Strategic Interactions between Parents and Daughters: Co-residence, Marriage and Intergenerational Transfers in Japan*

Mari Sakudo†
Department of Economics, University of Pennsylvania

February 2007

Job Market Paper

Abstract

Over the last few decades, the fraction of young adults residing with their parents has risen in many countries. In this paper, to understand the extent of the determinants of intergenerational co-residence, we develop and estimate a model of decision-making about family co-residence, intergenerational monetary transfers, and marriage. The model incorporates differences in parents' tastes about marriage and co-residence of their child, cultural heterogeneity, and altruism within the family. As environmental factors that influence the co-residence and marriage decisions, we consider housing market conditions (housing rent)

*I would like to thank Kenneth Wolpin, Antonio Merlo, and Petra Todd for their invaluable advice. I also thank Samuel Danthine, Christopher Ferrall, Susumu Imai, Donghoon Lee, Toshihiko Mukoyama, Kevin Song, Melissa Tartari, and seminar participants at University of Pennsylvania and the Numerically Intensive Economic Policy Analysis conference 2006 for their comments and suggestions.

†*Address:* Department of Economics, University of Pennsylvania, 160 McNeil Building, 3718 Locust Walk Philadelphia, PA 19104-6297. Tel.:1-215-898-7701; fax:1-215-573-2057. *E-mail address:* sakudo@ssc.upenn.edu.

and the marriage market conditions (matching probability). The model is estimated using a unique panel dataset on young women in Japan, which contains unusually rich information on monetary transfers between parents and children, regardless of whether the child resides with the parent. The estimated model is used to study the effects of strategic parental transfers and to perform a variety of counterfactual policy experiments of the kind recently introduced or being considered in Japan. For example, we assess how the strategic transfers affect the choices and the welfare of the parents and the children. We also evaluate the quantitative impact of housing policies, such as rent subsidy programs aimed at young people. In addition, we analyze the effect of government intervention in the marriage market in the form of the newly instituted and government-supported matching services.

Keywords: Co-residence, Strategic Interactions, Intergenerational Transfers, Marriage

JEL Classifications: D13, J12, J18

1 Introduction

In many countries, young people tend to live with their parents well into adulthood. For example, in Greece, Italy, and Japan, more than 40% of young adults aged 25-34 lived with their parents in 2000. As can be seen in Figure 1, many countries have seen in increase in the fraction of coresiding young adults over the last few decades.[1] Young adults usually have the option of living alone or with spouses, which suggests that there must be some perceived psychic or economic benefit from parental co-residence, either to the parents or to the children. Coresidence often ends when children get married, although, interestingly, in Japan it is fairly common for children to live with their parents even after marriage.

Another interesting pattern in cross country comparisons is that co-residence rates vary significantly. For instance, a much larger fraction of young adults in the southern European countries (such as Italy, Greece, Spain, and Portugal) and Asian counties (such as Japan) live with their parents than those in some other European countries (such as United Kingdom, Germany, France, Belgium, Luxembourg, and Netherlands), Canada, and the United States. As Figure 2 shows, there is significant difference between the first group of countries and the second group.[2] Such differences could arise from different housing market conditions, different marriage markets or different roles played by parents. This paper develops an economic model of decision-making about co-residence and marriage and uses the model to explore the major determinants

[1]The statistics for Japan are based on the Census of Japan reported by the Statistics Bureau. The statistics for Italy, Greece, Spain and Portugal are based on the EU Labour Force Survey. In the United States, the fraction of young adults aged 25-34 has increased from 10.1% in 1980 to 14.2% in 2000. We construct these statistics using the Integrated Public Use Microdata Series (IPUMS).

[2]The statistics in the United States is constructed from the Integrated Public Use Microdata Series (IPUMS), and those in European countries are calculated from the EU Labour Force Survey, as we explain before. This co-residence ratio in Japan is obtained as the fraction of young adults in the age group living with parents by summing up the total number of people whose ages are in the age range using the statistics of co-residence reported in the Census of Japan. They have started to report the statistics of co-residence since year 1995.

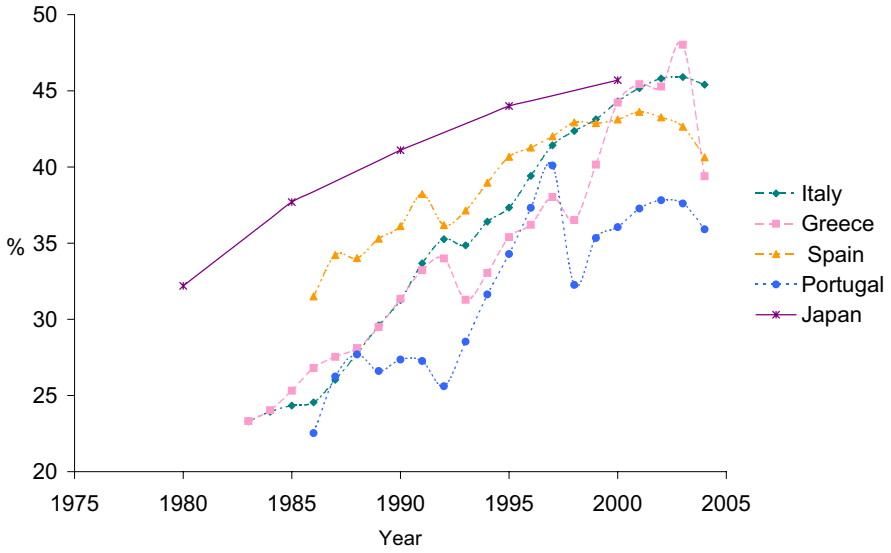

Figure 1: Young adults aged 25-34 living with parent(s)

of observed patterns of residence, marriage and monetary transfers. The model is estimated using data from the Japanese Panel Survey of Consumers.

In analyzing the determinants of co-residence decisions, there are several important factors to consider. The first is marriage. Never-married young adults are more likely to live with their parents than married young adults in all countries. In 2000, the fraction of single young adults aged 25-34 living with their parents was 81% in Italy, 65% in Japan, and 28% in the United States. In contrast, the fraction of married adults living with their parents was only 5%, 16% and 5%, respectively.[3] One of the characteristics of co-residence in Japan is that the proportion of married adult children residing with parents is significantly higher than those in other countries such as European countries and the United States.

The second factor that affects living arrangements is housing cost. A shared resi-

[3]The statistics of singles exclude widowed and divorced. We construct the statistics in Italy using the EU Labour Force Survey, and the statistics in the United States using the Integrated Public Use Microdata Series (IPUMS). We calculate the statistics in Japan using the information about co-residence in the Census of Japan.

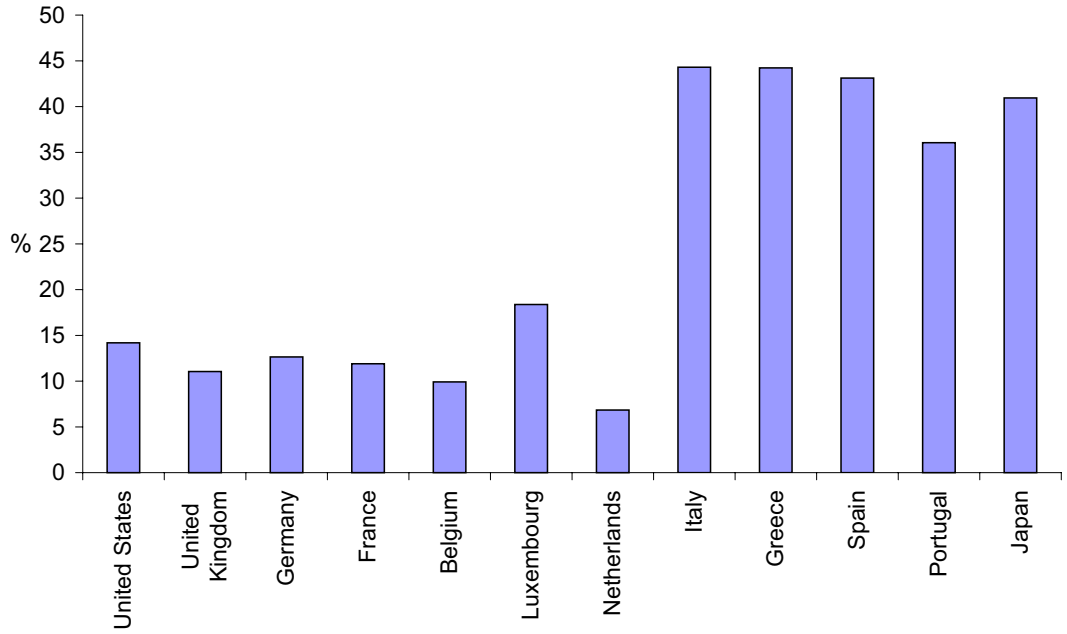

Figure 2: Young adults aged 25-34 living with parent(s) in year 2000

dence brings potential economies of scale, but also may come with costs such as loss of privacy. Patterns in the data indicate, however, that housing prices cannot be a sole determinant of co-residence behavior. For example, in year 2000, the proportion of young adults aged 25-34 living with their parents in Japan is 41%, which is much higher than the corresponding number in the United Kingdom (11%). Both countries have relatively high housing prices, but we observe a large heterogeneity even within this high-housing-price group of countries. Across some regions in Japan, the housing price and co-residence pattern even have a *negative* correlation. For example, the proportion of young adults aged 25-34 living with their parents is 32% in Tokyo, but is around 55-60% in agricultural areas (with cheaper housing cost) in 2000.

Cultural heterogeneity provides a possible explanation for these patterns, because families in rural areas may be more likely to adopt more traditional living arrangements. The model estimated in this paper aims to distinguish separate effects of housing costs and of cultural values, modeled as a source of unobserved heterogeneity. For example,

in Japan, married couples are more likely to live with the husbands' parents than with the wives' parents. The likeliness of co-residence also differs by birth orderings of siblings. Among married young couples living with parents, 77% live with the husbands' parents according to a household survey in Japan.[4] This percentage is higher (91%) for the eldest sons than the non-eldest sons (42%). Existing norms may have arisen as conventional wisdoms that provide priority and duty to particular children, so that conflicts in a family associated with these decisions do not arise. We estimate the importance of these type of cultural norms in determining co-residence patterns.

The fourth factor that is key to understanding co-residence behavior is family altruism and the existence of monetary and in-kind transfers. Co-residence can be regarded as an in-kind transfer from parents to their children. In Japan, financial transfers between parents and their children are also quite common, and it appears that financial transfers are closely linked to the co-residence decision. The frequency of intra-household transfers of money dominates that of inter-household transfers. In 2000, about 20% of single adults aged 20-34 living with parents receive financial transfers from parents, while only 9% of single living alone do.[5] This implies that a child who receives in-kind transfers also tends to receive monetary transfers. Most existing studies about intergenerational financial transfers consider only transfers from parents to children.[6] In reality, however, monetary transfers in the opposite direction often happen. Tranfers from children to parents are closely related to co-residence patterns. In 2000 Japan, 60% of single young adults aged 20-34 living with their parents hand some money to their parents, while 30% of single living alone do.[7]

[4]We explain about the Japanese Panel Survey of Consumers later.

[5]These statistics are reported by the cabinet office, the government of Japan.

[6]Most of the empirical literature analyzes bequests, although some researches such as Cox (1987) analyze inter vivos transfers. The theoretical work of Kotlikoff, Razin and Rosenthal (1990) considers transfers in both directions.

