errors are used. The sample size is based on parent–child observations; 2,841 parents with complete children information

† , *, **, and *** Statistical significance at the 10, 5, 1, and 0.1 % levels, respectively

eldest-son effect was consistent with previous studies (Nishioka 2000; Sakamoto 2006; Takagi et al. 2007; Wakabayashi and Horioka 2009) indicating the significance of the Japanese primogenital family system, in which the eldest son's family is the "main family" and the eldest son inherits assets such as land or a house as well as the surname from the parents. Parental age, baseline health conditions, marital status, and education were significant predictors of future coresidence. In contrast to the findings of Takagi et al. (2007) and Takagi and Silverstein (2011) that mothers were more likely to live with their children, the coefficient on *Female* was not significant, but this finding was not surprising. Because the vast majority of single parents in our sample were widowed mothers, *Spouse* captured the effect of being a widowed mother. Hence, what *Female* captured was predominantly which member of an elderly couple was the survey respondent. Regarding parental occupation, Wakabayashi and Horioka (2009) reported a positive association between coresidence and occupations with strong family nepotism, such as self-employment and farming. *Farmer* and *SelfEmployed* both showed positive coefficients, but only *Farmer* was significant.

The estimated coefficients on child variables suggested the costs and benefits of coresidence to children. Future coresidence was more likely with a young, unmarried child who lived nearby. These children may have lower opportunity costs of relocation, coresidence, and future caregiving. Consistent with this interpretation, Hanaoka and Norton (2008) found that the presence of unmarried children reduced single parents' use of formal care more than the presence of married children did. Among married children, daughters were more likely to coreside with parents than sons were. There existed a strong tendency for coresidence with the eldest son (but not with the eldest daughter), and its magnitude was much larger than the effect of fathers as the first son. This result suggested a preference for living with the eldest son regardless of whether the family is a "main family" or a "branch family." The effect of grandchildren depended on their age. Although the number of school-age grandchildren lowered the probability of the transition to coresidence, the presence of preschool grandchildren increased the transition probability, which may suggest the role of elderly parents in providing childcare.

Overall, these results confirmed the following four findings, which are consistent with the findings in the literature. First, intergenerational coresidence often begins in response to the heightened care needs of parents, including the loss of a spouse as well as their health deterioration. Second, coresidence is more likely to occur for parents who have sizable assets. Third, the Japanese traditions of intergenerational inheritance of the house and son preference are still prevalent. Fourth, differences in coresidence propensity across children's characteristics indicate that care and attention provided by children may not be unconditional.[14]

Conditional Logit: Subsample Analysis

The reciprocal nature of coresidence and the conditions for care and attention may vary across families. We applied the logit framework to two sub-groups: married parents and widowed mothers. We did not attempt the regression for widowed fathers because there were only 181 widowed father observations. The results are reported in the second and third columns of Table 7.

The results of the shock variables indicated that although heightened ADL care needs were a critical factor in inducing coresidence for widowed mothers, the coefficients of the health-shock variables were all nonsignificant for married parents. What triggered coresidence for married parents was the loss of current or future care provision by a spouse, either through the death or the deteriorating health of a spouse. This finding illuminated the role of the spouse as a primary caregiver and the position of a child as a replacement caregiver.

Coresidence was more likely for widowed mothers who were less educated, lived in a family-owned house, and had liquid assets. For married parents, house ownership played an important role, but other assets did not. Children who coresided with married parents tended to be young and unmarried, but children's age and marital status did not affect the transition probability for widowed mothers.

Finite Mixture Binary Logit Model

The above subsample analysis was based on our presumption of the distinctive nature of married parents and widowed mothers. We then applied a two-component mixture model to the entire sample to identify family heterogeneity based not on a priori grouping but on the empirical distribution in the data. Because this was a family-level model, we aggregated the child characteristics to the family level (e.g., the average number of years of education of children and the presence of at least one unmarried son or daughter).