[7]Similarly, 47% of co-resident married young adults hand monetary transfers to their parents, while only 8% of non-co-resident counterparts do. About 18% of co-resident married young adults receive monetary transfers, whereas 12% of non-co-resident counterparts do. This phenomenon is

As noted above, the model developed in this paper is estimated using the Japanese Panel Survey of Consumers, a unique dataset that permits estimation of a rich model that incorporates all of the above elements. It is a panel dataset on young women in Japan that includes information on co-residence, parental income, siblings and siblings' gender composition, housing rent, marital status and spouse characteristics. Importantly, the data contain information on monetary transfers between parents and children (in both directions) regardless of whether children co-reside with their parents. Transfer data of this sort are rarely available, but they are invaluable for empirically studying strategic parent-child interactions.

The behavioral model assumes that parents and their daughters jointly make co-residence, marriage, and transfer decisions in an environment with strategic interactions. The model incorporates all of the above-mentioned factors. The model explicitly formulates costs of housing, that is, market housing rent and imputed rent associated with co-residence. It allows for two-sided altruism of parents and their child. Each agent in the model (parents, daughters) makes decisions taking into account altruism. It is assumed that parents make a portfolio of offers of co-residence and of transfers (positive or negative) to the daughter that may be conditioned on her accepting or rejecting marriage offers. The daughter can choose to accept one of these offers or reject all of them and live on her own. The model allows for differences in consumption behaviors by daughter's marital status by introducing cooperative bargaining within marriage. In our model, we distinguish between living with own parents and with spouses' parents, in order to take into account the social norms that we see in Japan and other countries. As described in detail in the paper, the model is estimated using indirect inference and using simulation methods.

After estimating the model, we use it to perform a variety of counterfactual policy experiments. First, we consider the hypothetical world of no strategic monetary

not particular to Japan. For instance, Kochar (2000) also points out that "only 4 percent of parents received income transfers from non-resident children, whereas as many as 85 percent of the elderly aged 60 or more co-resided with adult sons in the household survey data of rural Pakistan".

transfers. We find that co-residence increases by 6.8 percentage points and marriage decreases by 4.1 percentage points if there is no strategic money between parents and children. According to the estimated model, some parents would charge their children more than imputed rent contingent on co-residence so that parents and children divide net monetary gain in terms of housing rent. Parents provide larger net transfers contingent on that their daughters get married. Eliminating strategic monetary transfers reduces the marriage rate. Second, we consider the hypothetical world of no option to co-reside and no monetary transfers. We find that marriage increases by 3.9 percentage points in the absence of parental involvement. We also find that there is large welfare loss of parents and daughters if no intergenerational transfers exist.

Third, we assess the impact of a variety of government interventions of the kind recently introduced or being contemplated in Japan. For example, we evaluate the impact of government intervention in the marriage market, notably of the recently introduced government-supported matching services that can be thought to affect marriage offer probabilities. We find that the government policy, which raise matching probabilities by 5 percentage points, increases marriage by 2.3 percentage points, decreases co-residence by 1.7 percentage points. We also study the impact of housing rent subsidy programs to young people. We find that even if the government provides financial support of a half of rent to young people living alone, the co-residence rate decreases by only 2.5 percentage points on average.

Lastly, we analyze the impact of cultural transition from traditional family to modern family. We find that the marriage rate declines by 10.7 percentage points in the transition from the situation that all families are traditional to the situation that all families are modern.

This paper is organized as following. The next section briefly reviews the related literature. Section 3 describes our model. Section 4 explains the data. We estimate the model in Section 5 and describe the result in Section 6. In Section 7, we perform a variety of counterfactual experiments. Section 8 concludes.

2 Literature

Intergenerational co-residence of young adults and their parents[8] is related to important economic behaviors and welfare programs. Hence, the existing literature studies its relationship with those variables. However, the progress on empirical research is still in the early stages. The empirical literature in this area consists of mainly two different streams. The first approach (method A) is to estimate relationships between variables, and to interpret the obtained relationships with or without an economic model, which is not technically connected to the estimation procedures. The second approach (method B) is to estimate a discrete choice model of only one representative economic agent given indirect utility.

Along with the method A, Manacorda and Moretti (2005) study the correlation between co-residence fraction of young men and parental income, while Kochar (2000) analyzes the correlation between fathers' labor participation and income of the co-resident sons. Manacorda and Moretti (2005) interpret that Italian young men living with parents financially benefit from co-residence, whereas Kochar (2000) interprets that fathers in rural Pakistan financially benefit from intergenerational co-residence.

Each existing study using method B incorporates different variables as covariates in their regressions, which can be interpreted as explanatory variables in a linear indirect utility function of an economic agent. In Hu's (2001) results, welfare benefits to parents, which differ by living arrangements, affect the choice of whether parents and child live apart. The results of Hu (2001) and Haurin, Hendershott and Kim (1993) imply that welfare benefits to children do not influence co-residence decisions. Haurin, Hendershott and Kim (1993), and Borsch-Supan (1986) consider more than two alternatives related to housing and living arrangements, but they do not use information that can affect parental income in their regressions. Their results suggest that hous-

[8]We study the co-residence of young adults and their parents rather than that of elderly parents and their child as in Pezzin and Schone (1999). In their study, as the parents' generation consists of elderly, they analyze issues about informal care-giving from daughters to parents and the work participation of the daughter.

ing costs influence co-residence. Among these researches, Haurin, Hendershott and Kim (1993) and Hu (2001) use instruments in order to control simultaneous bias of covariates.

In contrast, McElroy (1985) and Rosenzweig and Wolpin (1993, 1994) directly endogenize economic variables that their analyses focus on. McElroy (1985) considers a joint decision of whether to live with parents and labor supply by a young never-married male. Rosenzweig and Wolpin (1993, 1994) consider co-residence and whether children receive financial transfers or not as discrete alternatives.

All the above research except Kochar (2000) and Rosenzweig and Wolpin (1993, 1994) implicitly assume that there is no unobserved permanent heterogeneity such as culture or innate ability that possibly affects covariates. In contrast, among the studies using the method B, Ermisch (1999), which studies the correlation between housing price and co-residence, and Rosenzweig and Wolpin (1993, 1994) allow individual specific heterogeneity.

The first limitation of the existing literature is that estimated parameters are not fundamental parameters or a mixture of fundamental parameters in a particular environment only. The results using method A show only an aggregated relationship between co-residence and the variable of their interests in a specific situation, which is realized and observed in the data. Even if they use a random utility model by using the method B, a decision maker is either a child only or a single economic agent who represents a pair of parents and a child. They estimate indirect utility of a whole aggregated household rather than an individual's utility function. However, it is natural to presume that individuals, that is, parents and their young adult offspring, could be endowed with different preferences concerning co-residence, and that they negotiate about family decisions of co-residence. As an experiment, we can measure the impact on co-residence by altering values of an explanatory variable. However, to the extent that the aggregated relationship between variables in a particular environment does not represent true technological relationship, experiments based on these estimates can not derive appropriate outcomes corresponding to a hypothetical change in the

variable.

Second, there is a limitation regarding unobserved permanent heterogeneity. Intergenerational co-residence decisions seem to be closely related to culture and social norms, which can be considered as individual specific unobserved heterogeneity. The existing literature either strongly assumes that no individual specific effects exit, or estimates conditioning on the heterogeneity.[9] Hence, there is another reason why we can not correctly quantify impacts of environmental changes on co-residence behaviors with these estimation methods.[10] Since we exclude unobserved permanent heterogeneity either from a model or from an estimation, we can not recover marginal distributions necessary to perform counter-factual experiments.

Third, the existing literature typically assumes marital status is given even if it is taken into account, whereas marriage decisions must play a key rule in any study of co-residence decisions.

Fourth, the existing empirical literature lacks information about intergenerational transfers of money. Although studies such as Ermisch (1999) and Manacorda and Moretti (2005) discuss transfers from parents to their children contingent on co-residence as an interpretation, they do not use the information on transfers in their estimation. Rosenzweig and Wolpin (1993, 1994) use the information about indicator of whether transfers take place when living apart only.

3 Model

We construct a model of a family in an environment, where the players are a young female (daughter) and her parents. The decision horizon begins at a year when the daughter is a never-married young adult. It is a repeated bargaining model in which parents and their daughter are involved in a sequence of one-shot transactions until

[9] In other words, they use sufficient statistics to identify only parameters other than the fixed effects.

[10] We could know the odds ratio at most.

the daughter gets married. We focus on the transition periods, in which youths are in their twenties or thirties and are most likely to form a new family. The structure of a previous family youths have belonged to is also reformed.[11] Economic agents' decisions are static in the sense that history does not affect their decisions. However, the state variables, which are not determined by the past actions, influence their decisions.

We describe decisions of a family as a bargaining game, because intergenerational co-residence and associated economic behavior can be considered as an agreement between parents and their children. A conflict of interests among family members possibly exists, as each individual could be endowed with different preferences about the outcome. Yet, both generations have to approve the intergenerational transaction.

Each period consists of a two-stage game. In the first stage, parents make an offer of net transfers contingent on the daughter's marital and co-residential status, $t^F \in \mathbb{R}^5$. In the second stage, the daughter makes a decision about co-residence q and marriage x. There are five possible combinations of marital and co-residential choices, staying single and living alone ($x = s, q = 0$), staying single and living with her parents ($x = s, q = 1$), getting married and living alone ($x = m, q = 0$), getting married and living with her own parents ($x = m, q = 1$), getting married and living with her husband's parents ($x = m, q = 2$). Parents decide net transfers in each of these states, $t^F \equiv (t^F_{s0}, t^F_{s1}, t^F_{m0}, t^F_{m1}, t^F_{m2})'$. Here, t^F_{ij} is the net amount of transfer when $x = i$ and $q = j$. As transfers are a contingent offer, the parents' strategy is represented as five dimensional continuous variable. A daughter has the option to reject her parents' offer and not live with them. In this case, she can choose the options with $q \neq 1$. Therefore, there are eight possible alternatives a daughter decides on in total.

A daughter and parents respectively have their own tastes about intergenerational co-residence and marriage of the daughter. A daughter is endowed with preferences per period over c^F (daughter's consumption), c^P(parents' consumption), q(co-residential

[11] We exclude situations such that married couples live alone at early stages of their marriage and return to their parents' home, as such co-residence behavior when parents are elderly should be studied from a slightly different angle such as care giving.

status), and γ(matching quality). The parents are endowed with preferences per period over c^P(parents' consumption), c^F (daughter's consumption), t^F(net transfers), x (marital status of daughter) and q (co-residential status). The utility of each economic agent depends on the consumption of the other agent. Hence, we allow two-sided altruism.[12] Matching quality is interpreted as a surplus from marriage, which we will explain later when we mention a Nash bargaining game between a husband and a wife. The utility per period also depends on the vector of shocks per period to preferences over marital and co-residential status, ϵ, and their type of unobserved cultural heterogeneity, which we explain later.

When staying single, the daughter has to pay rent r_s in the market if she lives alone and imputed rent $\rho_s \cdot r_s$ if she lives with parents, where $\rho_s > 0$. The single daughter's budget constraint is, thus, $c^F + r_s \cdot I\{q = 0\} + \rho_s \cdot r_s \cdot I\{q = 1\} \leq y^F + t^F_{sq}$. Here, $I\{X\}$ is the indicator function which takes 1 if X is true and 0 if X is false. y^F is the daughter's income. When marriage is cooperative, a young couple pools income and transfers, and pays rent r_m if they live alone and imputed rent $\rho_m \cdot r_m$ if they live with parents, where $\rho_m > 0$. The married daughter's budget constraint is, thus, $c^F + c^M + r_m \cdot I\{q = 0\} + \rho_m \cdot r_m \cdot I\{q = 1 \vee q = 2\} \leq y^F + y^M + t^F_{mq} + t^M_q$, where c^M, y^M, t^M_q are husband's consumption, income and net transfer from his parents. The husband's transfer only depends on the living arrangement. Parents' consumption in each state is their income minus net transfer, $c^P = y^P - t^F_{xq}$. While parents and their offspring care about each other's welfare, they respectively face different budget constraints.[13]

Note that the daughter has to pay imputed rent when she lives with parents. Hence, we do not assume economies of scale. Shared residence may bring about economies of scale. At the same time, costs of privacy and congestion arise. Parents give up amenity to a certain degree. These costs to the parents are the imputed rents they charge

[12]Becker (1974) analyzes social interactions. Our model incorporates social interactions as parents' concern about marriage and co-residence status of their daughter and altruism between parents and a daughter.

[13]Altonji, Hayashi and Kotlikoff (1992) empirically reject the hypothesis that all family members share a common budget constraint.

to their never-married daughter or to the young married couple. It is possible that parents provide a higher level of positive net transfers than the amount of imputed rent when they live together. In that case, the daughter receives the difference as financial transfer. The difference between market housing rent and imputed rent stems from the combined effect of housing market imperfection, economies of scale and costs such as privacy. If a housing market is perfect, parents could rent a room to someone else, and provide positive financial transfer to their children out of the obtained rent, for example. The economies of scale may work in the same way regardless of whom parents share with. The costs such as a lack of privacy can be different in the case of sharing a house with someone else than in the case of living with their children. The costs may also be higher when parents live with their married couple children than when they live with their never-married daughter. The utility parents obtain from living with their children may offset the costs associated with co-residence. It is incorporated as the preference of parents over residential status. If parents prefer to live with their daughter, overall net intergenerational transfer amount contingent on co-residence reflects the parents' utility.

Each economic agent does not observe random shocks to preferences of the other economic agent. Preference shocks consist of individual specific shocks and time varying shocks. Hence, we allow the correlation of the unobserved preference shocks for each family over time.

The timing and the information each player observes in each period is the following. At the beginning of the first stage, economic agents have their gross earnings. The parents have their gross earnings, y^P. The daughter has her gross earnings, y^F. The daughter meets a young male who wants to marry her in the marriage market with probability p^M. This probability is a matching function which depends on the characteristics of the young female. In other words, the matching function is interpreted to reflect decisions of the young male. The young male is characterized by gross earnings y^M and net transfers from his parents contingent on his co-residential status, t^M. Similarly, net transfers from the male's parents are interpreted as a family matching

function, which depends on family characteristics of the young female. It is considered to reflect the preferences of the male's parents about co-residential status and their altruism. Next, the random preference shocks of parents, ϵ^P, are realized. Observing these information, parents make an offer of contingent net transfers to a daughter in the first stage. Net transfers can be positive or negative. In other words, transfers can be from parents to a child or from a child to parents.[14] Here, net transfers parents decide include both financial transfers and in-kind transfers of living together. The parents' offer specifies this total net amount of transfers from parents to their child, yet they take into account that they charge imputed rent if they live together. One incentive that the parents provide transfers to their daughter is altruism. The other incentive is that they are endowed with their own preference for co-residence and try to influence the action their daughter plays. They also may provide negative net transfers because their budget is tight but their daughter's welfare is high enough, or because they do not like a specific option their daughter has and are trying to manipulate her decision.

At the beginning of the second stage, random shocks to a daughter's preference are realized. In the second stage, knowing parents' action and all the information above, the daughter makes a decision about marriage, co-residence and whether to accept parents' offer. The daughter has the option to reject her parents' offer contingent on not living with own parents. When the daughter rejects her parents' offer, net transfers are zero. The daughter makes a choice considering her own preference and caring about the welfare of both herself and her parents. She rejects an offer if it causes very low welfare for either of them. Note that the daughter is not passive as she can reject the offer. The option of rejection and altruism toward parents empower the daughter. These can be the threat to parents when they make an offer in the first stage.

The parents and the daughter make choices, while considering their future consumption. The daughter's consumption when married is based on Nash bargaining

[14]Existing empirical literature typically does not take into account the fact that transfers can happen in both directions, even if their models include transfers from parents to a child.

between a husband and a wife, in which they jointly decide each of their levels of consumption. The daughter's consumption when single is based on maximization of her own utility subject to her own budget constraint.

Each period is a finite extensive game with perfect information. Thus, we can solve by backward induction. The solution is characterized as a subgame perfect equilibrium. First, we solve a consumption choice problem of a single female. Second, we consider a Nash bargaining problem between a husband and a wife to obtain consumption when married. Third, we solve marital and co-residence decision by a young female. Fourth, we discuss contingent net transfer decisions by parents.

The utility of a young female can be rewritten as

$$\begin{aligned} &W(c^F, c^P, q, \gamma, \epsilon^F_{xq}) \\ &\quad = \max\{C^F(c^F, c^P, q, \gamma, \epsilon^F_{mq}), S^F(c^F, c^P, q, \epsilon^F_{sq})\}, \end{aligned} \tag{1}$$

where C^F (utility of a married female) and S^F (utility of a single female).

3.1 Single

The consumption choice of the daughter who chose to stay single is as follows. She chooses her consumption level to maximize her utility under her budget constraint. For $q = 0, 1$, her utility is

$$\begin{aligned} V^q_s \equiv &\max_{c^F} S^F(c^F, c^P, q, \epsilon^F_{sq}) \\ s.t. \quad &c^F + r_s \cdot I\{q = 0\} + \rho_s \cdot r_s \cdot I\{q = 1\} \leq y^F + t^F_{sq} \\ &c^P = y^P - t^F_{sq}, \end{aligned} \tag{2}$$

where $\rho_s \cdot r_s$ is imputed rent paid to co-residing parents.

3.2 Nash Bargaining

A married couple decides their consumption to maximize their Nash product under a pooled budget. There is additional positive utility of matching quality, γ, when

marriage is cooperative. When marriage is not cooperative, a husband and a wife do not pool their income and each pays half of the housing rent. Certain portions of income $(1 - z_q^F, 1 - z_q^M)$ are destroyed in this case. Threat points are their utility under non-cooperative marriage $(\overline{C_q^F}, \overline{U_q^M})$. Nash bargaining of a married couple in each co-residence state is written as follows.

For $q = 0, 1, 2$, the Nash bargaining problem is

$$\begin{aligned} &\max_{c^F, c^M} \left(C_q^F - \overline{C_q^F}\right)^{\pi} \left(U_q^M - \overline{U_q^M}\right)^{1-\pi} \\ &\quad s.t. \quad c^F + c^M + r_m \cdot I\{q = 0\} + \rho_m \cdot r_m \cdot I\{q = 1 \vee q = 2\} \\ &\qquad\qquad \leq y^F + y^M + t_{mq}^F + t_q^M \\ &\qquad\quad c^P = y^P - t_{mq}^F, \end{aligned} \tag{3}$$

where $0 < \pi < 1$ is the wife's bargaining power and $\rho_m \cdot r_m$ is imputed rent paid to co-residing parents. Here, $C_q^F \equiv C^F(c^F, c^P, q, \gamma, \epsilon_{mq}^F)$ is the utility of a married female given q and $U_q^M \equiv U^M(c^M, q, \gamma)$ is the utility of a young male given q. Also

$$\begin{aligned} &\overline{C_q^F} \equiv \max_{c^F} C^F(c^F, c^P, q, \gamma, \epsilon_{mq}^F) \\ &s.t. \quad c^F + \tfrac{r_m}{2} \cdot I\{q = 0\} + \tfrac{\rho_m \cdot r_m}{2} \cdot I\{q = 1 \vee q = 2\} \leq z_q^F(y^F + t_{mq}^F) \\ &\qquad c^P = y^P - t_{mq}^F \\ &\qquad \gamma = 0, \end{aligned}$$

and $0 < z_q^F < 1$ is a portion of a female's own income, which is not destroyed under non-cooperative marriage. Similarly,

$$\begin{aligned} &\overline{U_q^M} \equiv \max_{c^M} U^M(c^M, q, \gamma) \\ &s.t. \quad c^M + \tfrac{r_m}{2} \cdot I\{q = 0\} + \tfrac{\rho_m \cdot r_m}{2} \cdot I\{q = 1 \vee q = 2\} \leq z_q^M(y^M + t_q^M) \\ &\qquad \gamma = 0, \end{aligned}$$

and $0 < z_q^M < 1$ is a portion of a husband's own income, which is not destroyed under non-cooperative marriage.

3.3 Daughter's strategy

Let's define the utility of a daughter as a result of optimization in each state. When a never-married daughter accepts her parents' offer, the utility evaluated at optimal

consumption given co-residence status $q \in \{0,1\}$ and transfers t^F is denoted as $V_s^{qA} \equiv S^F(c^F, c^P, q, \epsilon_{sq}^F)$ with $c^F = c_{sq}^F$ and $c^P = y^P - t_{sq}^F$, where c_{sq}^F is the optimum to the problem (2). Similarly, let the utility of a married daughter evaluated at the Nash bargaining solution given $q \in \{0,1,2\}$ and t^F be $V_m^{qA} \equiv C^F(c^F, c^P, q, \gamma, \epsilon_{mq}^F)$ with $c^F = c_{mq}^F$ and $c^P = y^P - t_{mq}^F$, where c_{mq}^F is the solution to the problem (3).

When the daughter rejects her parents' offer, the utility of a single female at optimal consumption given $q = 0$ and $t^F = 0$ is defined as $V_s^{0R} \equiv S^F(c^F, c^P, q, \epsilon_{sq}^F)$ with $q = 0, t^F = 0, c^P = y^P$ and $c^F = c_{s0}^F$, where c_{s0}^F is the solution to (2) given $q = 0$ and $t^F = 0$. Similarly, the utility of a married female with rejection given $q \in \{0,2\}$ and $t^F = 0$ is $V_m^{qR} \equiv C^F(c^F, c^P, q, \gamma, \epsilon_{mq}^F)$ with $c^P = y^P$ and $c^F = c_{mq}^F$, where c_{mq}^F is the solution to (3) given $q \in \{0,2\}$ and $t^F = 0$.

Then, a daughter makes a decision to maximize her utility:

$$\max_{(o,x,q)}\{V_s^{0A}, V_s^{1A}, V_m^{0A}, V_m^{1A}, V_m^{2A}, V_s^{0R}, V_m^{0R}, V_m^{2R}\}. \tag{4}$$

Her strategy is $\Upsilon^F : \Omega^F \to D$ such that (4) is satisfied, where $\Omega^F = \{t^F, y^P, y^F, t^M, y^M, \gamma, \epsilon^F, a, ed, sib, type\}$ is an information set, and $D = \{(A,s,0),(A,s,1),(A,m,0),(A,m,1),(A,m,2),(R,s,0),(R,m,0),(R,m,2)\}$ is the choice set. a is the daughter's age, ed is her educational level, sib is the information about siblings, and $type$ is family type. Among possible combinations in D, she decides whether to accept or to reject $o \in \{A,R\}$, whether to stay single or to get married $x \in \{s,m\}$, and whether to live alone, live with own parents, or live with her husband's parents $q \in \{0,1,2\}$. The daughter can not choose the option which gives her less consumption than the minimum consumption level.[15]

3.4 Parents' strategy

The daughter's preference shocks are uncertain to the parents. The parents construct expected utility based on their beliefs about their daughter's choice. Then, they make

[15]In the estimation, we set income of lower 7% quantile of single women's income distribution as the minimum consumption per person.