The results are shown in Table 8. The first column reports the full-sample logit results for comparison purposes. The last two columns report the results from the

[14] In this study, we did not attempt to interpret the coefficients of the two wave dummies. On the one hand, they may reflect changes in the composition of the population due to attrition. On the other hand, the time trend may be influenced by the introduction of the public Long-Term Care Insurance (LTCI) in 2000. Nevertheless, Tamiya et al. (2011) found that the introduction of LTCI had a limited effect on reducing family informal care.

Table 8 Two-component mixture binary logit

	Logit		Mixture logit			
	Coeff	*t* stat	Coeff	*t* stat	Coeff	*t* stat
MIXTURE						
			Type 1		Type 2	
Age	0.033	1.45	0.048	0.86	0.062	1.1
1stson	0.287	1.95†	1.236	2.24*	−0.382	−0.92
Spouse	−0.627	−3.11**	0.126	0.22	−1.090	−3.0**
YearEducation	−0.053	−1.61	−0.162	−1.96†	−0.018	−0.26
Physical	−0.103	−1.19	−0.053	−0.29	−0.024	−0.13
ADL	0.175	1.37	0.391	1.87†	−1.275	−1.39
SubjectiveHealth	−0.078	−0.72	0.459	0.82	−0.406	−1.73†
HouseWealth	0.002	1.91†	0.010	2.98**	−0.003	−0.83
HouseRent	−0.858	−3.1**	−2.926	−2.40*	−0.598	−1.31
AssetOther	0.478	2.75**	−0.233	−0.36	0.953	2.47*
AC_AvgAge	−0.023	−1.05	−0.130	−2.52*	0.005	0.1
Constant	−3.026	−2.18*	−1.874	−0.63	−5.379	−1.99†
Share			0.725		0.275	
Common						
	Coeff	*t* stat	Coeff	*t* stat		
Shocks						
Lostspouse	1.165	4.07***	1.333	3.97***		
HS_physical	0.571	2.01*	0.526	1.62		
HS_ADL	1.236	3.14**	1.536	3.38***		
HS_spouse	0.509	2.24*	0.626	2.49*		
Parent						
Female	0.116	0.65	0.245	1.18		
Rural	−0.097	−0.53	−0.148	−0.7		
Work	0.129	0.7	0.168	0.75		
Farmer	0.253	1.13	0.352	1.35		
SelfEmployed	0.299	1.62	0.336	1.56		
HouseFamily	1.266	4.86***	1.767	4.75***		
Child						
AC_Onechild	−0.198	−0.79	−0.351	−1.14		
AC_NumChild	0.082	0.7	0.078	0.55		
AC_UnmarSon	0.524	2.66**	0.612	2.5*		
AC_UnmarDtr	0.543	2.73**	0.723	2.89**		

Table 8 continued

Common				
	Coeff	*t* stat	Coeff	*t* stat
AC_YearEduc	−0.080	−1.66†	−0.103	−1.83†
AC_Near	0.793	4.96***	0.969	4.87***
AC_NumGrandChild	−0.103	−2.34*	−0.126	−2.44*
AC_NumGrandChildSmall	0.089	1.17	0.084	0.82
Time				
wave2	−0.540	−2.83**	−0.548	−2.51*
wave3	0.121	0.72	−0.229	−1.22
N	3,513		3,513	
Log *L*	−750.855		−734.531	
Chi-Sq	217.51		112.74	
Pseudo R^2	0.1132			

† , *, **, and *** Statistical significance at the 10, 5, 1, and 0.1 % levels, respectively

mixture logit. The upper panel of Table 8 reports the estimated coefficients of the variables for which we introduced the two-component family-specific heterogeneity. The lower panel shows the coefficients in the common part, which were assumed to have the same effect for both types. The selection of variables for which we introduced heterogeneity was based on interest and estimation tractability. In particular, the identification of model parameters became challenging when we introduced heterogeneity for a variable with insufficient variation. For example, we did not introduce heterogeneity for *HouseFamily* because this dummy variable applied to less than 5 % of our sample. Comparing estimated coefficients in the common part with those of the standard logit model provided a robustness check. The differences were generally modest, and the logit and finite mixture models offered overall consistent findings. Our results were fairly robust in removing the mixture component from any variable in our current specification.