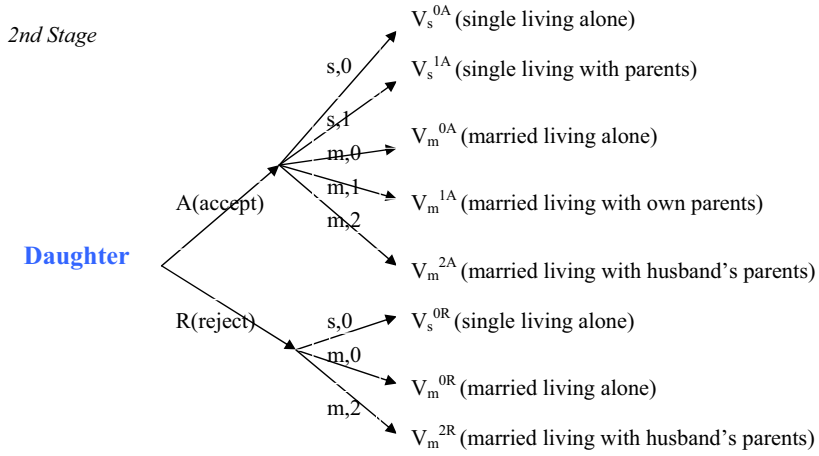

Figure 3: Daughter's strategy

decisions about transfers to maximize their expected utility:

$$\begin{aligned} &\max_{t^F} EU^P(c^P, c^F, x, q, t^F, \epsilon^P) \\ &s.t.\ c^P_{xq} = y^P - t^F_{xq} \ \text{ for all } x, q. \end{aligned} \tag{5}$$

Parents' strategy is $\Upsilon^P : \Omega^P \to T$ such that (5) is satisfied, where $\Omega^P = \{y^P, y^F, t^M, y^M, \epsilon^P, a, ed, sib, type\}$ and $T = [-y^F, y^P]$[5] with minimum consumption restrictions. Note that consumption is always assumed to be equal to or greater than the minimum consumption level. Parents can not offer contingent transfer such that consumption level of either a female or parents is less than the minimum consumption. When parents can not offer contingent transfer with which the minimum consumption restrictions are satisfied, the family has no option to choose it.

3.5 Cultural heterogeneity

We assume that there exists endowment heterogeneity. There are two types of family, modern family and traditional family. Economic agents know their own and others' family type. Econometricians can not observe it, while they know that that there are two types of family. If a young female belongs to a traditional family, her choice of

Choice set	#1	#2	#3	#4
Single live alone	o	o	o	o
Single live with parents	o	o	o	o
Married live alone	o	o	o	o
Married live with female's parents	o	x	o	x
Married live with husband's parents	o	o	x	x

Table 1: Choice set

co-residing with her own parents when she is married is restricted depending on her siblings. If she belongs to a modern family, she always has an option to live with her own parents.[16] Similarly, if a young male belongs to a traditional family, availability of co-residing with his parents is restricted depending on his siblings. If a male belongs to a modern family, the option to live with his parents is always available.

There are four possible combinations of a female's family type and her husband's family type, (modern, modern), (traditional,traditional), (modern,traditional), (traditional, modern). Let's name each family type combination A,B,C, and D, respectively.

Depending on family type combinations and siblings, there are four different sets of marital and co-residential choices. Table 1 displays possible choices in each set. Each row shows a marital and co-residential option. Each column represents a choice set. The mark of 'x' means that the choice is impossible and 'o' means possible.

With the choice set #1, all marital and co-residential choices are possible. The option to get married and to live with her own parents does not exist in the choice sets #2 and #4. The option of being married and living with her husband's parents is not allowed in the choice sets #3 and #4.

If a young female and a young male are both from modern family (family type combination A), the choice set is #1. Any choices are possible regardless of siblings. The choice sets of family type combinations of B, C, and D are described in Tables 2,

[16]The option to get married and to live with her own parents is available as long as she receives a marital offer and minimum consumption restrictions are satisfied in this case.

	Male is Eldest son	Male is Not eldest son
Female has a brother or she is Not eldest	#2	#4
Female has No brother and she is Eldest	#2	#3

Table 2: Choice set of family type combination B

	Male is Eldest son	Male is Not eldest son
Female has a brother or she is Not eldest	#1	#3
Female has No brother and she is Eldest	#1	#3

Table 3: Choice set of family type combination C

3, and 4.

	Male is Eldest son	Male is Not eldest son
Female has a brother or she is Not eldest	#2	#2
Female has No brother and she is Eldest	#1	#1

Table 4: Choice set of family type combination D

Roughly speaking, if a young female belongs to a traditional family, she can have an option to live with her own parents even after getting married only when she has no brother and when she is the eldest daughter. If her husband is from a traditional family, the option to live with his parents is available only when he is the eldest son.

4 Data

We use micro data on households in Japan, and other data which allow us to match the micro data to the aggregated regional variables. The main data set used for the analysis comes from the Japanese Panel Survey of Consumers conducted by the Institute for Research on Household Economics. The JPSC in the first survey had consisted of 1500 women in Japan, who were 24 to 34 years of age as of September 1993, and their family members. Beginning in 1997, the data for 500 women aged 24-27 as of year 1997, another cohort, were added. It is national random samples, hence, contains

samples of all 47 prefectures in Japan. The sample proportions assigned to each region by age and by marital status is set to equal to the proportions in the census of Japan. The interviews have been conducted annually to the present. In this paper, we follow each woman who was single in the initial interview either until she got married or until the most recent interview.

4.1 Variables

Marital status

At each interview, respondents are asked about their current marital status. The interview is composed of some different questions depending on whether the respondent is single or married, as well as of common questions. From the second survey, married respondents who got married during the past year are asked about additional questions.

Living arrangements

The residential status is constructed from the information about persons with whom a respondent lives. Living together means living either under the same roof or on the same lot of land. The classifications of relationship with a respondent includes parents of a respondent (female) and parents of a spouse (the respondent's husband). For instance, if there is at least one person who lives together with a respondent and whose relationship is her own parents, she is considered as co-residing with her own parents.

Region

We use the data on the name of a prefecture each respondent lives in and on whether it is one of the thirteen or fourteen largest cities in Japan.

Siblings

The data used are the number of sisters a respondent has, the number of brothers she has, and the birth ordering of herself among sisters regardless of marital status.

Regarding a married woman, the data on birth orderings of her husband among his brothers indicate whether he is the eldest son.

Education

Retrospective questions about respondents' education levels are asked at the initial interview, and they update the information by questioning educational experience during the past year in the later surveys. The variable of whether a respondent graduated a four-year university or a junior college is constructed from the data.

Income

(1) Incomes for young women and those for their husbands respectively are the data on the previous year's incomes from salary, business, assets and social security benefits. (2) Parents' total annual income is categorized into eight classifications. The intermediate value of each bin is used as parents' income. They did not collect this information in year 1995 and 1999, and collected these data only of the second cohort in 1997. We integrated using all available data per each observation for missing values. Parental income is available regardless of living arrangements.

Transfers

The data on net transfers of money are constructed from several kinds of questions associated with intergenerational transfers. They ask different questions to single women and to married women so that the questions suit their household structures. The questions include amounts of money women receive from their parents as allowance or remittance, whether women hand their earnings to their parents, amounts of money women hand to their parents out of their earnings, financial assistance from parents as expenditures for housing and marriage respectively, and amounts of money from adult children to their parents as basic living expenditures. To married women, they ask these questions related to women's own parents and their husbands' parents respectively. The detailed explanations are in the appendix. The data on financial transfers

are available for all years in samples of single women, but these data in samples of married women are only available since 1998.

Housing rents

Housing rents are the amounts of money a respondent's household pay per month if they live in private rented housing. We exclude the data on rents for public rented housing, a company house or dormitory including rented company houses, as they are usually heavily subsidized.

Other

We use land price in each prefecture reported by the Ministry of Land, Infrastructure and Transport. It is the average price of one m^2 size for residential areas in the prefecture. The average incomes of males in each prefecture are from the Basic Survey on Wage Structure reported by the Ministry of Health, Labour and Welfare.

4.2 Sample

The sample used for the analysis consists of 709 women who are never-married when they were initially interviewed. The first cohort is composed of 454 individuals aged from 24 to 34 in the first interview in 1993. The second cohort, which begins four years later, is composed of 255 women aged from 24 to 27 in their initial interview. Overall, there are 3,078 person-periods of women in the data used for this analysis.

45.3% of these respondents get married during the periods observed. 65.3% of respondents' husbands are eldest sons.

5 Estimation

Because we can only solve the model numerically, due to the richness of the model, we need to use a simulation based econometric method. There are three main difficulties. First, since the model includes five dimensional continuous choice variables determined

Age	Freq.	Percent	Cum.
24	104	22.91	22.91
25	88	19.38	42.29
26	57	12.56	54.85
27	45	9.91	64.76
28	43	9.47	74.23
29	34	7.49	81.72
30	29	6.39	88.11
31	19	4.19	92.29
32	20	4.41	96.70
33	8	1.76	98.46
34	7	1.54	100.00
Total	454	100.00	

Table 5: Age distribution of women in 1993

by parents, the set of choice variables is very huge. Because it is high dimensional, even a few points of grids generates a large choice set. As the observed data show that there exists both positive and negative net transfers, discretization to only a few points does not provide us with reasonable simulation outcomes. A larger number of grids makes the estimation infeasible. Moreover, we can not use a gradient based method, since the objective function of parents can not guarantee smoothness and strictly concavity. Hence, we use the simulated annealing method for the solution to parents' problem, which we explain later.

Second, even though the above method mitigates the computational burden, it still requires a lot of computation and the simulation replication number can not be very large. At the same time, we need a certain number of replications since the choice set in the model includes continuous variables.[17] Estimation procedures which only provide consistency with an infinite number of replications are infeasible.

[17]In the estimation, one hundred replications are used.

Age	Freq.	Percent	Cum.
24	83	16.37	16.37
25	79	15.58	31.95
26	57	11.24	43.20
27	36	7.10	50.30
28	42	8.28	58.58
29	38	7.50	66.07
30	34	6.71	72.78
31	27	5.33	78.11
32	25	4.93	83.04
33	23	4.54	87.57
34	20	3.94	91.52
35	13	2.56	94.08
36	15	2.96	97.04
37	5	0.99	98.03
38	10	1.97	100.00
Total	507	100.00	

Table 6: Age distribution of women in 1997

Third, there are a lot of unobserved or missing values. For example, males' characteristics such as income and siblings are observable to an econometrician only when the respondents actually get married. Transfer data of married respondents are not observed until 1997. An exact likelihood based method requires us to integrate all these values over their distribution in order to construct the corresponding criterion function. Due to these reasons, we use the indirect inference method.

In the estimation, we consider a rich auxiliary model and its parameters of φ. Using this auxiliary model, we obtain the pseudo- maximum likelihood estimator of φ_o based on the observed data ($\varphi_o = argmax_\varphi L(\omega, \xi; \varphi)$) and that of φ_s based on simulation values conditional on initial exogenous conditions ($\varphi_s = argmax_\varphi L(\omega, \xi^S(\theta); \varphi)$). The estimator of behavioral parameters in the original model is obtained by choosing the value which minimizes the distance between the estimates φ_o and φ_s with a metric. This procedure uses $dim\varphi$ information to identify the behavioral parameters whose dimension is not larger than $dim\varphi$. The estimator is reduced to

$$\hat{\theta} \equiv argmin_{\theta\in\Theta}\{\varphi_o - \varphi_s(\theta)\}^\top \Lambda \{\varphi_o - \varphi_s(\theta)\}, \tag{6}$$

where the parameter set Θ satisfies the restrictions from the behavioral model, Λ is a symmetric positive semi-definite matrix, which determines the metric. With moments as pseudo parameters, it is asymptotically equivalent to

$$\hat{\theta} \equiv argmin_{\theta\in\Theta}\{\sum_{i=1}^n [K(\omega_i, \xi_i) - \frac{1}{S}\sum_{j=1}^S k(\omega_i, \epsilon_i^j; \theta)]\}^\top \Lambda \{\sum_{i=1}^n [K(\omega_i, \xi_i) - \frac{1}{S}\sum_{j=1}^S k(\omega_i, \epsilon_i^j; \theta)]\}, \tag{7}$$

where ω_i is a vector of exogenous variables, ξ_i is a vector of endogenous variables, ϵ_i^j is a vector of random draws, n is the total number of observations, and S is the total number of replications. It is a root-n consistent estimator with a fixed number of replications.

This can be viewed as a simulated method of moments on identity instruments. To exploit as much information as possible from the observed data, we use conditional

moment conditions. However, we do not use predetermined-ness assumption. The estimation procedure consists of a two step estimation. In the first step of the estimation, we obtain a consistent estimator. We construct the optimal weighting matrix using the consistent estimator with a large replication number. In the second step estimation, we estimate efficiently using the optimal weighting matrix.

First, we would like to explain how to simulate the model. Second, we explain the optimal weighting matrix used to obtain the efficient estimator.

5.1 Simulation

Given parameters in the behavior model, we simulate and obtain its moments of each observation. As uncertainty exists in the economic model, random shocks are drawn in each simulation replication $j = 1, ..., S$. We use the same random draws of the jth replication for all observations $i = 1, ..., n$. For each observation i and in each simulation j, we numerically solve the model by backward induction.When solving the optimization problem of parents, we use the simulated annealing method combined with the simplex method. The main reasons are as follows. First, the objective function to the parents' optimization problem can be non-smooth (jump), because a daughter has the option to reject her parents' offer, and because parents optimize their expected utility based on their expectation about their daughter's choice. Second, the parents' objective function can be non-quasi-concave in the sense that we can not prove strict quasi concavity analytically. Hence, we exploit Brownian motions in order to globally solve the parents' optimization problem.[18]

[18]The settings used are as followed. One unit of step size for the simplex method is 1 % of parents' income. The tolerance parameter is 0.00001. For each observation i, the starting simplex with the first random draws $j = 1$ consists of diagonal elements of 5 % of parents' income corresponding to staying single, 2 % of parents' income corresponding to getting married and one diagonal element of zero and off-diagonal elements of zeros. When a transfer level above violates minimum consumption restrictions, it is replaced by an arbitrary level between lower and upper transfer bounds within which consumption levels of all economic agents are not less than the minimum restrictions. We use simulation results in the previous iteration $j - 1$ of an identical observation i when we construct a

	Data	Model
Live alone	80.37	83.30
Live with female's parents	6.54	5.52
Live with husband's parents	13.09	11.19

Table 7: Co-residential status at a year of marriage

5.2 Metric

In the first step estimation, we use a weight such that diagonal elements are the inverse of a consistent estimate of an asymptotic variance of the moment conditions with an infinite number of replications. We obtain a consistent estimator in order to construct the optimal weighting matrix for the efficient estimator.

6 Estimation Results

The figures 4, 5 and 6 and tables 7 and 8 depict the fit of the model to the data from the preliminary estimation.[19] The model captures overall patterns in the data. The proportion of getting married declines as they get older. The percentage staying single and living alone increases with age. At a year of marriage, around 80 % of young couples live alone, a larger portion lives with husbands' parents rather than wives' parents. About 20 % of women receive net transfers of money which are more than 5 % of their parents' incomes.

starting matrix with different random draws of $j > 1$. Starting simplex after the first random draws comprises diagonal elements of 0.7 times the difference between the previous result and the lower transfer bound and all other elements of zeros. (When a transfer level violates minimum consumption restrictions, it is replaced by an arbitrary level between transfer bounds.) Let T be the temperature for the Brownian motion, and $itmove$=100 be the maximal number of total moves at each temperature. We use three different temperature i=1,2,3. The maximal number of total moves is $Titer$=300. Here, $T = (1 - \frac{i*itmove}{Titer})^4$.

[19] All the statistics are conditional on staying single until a previous year, but we abbreviate them.

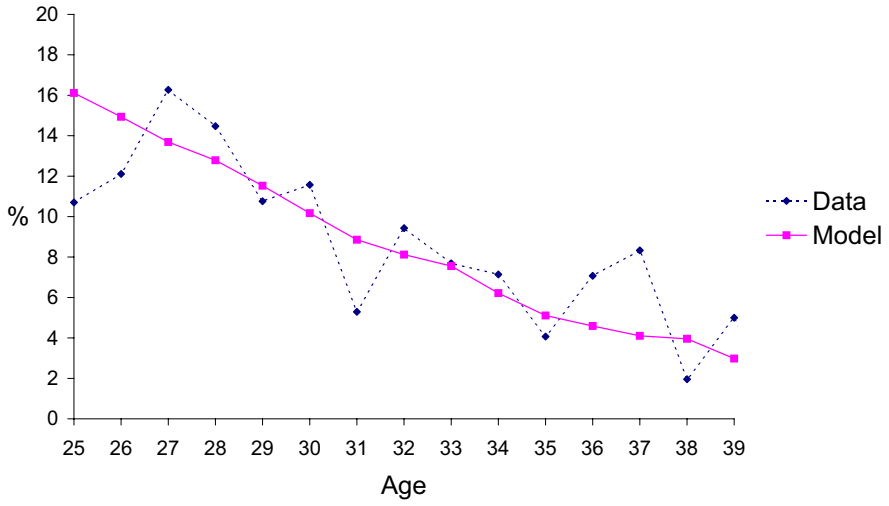

Figure 4: Percent getting married by age

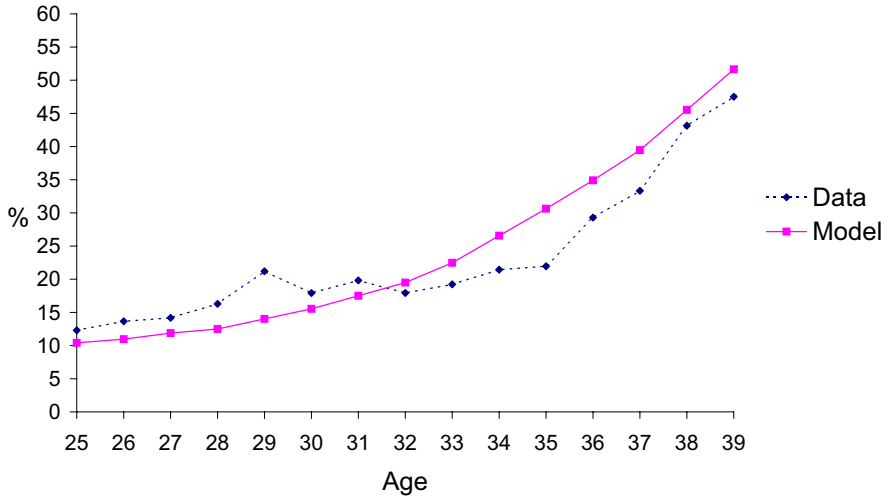

Figure 5: Percent staying single and living alone by age

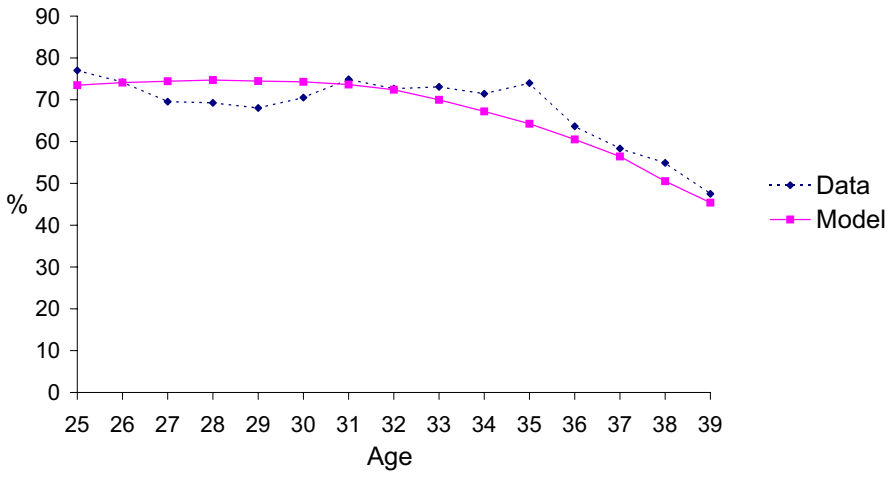

Figure 6: Percent staying single and residing with parents by age

	Data	Model
Less than - 5 % of parents' income	15.03	16.64
Between -5 % and 5%	65.92	66.87
More than 5 % of parents' income	19.05	16.49

Table 8: Net monetary transfers from parents

7 Counterfactual Experiments

Using the estimated model, we perform counterfactual experiments. At first, we explain the backgrounds. Intergenerational co-residence is an important issue in Japan. There are many arguments such that some young adults do not become to live on their own because they stay single and live with their parents. As the parents' generation is relatively wealthier, they support their children's livings and a large fraction of adult children do not become independent. In the first and second experiments, we assess how strategic behavior on the part of parents affects marriage and co-residence choices of daughters.

The delayed marriage is viewed as a serious problem in Japan. A number of government policies have been instituted to encourage earlier marriage and household formation. The average age of first marriage has been rising over the last few decades. Along with it, the average number of childbirth has fallen to 1.25 in year 2003. One of the policies executed is government-supported matching services. By conducting a lot of surveys, they consider that there is fewer matching opportunity for young people in recent years. In the past, parents and their community have encouraged the matching of youths. Such mechanisms have not functioned well in recent years. At the same time, the quality of current matching services provided by private companies is perceived to be low, and young adults hesitate to utilize those services. In order to enhance the matching probabilities, the government introduced the approval system to asses the quality of service each company provides and to support matching services industry.

7.1 Options to co-reside, but no strategic monetary transfers

We consider the hypothetical world such that there are no strategic monetary transfers between parents and children. When children reside with parents, costs associated with co-residence arise. Co-resident children have to pay imputed rent to parents, but no other monetary transfers exist. When daughters get married, there is no strategic

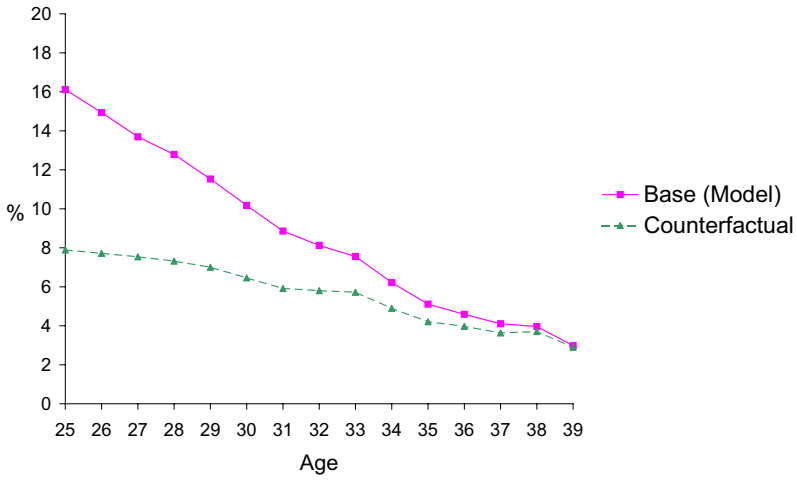

Figure 7: Percent getting married by age

monetary transfer from their husbands' parents, either. In addition, the government provides financial support to low-income households. If consumption (after paying rent without any financial support) is lower than the minimum necessary consumption level, economic agents can receive social benefits, which are the difference between the minimum level and the original consumption level. Married couples are qualified to receive social benefits only when their consumption with pooled income is lower than the minimum. In other words, the government does not provide social benefits when their marriage is not cooperative and one of their consumption levels is lower than the minimum.