The estimated finite mixture model identified two distinct types of families, with 72.5 % classified as Type 1 and 27.5 % classified as Type 2. The differences in the coefficient estimates across types reflect the heterogeneity in the coresidence decisions of Japanese families. Type 2 families had a smaller constant term than Type 1 families, but when evaluated at sample mean values, Type 1 families had, on average, a smaller probability of transition to coresidence than their Type 2 counterparts. Type 1 families were more likely to start coresidence when the parent was an eldest son (or a spouse of an eldest son), was less educated, was more severely disabled at the baseline, had younger children, and lived in a self-owned house with a higher housing value. For Type 2 families, coresidence was more likely to occur when the parent was widowed, had better subjective health, and had assets other than a house.

Discussion

The heterogeneity identified by the finite mixture model exhibits similarities with the subsample analysis. Important factors are parental housing conditions and children's age for Type 1 and parental widowhood and non-house wealth for Type 2. Although the setups are different and the two models do not necessarily reflect the same type of heterogeneity, both models suggest that a parent's marital status is significantly related to heterogeneity in the mode of reciprocity within a family. Specifically, Type I parents are similar to married parents in that the transition to coresidence is associated positively with house ownership and housing wealth, negatively with children's age, and nonsignificantly with non-house assets. Likewise, Type II parents are similar to widowed mothers in that the initiation of coresidence is associated positively with non-house assets and is nonsignificantly associated with house ownership, housing wealth, and children's age. In addition, Type II parents are less likely to start coresidence when living with a spouse and thus are similar to widowed mothers in our sample.

The results from both models suggest that factors associated with new coresidence vary across families. We argue that these factors reflect the costs and benefits of

coresidence to children. For married parents, coresidence typically begins when sharing a house with parents is attractive for children. Better housing conditions make coresidence more likely, allowing young and unmarried children to rely on parents' resources. Parents can also enjoy care and attention from children, but the presence of a healthy spouse would decrease the current or future caregiving burden for children. From this perspective, coresidence for married parents may be regarded as a means of securing children's long-term commitment for the burden of future care (both further health deterioration and loss of spouse) by offering an environment that is attractive to children and the potential deed to the residential house. These factors reiterate the importance of a house in mediating intergenerational transfers.

However, married/unmarried children and young/old children are all equally likely to start living with widowed mothers. Although this finding appears to suggest that children's altruism dictates the opportunity costs and benefits of children for widowed mothers, our results also suggest that coresidence with widowed mothers involves different forms of reciprocity. Coresiding widowed mothers tend to be rich in liquid assets and, if healthy, may be better able to provide help with household chores and care for grandchildren compared with fathers and married mothers who must take care of their husbands.

Our results do not exclude other possible motives of children for providing care and attention to their parents, such as altruism and social norms. Additionally, children may compensate parents for the financial and time investments they received in childhood. Nevertheless, our results illuminate the importance of wealth transfers from parents to children in later life in the formation of intergenerational coresidence. These results differ from those of American studies reporting an nonsignificant association between parental wealth and children's provision of care and attention to parents (Brown 2007; Nakamura and Maruyama 2012; Perozek 1998; Pezzin and Schone 1999; Sloan et al. 1997, 2002). The parent–child relationship in Japan may be characterized by higher levels of filial support for parents and parental support for children. Despite this difference, however, our findings are consistent with various studies of countries other than Japan that find evidence of reciprocity in transfers between elderly parents and adult children (Bernheim et al. 1985; Chan 2005; Cox 1987; Henretta et al. 1997; Johar and Maruyama 2011; Koh and Macdonald 2006; Norton and Van Houtven 2006).

Conclusions

Intergenerational coresidence and traditional informal care provision are declining in Japan and in other aging societies. The disabled elderly live longer, and family caregivers are older. The relative number of children is decreasing, and children's opportunity costs of caring for parents are growing. Developed countries emphasize the efficient use of formal care and community-based care. Nevertheless, care and attention provided by children remains important for the well-being of elderly, particularly widowed, individuals.