In the base model, parents offer contingent transfers strategically. In this hypothetical world, the government supports households with low income. There is no strategic consideration for the government.

Figures 7, 8 and 9 depict the comparisons of outcomes in the counterfactual world with those in the baseline model. On average, the percentage of co-residence increases by 6.8 percentage points (from 72.6% to 79.3%). Co-residence conditional on singles increases by 4.2 percentage points (from 79.1% to 83.3%). Co-residence conditional on married increases by 3.6 percentage points (from 16.7% to 20.3%). In the baseline

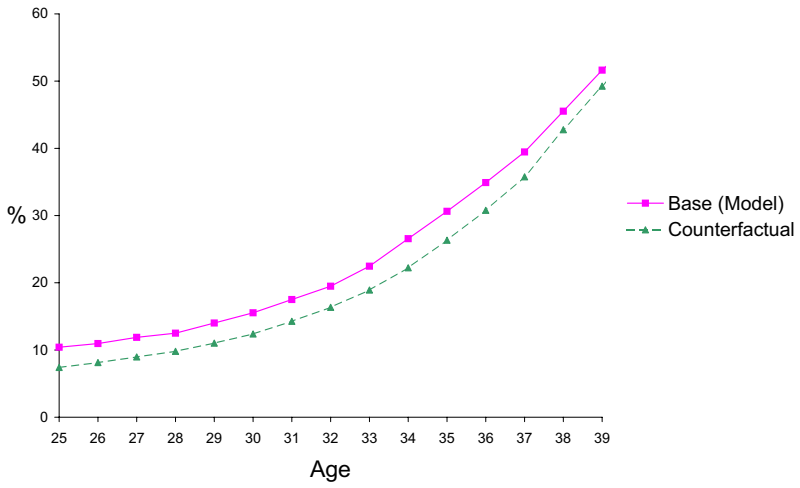

Figure 8: Percent staying single and living alone by age

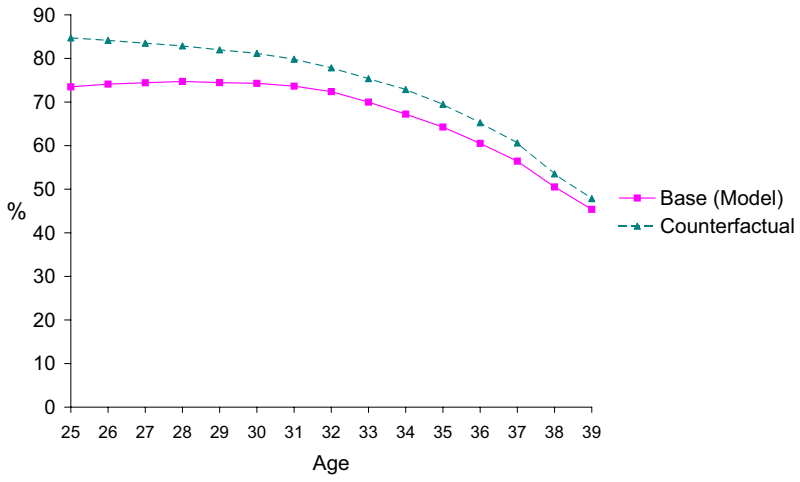

Figure 9: Percent staying single and living with parents by age

model, some parents provide offers such that net transfers contingent on co-residence are smaller or (largely) negative, and their daughters decide to live alone. There is net monetary gain from co-residence in terms of rent (market rent − imputed rent). Those parents' offers are such that parents and their children divide the surplus, hence the children have to pay more than imputed rent to parents if co-residing. Some of the children alter their choices and decide to live with parents in the hypothetical world.

Daughters are more like to stay single in the counterfactual world. On average, the percentage of getting married decreases by 4.1 percentage points (from 10.5% to 6.4%). Parents are endowed with strong preference for marriage of their daughters. In the base model, parents offer larger transfers contingent on getting married. In the absence of such strategic transfers, some daughters decide not to get married.

The welfare of both parents and daughters decreases. As in tables 17 and 18 in the appendices, the decreases in the welfare are larger in the groups of high housing rent, high income of daughters and high education. The percentage decreases in the welfare are larger when daughters are old and when parental income is low, too. The average welfare loss of daughters worths 2.7 million yen per year.

7.2 No options to co-reside and no monetary transfers

In this counterfactual experiment, we assume that no intergenerational (both in-kind and monetary) transfers exist. Daughters' choices are either to stay single and live alone or to get married and live alone. The same social welfare program as in the first experiment is instituted. Because there is no option to live with parents, every one has to pay market housing rent. As housing rent is a large portion in households' expenditures, social benefits can be viewed as rent subsidies.

The figure 10 shows behavioral alteration in the hypothetical world. The percentage of women getting married increases by 3.9 percentage points (from 10.5% to 14.4%). Especially, the impact is 6.2 percentage points (from 14.1% to 20.3%) in the young age group, and 5.6 percentage points (from 12.3% to 17.9%) in the group of low income of

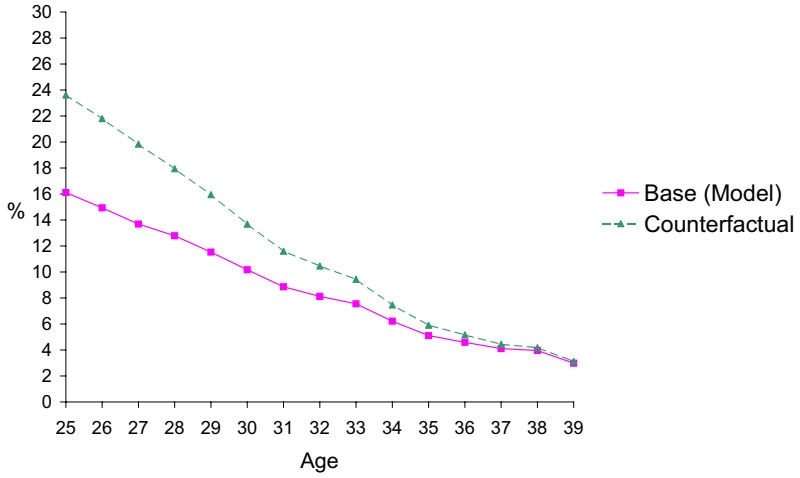

Figure 10: Percent getting married by age

daughters.

If parents do not involve at all, daughters tend to get married even though young people with low income can receive rent subsidies by staying single. There are two main reasons. First, daughters obtain more utility from getting married rather than staying single and living alone. Second, on average, males' income is higher than females' income. When women get married, they financially benefit from pooling a budget. In addition, due to the economies of scale, housing rent per person is less expensive for married couples than for singles. The combined financial benefits are larger than the social benefits they would receive from the government when staying single.

The welfare of both parents and daughters decreases. As in table 19 and 20, the decreases in the welfare of daughters are larger in the groups of high housing rent, high income of daughters and high education. The decreases in the welfare of parents are larger in the groups of old, high housing rent, high income of daughters and high education. The percentage decreases in their welfare are larger when daughters are old and when parental income is low. The average welfare loss of daughters worths 2.9 million yen per year. Compared with the results from the experiment of 'no monetary transfers, but options to co-reside,' the welfare loss is larger when options to co-reside

	Counterfactual	Base (Model)	Change
Single living alone	20.63	18.72	1.91
Single living with parents	68.35	70.80	-2.45
Married living alone	9.34	8.73	0.62
Married living with own parents	0.60	0.58	0.02
Married living with husband's parents	1.09	1.17	-0.09

Table 9: Marriage and co-residence status (%)

are also unavailable.

7.3 Housing rent subsidy

Next, we analyze the effect of housing rent subsidies to young people. Suppose that the government provides rent subsidies of a half of market housing rent to young people if they live alone. Table 9 shows the comparison of marriage and co-residence outcomes in the baseline model and those under the housing policy. Due to the governmental support for housing rent, the average marriage rate increases by only about a half percentage points.[20] The average decrease in the choice of 'single and living with parents' is around 2.5 percentage points. However, the impact is relatively larger in the group of high housing rent, that is, 4.3 percentage points. In the group of high housing rent and low parental income, the effect is 5.1 percentage points and its elasticity with respect to market housing rent is 0.14.

Table 10 shows the impact of rent subsidies on monetary transfers by marriage and co-residence status. Net monetary transfers from parents to daughters more than 5% of parental income increase conditional on living together, whereas they decrease conditional on living separately. The impact conditional on the choice of 'single living with parents' is larger in the groups of high housing rent, high income of daughters, and high income of parents, as in table 21 in the appendices.

[20]The elasticity of marriage rate with respect to market housing rent is about 0.1.

	Counterfactual	Base (Model)	Change	Elasticity
Single living alone	6.56	7.88	-1.32	0.34
Single living with parents	17.75	13.93	3.83	-0.55
Married living alone	41.31	46.20	-4.88	0.21
Married living with own parents	5.28	4.86	0.42	-0.17
Married living with husband's parents	29.81	30.87	-1.06	0.07

Table 10: Net monetary transfers from parents more than 5% of parental income (%)

Overall, parents and daughters respond to the rent subsidy policy more by changing monetary transfers rather than by altering co-residence and marriage choices. When market housing rent is less expensive, parents have less incentive to provide monetary transfers contingent on that daughters live alone. This results imply that altruism plays an important role in family decision-making.

7.4 Government intervention in the marriage market

We study the impact of government intervention in the marriage market. In the counterfactual world, due to the intervention, matching probability distributions shift upward by 5 percentage points. Figures 11 depicts the impacts on marriage outcomes. Overall, the percentage of women getting married increases by 2.3 percentage points (from 10.5% to 12.8%). The percentage of women co-residing decreases by 1.7 percentage points (from 72.6% to 70.8%). Co-residence conditional on singles decreases by 0.4 percentage points (from 79.1% to 78.7%). Co-residence conditional on married increases by 0.1 percentage points (from 16.7% to 16.8%). The fraction of young women receiving net monetary transfers from parents that are more than 5% of parents' income increases by 0.4 percentage points.

First, parents' transfers are more strategic rather than altruistic when daughters' consumption levels are guaranteed to reach certain levels due to the marriage opportunity and relatively high income of future husbands. Since parents want their

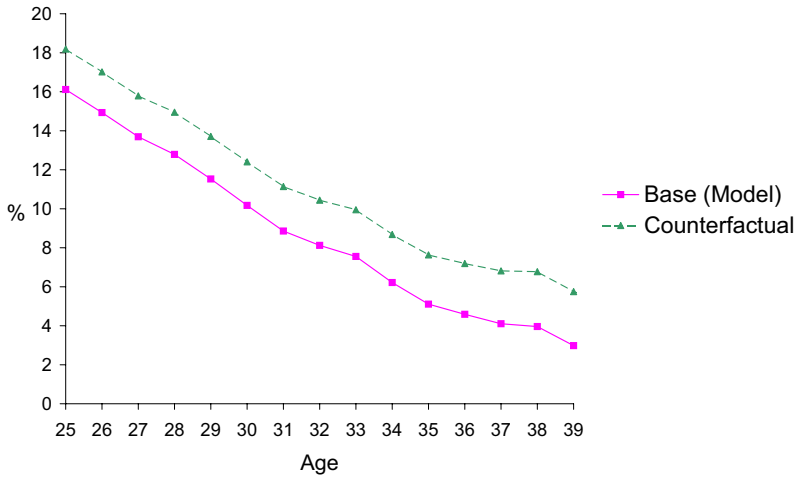

Figure 11: Percent getting married by age

daughters to get married and co-reside, they increase net transfers contingent on the choice. Therefore, co-residence conditional on married increases. Second, parents do not want their daughters to stay single, while daughters prefer to stay single and live with their parents. As parents behave more strategically due to the marriage opportunity, some parents become to charge (more) money to their daughters contingent on single living with them. Co-residence conditional on single decreases. Third, as parents are endowed with relatively strong preference for their daughters' marriage, they provide larger transfers contingent on getting married. Hence, transfers from parents to daughters increase.

7.5 Cultural Transition

According to the estimated model, the fraction of modern family is 41.9%. The fraction that both the daughter and her possible future husband are from traditional family is 53.2%. The fraction that the both are from modern family is 37.0%. The fraction that the one is from modern family and the other is from traditional family is 4.9%.

As a thought experiment, we compare the extreme cases. In other words, we

	Modern	Traditional	Difference
Single living alone	20.93	17.03	3.90
Single living with parents	74.54	67.76	6.78
Married living alone	2.96	13.46	-10.50
Married living with own parents	0.66	0.35	0.31
Married living with husband's parents	0.91	1.40	-0.49

Table 11: Marriage and co-residence status

consider *Case 1*: All families are traditional, and *Case 2*: All families are modern. Table 11 shows the difference in marriage and co-residence outcomes. The extreme transition from Case 1 to Case 2 causes the marriage rate declines by about 10.7 percentage points. The impacts of family type transition on net monetary transfers are in table 22 in the appendices.

8 Conclusion

In this paper, we develop and structurally estimate a behavioral model of family co-residence, marriage and intergenerational monetary transfers decisions using the Japanese Panel Survey of Consumers. The obstacles of the estimation and simulation have been overcome by utilizing the indirect inference method and the simulated annealing method.

We find that the model performs well to fit the data on co-residence, marriage and intergenerational transfers of money. The inclusion of unobserved heterogeneity in culture allows it to fit the co-residence patterns better.

Using the estimated model, we perform counterfactual policy experiments. First, we find that co-residence increases by 6.8 percentage points and marriage rate decreases by 4.1 percentage points if there are no strategic monetary transfers between parents and children. This is because some parents would charge their children more than

imputed rent contingent on co-residence so that parents and children will divide net monetary gain in terms of housing rent. Parents offer larger net transfers contingent on getting married. No strategic monetary transfers reduce the marriage rate. Second, we find that marriage increases by 3.9 percentage points if there is no parental involvement at all (no option to co-reside, no intergenerational monetary transfers). In the absence of intergenerational transfers, there is large welfare loss of both parents and daughters.

Third, we consider the impact of rent subsidy programs such that the government financially supports a half of market housing rent if young people live alone. The fraction of women staying single and co-residing with their parents decreases by only 2.5 percentage points on average. However, the impact is relatively large on families residing in the regions of relatively high housing rent and on families such that parents' income is low.

Fourth, we find that government intervention in the marriage market, which raises matching probabilities by 5 percentage points, increases marriage by 2.3 percentage points, decreases co-residence by 1.7 percentage points.

Lastly, we find the quantitative impact of cultural transition from traditional family to modern family. In the transition from the situation that all families are traditional to the situation that all families are modern, the marriage rate declines by about 10.7 percentage points.

Appendix

A Utility functions

- Utility of parents[21][22]

$$
\begin{aligned}
&U^P(c^P, c^F, t^F, x, q, \epsilon^P_{xq}, type) \\
&\equiv u^P(c^P, x, q, \epsilon^P_{xq}, type) + \mu^P c^F + [\alpha_{11}|t^F| + \alpha_{12}(t^F)^2] \cdot I\{t^F < 0\} \\
&= \log(c^P) + \mu^P \cdot c^F + \tilde{\alpha_7} \cdot I\{(x,q) = (s,1)\} + \tilde{\alpha_8} \cdot I\{(x,q) = (m,0)\} \\
&+\tilde{\alpha_9} \cdot I\{(x,q) = (m,1)\} + \tilde{\alpha_{10}} \cdot I\{(x,q) = (m,2)\} + \alpha^P \cdot I\{q \neq 0\} I\{type = trad\} \\
&+[\alpha_{11}|t^F| + \alpha_{12}(t^F)^2] \cdot I\{t^F < 0\}
\end{aligned} \tag{8}
$$

$\alpha_{11}, \alpha_{12} < 0,\ 0 < \mu^P$

- Utility of a daughter[23]

$$
\begin{aligned}
&W(c^F, c^P, q, \gamma, \epsilon^F_{xq}, type) \\
&\equiv \max\{S^F(c^F, c^P, q, \epsilon^F_{sq}, type), C^F(c^F, c^P, q, \gamma, \epsilon^F_{mq}, type)\}
\end{aligned} \tag{9}
$$

  - Utility of a single daughter

$$
\begin{aligned}
&S^F(c^F, c^P, q, \epsilon^F_{sq}, type) \\
&\equiv c^F + \mu^F \log(c^P) + \tilde{\alpha_1} \cdot I\{q = 1\} + \alpha^F \cdot I\{q \neq 0\} I\{type = trad\}
\end{aligned}
$$

[21] The utility function needs to be strictly concave with respect to consumption to ensure uniqueness and to avoid a situation where every solution is a corner solution.

[22] If parents are concerned about their daughter's whole utility rather than consumption only, we need to solve high dimensional numerical integration when constructing parents' expected utility. This requires huge computational burden and makes the estimation infeasible.

[23] A linear utility function of a daughter and that of her future husband provides a closed form solution to a Nash bargaining, which makes the estimation feasible.

– Utility of a married daughter

$$
\begin{aligned}
&C^F(c^F, c^P, q, \gamma, \epsilon^F_{mq}, type) \\
&\equiv c^F + \mu^F \log(c^P) + \tilde{\alpha_2} \cdot I\{q = 0\} + \tilde{\alpha_3} \cdot I\{q = 1\} \\
&+\tilde{\alpha_4} \cdot I\{q = 2\} + \alpha^F \cdot I\{q \neq 0\} I\{type = trad\} + \gamma
\end{aligned}
$$

$0 < \mu^F$

γ is positive when marriage is cooperative, and is zero when marriage is not cooperative.

- Utility of a young male adult

$$
\begin{aligned}
&U^M(c^M, q, \gamma) \\
&= c^M + \alpha_5 \cdot I\{q = 1\} + \alpha_6 \cdot I\{q = 2\} + \gamma
\end{aligned}
\tag{10}
$$

The preference parameters of ($\tilde{\alpha_1}$,$\tilde{\alpha_2}$,$\tilde{\alpha_3}$,$\tilde{\alpha_4}$, $\tilde{\alpha_7}$, $\tilde{\alpha_8}$,$\tilde{\alpha_9}$, $\tilde{\alpha_{10}}$) are random coefficients.

$$
\begin{aligned}
\tilde{\alpha_1} &\equiv \alpha_1 + \epsilon^F_{s1} \\
\tilde{\alpha_2} &\equiv \alpha_2 + \epsilon^F_{m0} \\
\tilde{\alpha_3} &\equiv \alpha_3 + \epsilon^F_{m1} \\
\tilde{\alpha_4} &\equiv \alpha_4 + \epsilon^F_{m2} \\
\tilde{\alpha_7} &\equiv \alpha_7 + \epsilon^P_{s1} \\
\tilde{\alpha_8} &\equiv \alpha_8 + \epsilon^P_{m0} \\
\tilde{\alpha_9} &\equiv \alpha_9 + \epsilon^P_{m1} \\
\tilde{\alpha_{10}} &\equiv \alpha_{10} + \epsilon^P_{m2}
\end{aligned}
$$

where $\alpha_1 \equiv \alpha_{13} + \alpha_{14} \cdot (a - 20)^2$, and a is a daughter's age. The utility of a daughter when staying single and residing with parents depends on the number of years that she is an adult.The preference shocks in each state (x, q), $\breve{\epsilon}^F_{xq}$, consist of two components; individual specific taste shocks of $\bar{\varepsilon}^F_{xq}$ and time-varying random shocks of $\acute{\varepsilon}^F_{xq}$. We assume that random shocks to a daughter's preference, $\acute{\varepsilon}^F_{xq}$'s, are drawn from i.i.d. type I extreme value distributions, and $\bar{\varepsilon}^F_{xq}$ are drawn from a multinomial normal

distribution. This enables us to obtain a mixed logistic form solution to parents' beliefs. To simplify notation, we subtract $\breve{\varepsilon}^F_{s0}$ from utility in each state and rewrite them as $(\epsilon^F_{s1}, \epsilon^F_{m0}, \epsilon^F_{m1}, \epsilon^F_{m2}) \equiv (\breve{\epsilon}^F_{s1} - \breve{\epsilon}^F_{s0}, \breve{\epsilon}^F_{m0} - \breve{\epsilon}^F_{s0}, \breve{\epsilon}^F_{m1} - \breve{\epsilon}^F_{s0}, \breve{\epsilon}^F_{m2} - \breve{\epsilon}^F_{s0})$. That is, $(\epsilon^F_{s1}, \epsilon^F_{m0}, \epsilon^F_{m1}, \epsilon^F_{m2})$ $= (\bar{\varepsilon}^F_{s1} - \bar{\varepsilon}^F_{s0}, \bar{\varepsilon}^F_{m0} - \bar{\varepsilon}^F_{s0}, \bar{\varepsilon}^F_{m1} - \bar{\varepsilon}^F_{s0}, \bar{\varepsilon}^F_{m2} - \bar{\varepsilon}^F_{s0}) + (\acute{\varepsilon}^F_{s1} - \acute{\varepsilon}^F_{s0}, \acute{\varepsilon}^F_{m0} - \acute{\varepsilon}^F_{s0}, \acute{\varepsilon}^F_{m1} - \acute{\varepsilon}^F_{s0}, \acute{\varepsilon}^F_{m2} - \acute{\varepsilon}^F_{s0})$.

Preference shocks to parents are drawn from a normal distribution of $\bar{\varepsilon}^P$. Similarly, ϵ^P is defined as $\epsilon^P \equiv (\epsilon^P_{s1}, \epsilon^P_{m0}, \epsilon^P_{m1}, \epsilon^P_{m2})' \equiv (\bar{\varepsilon}^P_{s1} - \bar{\varepsilon}^P_{s0}, \bar{\varepsilon}^P_{m0} - \bar{\varepsilon}^P_{s0}, \bar{\varepsilon}^P_{m1} - \bar{\varepsilon}^P_{s0}, \bar{\varepsilon}^P_{m2} - \bar{\varepsilon}^P_{s0})'$. $\varepsilon^P \sim N(0, \Sigma_P)$.

Hence, when we mention utility, it means transformed utility of fundamental utility minus a preference shock in state $x = s, q = 0$. In addition, we normalize the variance.