This study provides a first step toward deepening our knowledge about reciprocity in intergenerational exchanges, particularly parent–children coresidence that involves care and attention provided by children. We find considerable heterogeneity in the determinants of the transition to coresidence across Japanese families. Our results suggest that the way in which elderly parents compensate their children for care and attention depends on the costs and benefits to the children for coresidence and service provision. There are two distinct types of coresidence in Japanese families. For the more common type of family, new coresidence tends to involve young, unmarried children and married parents. In this type of family, the main mode of transfer appears to be housing assets. The other, less common type has a higher tendency of transition to coresidence. When this type of family starts coresidence, it typically involves widowed mothers, and reciprocity seems to be achieved through financial assets other than a house.

This study has the following implications for future studies on the parent–child relationship. First, our finding of significant family heterogeneity highlights the importance of an analytical framework that can account for observed and unobserved heterogeneity, such as finite-mixture models. Second, our finding of the important role of parental compensation requires future studies of reciprocity in family decisions regarding informal care. The high rate of intergenerational coresidence in Japan likely reflects intergenerational reciprocity or mutual altruism rather than one-sided, unconditional, and self-sacrificing filial altruism or social norms. Third, the findings that non-house wealth and health promote coresidence for widowed mothers suggest that widowed mothers may lack care and attention from their children when they are physically frail and poor in wealth. Ways of safeguarding the welfare of such vulnerable populations remain a pressing question for policy makers and researchers.

Children's support for elderly parents can take forms other than coresidence, such as distant informal care and financial assistance for formal care. Additionally, recent studies have questioned the effectiveness of intergenerational coresidence in promoting elderly parents' longevity (Johar and Maruyama 2013; Maruyama 2012). However, similar reciprocity could exist in these dimensions of old-age support from children. Analysis of a broader spectrum of filial support is a task we leave for future research.

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References

Ando, A., Yamashita, M., & Murayama, J. (1986). Analysis of consumption and saving based on the lifecycle hypothesis. *Economic Analysis, 101*, 25–114. (in Japanese).

Bernheim, B. D., Shleifer, A., & Summers, L. H. (1985). The strategic bequest motive. *Journal of Political Economy, 93*(6), 1045–1076. doi:10.1086/261351.

Brandon, P. D. (2012). The rise of three-generation households among households headed by two parents and mothers only in Australia. *Journal of Family and Economic Issues, 33*(3), 376–388. doi:10.1007/s10834-012-9284-5.

Brown, M. (2007). End-of-life transfers and the decision to care for a parent (unpublished manuscript).

Brown, J. W., Lianga, J., Krausea, N., Akiyama, H., Sugisawa, H., & Fukaya, T. (2002). Transitions in living arrangements among elders in Japan: Does health make a difference? *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(4), 209–220. doi:10.1093/geronb/57.4.S209.

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and applications*. Cambridge: Cambridge University Press.

Carmichael, F., Charles, S., & Hulme, C. (2010). Who will care? Employment participation and willingness to supply informal care. *Journal of Health Economics, 29*(1), 182–190. doi:10.1016/j.jhealeco.2009.11.003.

Chan, A. (2005). Aging in Southeast and East Asia: Issues and policy directions. *Journal of Cross Cultural Gerontology, 20*(4), 269–284. doi:10.1007/s10823-006-9006-2.

Cox, D. (1987). Motives for private income transfers. *Journal of Political Economy, 95*(3), 508–546. doi:10.1086/261470.

Dodge, H. H., Kadowaki, T., Hayakawa, T., Yamakawa, M., Sekikawa, A., & Ueshima, H. (2005). Cognitive impairment as a strong predictor of incident disability in specific ADL-IADL tasks among community-dwelling elders: The Azuchi study. *The Gerontologist, 45*(2), 222–230. doi:10.1093/geront/45.2.222.

Dostie, B., & Léger, P. T. (2005). The living arrangement dynamics of sick, elderly individuals. *Journal of Human Resources, 40*(4), 989–1014. doi:10.3368/jhr.XL.4.989.

Endo, H., & Yoshida, A. (2001). Family decision on coresidence and demand for formal care services. *Quarterly Journal of Social Security Research*, *37*(3), 281–296 (in Japanese). http://www.ipss.go.jp/syoushika/bunken/data/pdf/15690409.pdf.

Fast, J. E., Williamson, D. L., & Keating, N. C. (1999). The hidden costs of informal elderly care. *Journal of Family and Economic Issues, 20*(3), 301–326. doi:10.1023/A:1022909510229.

Hall, J., Kenny, P., & Hossain, I. (2007). The provision of informal care in terminal illness: An analysis of carers' needs using a discrete choice experiment. CHERE working paper 2007/12, University of Technology Sydney. http://www.chere.uts.edu.au/pdf/wp2007_12.pdf.

Hanaoka, C., & Norton, E. C. (2008). Informal and formal care for elderly persons: How adult children's characteristics affect the use of formal care in Japan. *Social Science and Medicine, 67*(6), 1002–1008. doi:10.1016/j.socscimed.2008.05.006.

Hays, J. C., Pieper, C. F., & Purser, J. L. (2003). Competing risk of household expansion or institutionalization in late life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 58*(1), S11–S20. doi:10.1093/geronb/58.1.S11.

Heckman, J. J., & Singer, B. (1984). A method for minimizing the impact of distributional assumptions in econometric models for duration data. *Econometrica, 52*(2), 271–320. doi:10.2307/1911491.

Henretta, J. C., Hill, M. S., Li, W., Soldo, B. J., & Wolf, D. A. (1997). Selection of children to provide care: The effect of earlier parental transfers. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 52B*, S110–S119. doi:10.1093/geronb/52B.Special_Issue.110.

Horioka, C. Y. (2002). Are the Japanese selfish, altruistic or dynastic? *Japanese Economic Review, 53*(1), 26–54. doi:10.1111/1468-5876.00212.

Iwamoto, Y., & Fukui, T. (2001). The effect of income on intergenerational coresidence. *JCER Economic Journal, 42*, 21–43 (in Japanese). http://www.jcer.or.jp/academic_journal/jer/PDF/42-2.pdf.

Johar, M., & Maruyama, S. (2011). Intergenerational cohabitation in modern Indonesia: Filial support and dependence. *Health Economics, 20*(S1), 87–104. doi:10.1002/hec.1708.

Johar, M., & Maruyama, S. (2013). Does coresidence improve an elderly parent's health? *Journal of Applied Econometrics*. doi:10.1002/jae.2339.

Kim, Y. (2004). What makes family members live apart or together? An empirical study with Japanese panel study of consumers. *The Kyoto Economic Review*, *73*(2), 121–139. http://repository.kulib.kyoto-u.ac.jp/dspace/bitstream/2433/24836/1/73.121.pdf.

Koh, S. K., & MacDonald, M. (2006). Financial reciprocity and elder care: Interdependent resource transfers. *Journal of Family and Economic Issues, 27*(3), 420–436. doi:10.1007/s10834-006-9028-5.

Konrad, K. A., Kunemund, H., Lommerud, K. E., & Robledo, J. R. (2002). Geography of the family. *American Economic Review, 92*(4), 981–998. doi:10.1257/00028280260344551.

Kureishi, W., & Wakabayashi, M. (2009). One's own parents and one's spousal parents: A question of strategic bequest motives (unpublished manuscript). http://iussp2009.princeton.edu/papers/91391.

Maruyama, S. (2012). Inter vivos health transfers: Final days of Japanese elderly parents. *UNSW Australian School of Business Research Paper,* No. 2012 ECON 20, University of New South Wales.

Maruyama, S., & Johar, M. (2013). Do siblings free-ride in 'being there' for parents? *UNSW Australian School of Business Research Paper,* No. 2013 ECON 06, University of New South Wales.

Michael, Y. L., Berkman, L. F., Colditz, G. A., & Kawachi, I. (2001). Living arrangements, social integration, and change in functional health status. *American Journal of Epidemiology, 153*(22), 123–131. doi:10.1093/aje/153.2.123.

Ministry of Health, Labour and Welfare. (2008). *Report on the comprehensive survey of living conditions of the people on health and welfare* (in Japanese). http://www.mhlw.go.jp/toukei/list/20-19-1.html.

Nakamura, S., & Maruyama, S. (2012). Intergenerational transfers from children to parents. *Economic Analysis*, *63*(4), 318–332 (in Japanese). http://www.ier.hit-u.ac.jp/Japanese/publication/ER/.

Nishioka, H. (2000). Parent–adult child relationship in Japan: Determinants of parent–adult child coresidence. *Journal of Population Problems, 56*(3), 34–55 (in Japanese). http://websv.ipss.go.jp/syoushika/bunken/data/pdf/15441102.pdf.

Norton, E. C., & Van Houtven, C. H. (2006). Inter-vivos transfers and exchange. *Southern Economic Journal, 73*(1), 157–172. doi:10.2307/20111880.

OECD. (2005). *The OECD health project: Long-term care for older people*. Paris: OECD.

Perozek, M. G. (1998). A reexamination of the strategic bequest motive. *Journal of Political Economy, 106*(2), 423–445. doi:10.1086/250015.

Pezzin, L. E., & Schone, B. S. (1999). Intergenerational household formation, female labor supply and informal caregiving: A bargaining approach. *Journal of Human Resources, 34*(3), 475–503. doi:10.2307/146377.

Pinquart, M. (2001). Correlates of subjective health in older adults: A meta analysis. *Psychology and Aging, 16*(3), 414–426. doi:10.1037/0882-7974.16.3.414.

Sakamoto, K. (2006). Factors affecting coresidence with parents and the effect of coresidence. *Japanese Journal of Research on Household Economics, 72*, 21–30 (in Japanese). http://dl.dropboxusercontent.com/u/88984691/journal/jjrhe/pdf/72/072_04.pdf.

Sarwari, A. R., Fredman, L., Langenberg, P., & Magaziner, J. (1998). Prospective study on the relation between living arrangement and change in functional health status of elderly women. *American Journal of Epidemiology, 147*(4), 370–378. doi:10.1093/oxfordjournals.aje.a009459.

Sloan, F. A., Picone, G., & Hoerger, T. J. (1997). The supply of children's time to disabled elderly parents. *Economic Inquiry, 35*(2), 295–308. doi:10.1111/j.1465-7295.1997.tb01911.x.

Sloan, F. A., Zhang, H. H., & Wang, J. (2002). Upstream intergenerational transfers. *Southern Economic Journal, 69*(2), 363–380. doi:10.2307/1061677.

Tabuchi, R. (2008). Parental housing assistance as a determinant of parent-child proximity in Japan: Results from the JGSS-2006. *Japanese General Social Surveys Research Series, 7*, 13–23 (in Japanese). http://jgss.daishodai.ac.jp/research/monographs/jgssm7/jgssm7_02.pdf.

Takagi, E., & Silverstein, M. (2011). Purchasing piety? Coresidence of married children with their older parents in Japan. *Demography, 48*(4), 1559–1579. doi:10.1007/s13524-011-0053-0.

Takagi, E., Silverstein, M., & Crimmins, E. (2007). Intergenerational coresidence of older adults in Japan: Conditions for cultural plasticity. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62*(5), 330–339. doi:10.1093/geronb/62.5.S330.

Tamiya, N., Noguchi, H., Nishi, A., Reich, M. R., Ikegami, N., Hashimoto, H., et al. (2011). Population ageing and wellbeing: Lessons from Japan's Long-Term Care Insurance. *Lancet, 378*(9797), 1183–1192. doi:10.1016/S0140-6736(11)61176-8.

Wakabayashi, M., & Horioka, C. Y. (2009). Is the eldest son different? The residential choice of siblings in Japan. *Japan and the World Economy, 21*(4), 337–348. doi:10.1016/j.japwor.2009.04.001.

Wolff, F. (2001). Private intergenerational contact in France and the demonstration effect. *Applied Economics, 33*(2), 143–153. doi:10.1080/00036840122181.

World Health Organization. (2007). *Women, ageing and health: A framework for action*. Canada: WHO.

Yamada, K. (2006). Intra-family transfers in Japan: Intergenerational co-residence, distance, and contact. *Applied Economics, 36*(16), 1839–1861. doi:10.1080/00036840600825746.

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