A.1 Solutions of Nash bargaining

$$
\begin{aligned}
c^F_{m0} &= z^F_0(y^F + t^F_{m0}) - \tfrac{r_m}{2} + \pi\{2\gamma + (1 - z^F_0)(y^F + t^F_{m0}) + (1 - z^M_0)(y^M + t^M_0)\} - \gamma \\
c^M_{m0} &= z^M_0(y^M + t^M_0) - \tfrac{r_m}{2} + (1 - \pi)\{2\gamma + (1 - z^F_0)(y^F + t^F_{m0}) + (1 - z^M_0)(y^M + t^M_0)\} - \gamma
\end{aligned}
$$

$$
\begin{aligned}
c^F_{m1} &= z^F_1(y^F + t^F_{m1}) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z^F_1)(y^F + t^F_{m1}) + (1 - z^M_1)(y^M + t^M_1)\} - \gamma \\
c^M_{m1} &= z^M_1(y^M + t^M_1) - \tfrac{\rho_m r_m}{2} + (1 - \pi)\{2\gamma + (1 - z^F_1)(y^F + t^F_{m1}) + (1 - z^M_1)(y^M + t^M_1)\} - \gamma
\end{aligned}
$$

$$
\begin{aligned}
c^F_{m2} &= z^F_2(y^F + t^F_{m2}) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z^F_2)(y^F + t^F_{m2}) + (1 - z^M_2)(y^M + t^M_2)\} - \gamma \\
c^M_{m2} &= z^M_2(y^M + t^M_2) - \tfrac{\rho_m r_m}{2} + (1 - \pi)\{2\gamma + (1 - z^F_2)(y^F + t^F_{m2}) + (1 - z^M_2)(y^M + t^M_2)\} - \gamma
\end{aligned}
$$

A.2 Solutions of a daughter's consumption

When an option is available, the followings are a daughter's consumption in each contingency state.

$$
\begin{aligned}
c^F_{s0} &= y^F + t^F_{s0} - r_s \\
c^F_{s1} &= y^F + t^F_{s1} - \rho_s r_s \\
c^F_{m0} &= z^F_0(y^F + t^F_{m0}) - \tfrac{r_m}{2} + \pi\{2\gamma + (1 - z^F_0)(y^F + t^F_{m0}) + (1 - z^M_0)(y^M + t^M_0)\} - \gamma \\
c^F_{m1} &= z^F_1(y^F + t^F_{m1}) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z^F_1)(y^F + t^F_{m1}) + (1 - z^M_1)(y^M + t^M_1)\} - \gamma \\
c^F_{m2} &= z^F_2(y^F + t^F_{m2}) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z^F_2)(y^F + t^F_{m2}) + (1 - z^M_2)(y^M + t^M_2)\} - \gamma
\end{aligned}
$$

A.3 Bounds of transfers

Assume that parents make an offer of contingent transfers which satisfies the minimum consumption restrictions. In other words, if there is no contingent transfer level which satisfies the restrictions, it is assume that the family does not have the option to choose such a marital and co-residential status. Similarly, we assume that a daughter has no option to reject if her consumption is less than the minimum by rejecting the offer.

- Minimum consumption of a daughter: $\underline{c}$
- Minimum consumption of parents: $2\underline{c}$

Lower bounds of net transfers:

$$
\begin{aligned}
LB_{s0} &= \underline{c} - y^F + r_s \\
LB_{s1} &= \underline{c} - y^F + \rho_s r_s \\
LB_{m0} &= \frac{\underline{c} + r_m/2 + \gamma - \pi\{2\gamma + (1 - z_0^M)(y^M + t_0^M)\}}{z_0^F + \pi(1 - z_0^F)} - y^F \\
LB_{m1} &= \frac{\underline{c} + \rho_m r_m/2 + \gamma - \pi\{2\gamma + (1 - z_1^M)(y^M + t_1^M)\}}{z_1^F + \pi(1 - z_1^F)} - y^F \\
LB_{m2} &= \frac{\underline{c} + \rho_m r_m/2 + \gamma - \pi\{2\gamma + (1 - z_2^M)(y^M + t_2^M)\}}{z_2^F + \pi(1 - z_2^F)} - y^F
\end{aligned}
$$

Upper bound of net transfers:

$$UB = y^P - 2\underline{c}$$

A.4 Contingent utility of a daughter

When each option including rejection is available (that is, satisfying the minimum consumption restrictions), the followings are a daughter's utility contingent on each marital and co-residential status, given parameters, exogenous variables and contingent transfers from parents. (There are options to reject offers contingent on single living

alone (s0), on married living alone (m0), and on married living with her husband's parents (m2).)

$$W_{s0} = \max\{W_{s0}^A, W_{s0}^R\}$$

$$W_{s0}^A = y^F + t_{s0}^F - r_s + \mu^F \log(y^P - t_{s0}^F)$$
$$W_{s0}^R = y^F - r_s + \mu^F \log(y^P)$$

$$W_{s1} = y^F + t_{s1}^F - \rho_s r_s + \alpha_1 + \alpha^F \cdot I\{type = trad\} + \mu^F \log(y^P - t_{s1}^F) + \epsilon_{s1}^F$$

$$W_{m0} = \max\{W_{m0}^A, W_{m0}^R\}$$

$$W_{m0}^A = z_0^F(y^F + t_{m0}^F) - \tfrac{r_m}{2} + \pi\{2\gamma + (1 - z_0^F)(y^F + t_{m0}^F) + (1 - z_0^M)(y^M + t_0^M)\}$$
$$+\alpha_2 + \mu^F \log(y^P - t_{m0}^F) + \epsilon_{m0}^F,$$

$$W_{m0}^R = z_0^F y^F - \tfrac{r_m}{2} + \pi\{2\gamma + (1 - z_0^F)y^F + (1 - z_0^M)(y^M + t_0^M)\} + \alpha_2 + \mu^F \log(y^P) + \epsilon_{m0}^F$$

$$W_{m1} = z_1^F(y^F + t_{m1}^F) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z_1^F)(y^F + t_{m1}^F) + (1 - z_1^M)(y^M + t_1^M)\}$$
$$+\alpha_3 + \alpha^F \cdot I\{type = trad\} + \mu^F \log(y^P - t_{m1}^F) + \epsilon_{m1}^F$$

$$W_{m2} = \max\{W_{m2}^A, W_{m2}^R\}$$

$$W_{m2}^A = z_2^F(y^F + t_{m2}^F) - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z_2^F)(y^F + t_{m2}^F) + (1 - z_2^M)(y^M + t_2^M)\}$$
$$+\alpha_4 + \alpha^F \cdot I\{type = trad\} + \mu^F \log(y^P - t_{m2}^F) + \epsilon_{m2}^F,$$

$$W_{m2}^R = z_2^F y^F - \tfrac{\rho_m r_m}{2} + \pi\{2\gamma + (1 - z_2^F)y^F + (1 - z_2^M)(y^M + t_2^M)\} + \alpha_4$$
$$+\alpha^F \cdot I\{type = trad\} + \mu^F \log(y^P) + \epsilon_{m2}^F$$

A.5 Parents' beliefs

$$P_{xq} = \int \frac{\exp(\widetilde{W}_{xq})}{\sum \exp(\widetilde{W}_{xq})} df_{\bar{\epsilon}^F},$$

where $\widetilde{W}_{s0} = W_{s0}$,
and $\widetilde{W}_{xq} = W_{xq} - \acute{\epsilon}^F_{xq}$ for $(x,q) = (s,1),(m,0),(m,1),(m,2)$

A.6 Male's characteristics

Income of a young male and transfers from his parents depend on a female's characteristics, whose parameters are estimated. Because characteristics of young males are available only when they are married, we estimate parameters to cope with sample selection problems.

A.6.1 Male's income

$$y^M = \beta_{M1} + \beta_{M2} \cdot \bar{y}^M + \beta_{M3} \cdot a + \beta_{M4} \cdot ed + \epsilon_{yM}$$

$\bar{y}^M$: average income of males in the region
ed: =I{A daughter went to a junior college or a university}
$\epsilon_{yM} = \sigma_{yM} \cdot N(0,1)$

A.6.2 Net transfers from male's parents

For $q = 0,1,2$,
$t^M_q = \beta_{M5} + \beta_{M6} \cdot I\{4.5 <= y^P\} + (\beta_{M7} + \epsilon_{tM0}) \cdot I\{q = 0\} + (\beta_{M8} + \epsilon_{tM2}) \cdot I\{q = 2\} + \epsilon_{tM1}$
where $\epsilon_{tM,k} = \sigma_{tM,k} \cdot N(0,1), k = 0,1,2.$

A.7 Marriage offer probability

$p^M = \frac{\exp(X)}{1+\exp(X)}$
where
$X = p_0^M + p_1^M \cdot a + p_2^M \cdot a^2 + p_3^M \cdot r_s + p_4^M \cdot r_s^2 + p_5^M \cdot I\{y^F <= 2.0\} + p_6^M \cdot I\{3.3 < y^F\}$
$+p_7^M \cdot I\{y^P <= 3.7\} + p_8^M \cdot I\{6.5 < y^P\} + p_9^M \cdot ed$

A.8 Imputed rents

Imputed rents for singles= $\rho_s \times r_s$,

Imputed rents for married= $\rho_m \times r_m$,

where $\rho_s > 0$ and $\rho_m > 0$.[24]

$$\ln \rho = \beta_{r1} \cdot I\{x = s\} + \beta_{r2} \cdot I\{x = m\} + \beta_{r3} \cdot I\{4.5 <= y^P\} + \beta_{r4} \cdot n_{sib}$$

where n_{sib} is the number of siblings.

A.9 Family types

$v^F \equiv I\{\text{The female is from a modern family.}\}$

$v^M \equiv I\{\text{The male is from a modern family.}\}$

The fraction of each family type combination is defined as[25]

$$P(v^F, v^M) = \frac{\exp(\alpha_{21}(v^F + v^M) + \alpha_{22} v^F v^M)}{1 + 2\exp(\alpha_{21}) + \exp(2\alpha_{21} + \alpha_{22})}.$$

[24]The coefficients of imputed rents ρ_s and ρ_m are not restricted to be less than one. We allow the situation such that young people live in a more luxurious house when co-residing than when living alone.

[25]$\alpha_{21} + \alpha_{22} \geq 0$: A person from a modern family is more likely to meet a person from a modern family. $\alpha_{21} \leq 0$: A person from a traditional family is more likely to meet a person from a traditional family. We do not impose these assumptions in the estimation. The estimation results show these relationships hold.

B Appendix

B.1 Data on net transfers of money

We explain the data on net financial transfers from parents to their young adult children by marital and co-residential status.

B.1.1 Net financial transfers from non-co-residing parents to married couples

Net transfers of money from a respondent's parent(s) and from her husband's parent(s) are, for $g = F, M$,

$$Transfer^g = 12 \cdot (Qm2^g - Qm1^g) + 10 \cdot (Qm4^g + Qm5^g).$$

- $Qm1^F \equiv$ amount of money married couples gave to female's parents, in thousands of yen per month (in September) as answered in the questions about expenditures of the female's household. Because the survey question did not specify which parents receive monetary transfers in year 2001, those in that year are constructed as half of the amount of money married couple gave to parents.

- $Qm2^F \equiv$ amount of money the female's parents pay for costs such as housing loan repayment, rent(s), living expenses.

- $Qm4^F \equiv$ financial assistance from female's parents for marriage expenses (including moving expenses when they rend a new house/apartment), in ten thousands of yen. Loans from parents are not included as financial assistance.

- $Qm5^F \equiv$ financial assistance from female's parents for purchasing a house/ a house and a lot, in ten thousands of yen. The reasons for these financial support include a newly built house or a house/lot purchased under the joint ownership with parents. Loans from parents are not included as financial assistance. The questions in 1999 are asked in the survey to all married women. Those in 1998,

2000 and 2001 are asked in the survey only to married women who got married during the past one year.

Similarly, the variables of $Qm1^M, Qm2^M, Qm3^M, Qm4^M, Qm5^M$ are the same questions related to husbands'parents instead.

B.1.2 Net financial transfers from co-residing parents to married couples

We exploit the information about how they share the livelihood when married young couples co-reside with their parents. Net transfers of money from co-residing parents are obtained as, for $g = F, M$,

$$Transfer^g = 12 \cdot (Qm2^g - Qm1^g) + 10 \cdot (Qm4^g + Qm5^g)$$
$$-12 \cdot Qm6 \cdot I\{\text{Married couple and co-residing parents share same livelihood}\}.$$

$Qm6 \equiv$ Basic living costs for parents, in thousands of yen per month, are obtained as followed. We first regress the data of (a) basic living costs per person on (b) land price in the prefecture, (c) city dummy, (d) total floor area per person, and obtain basic living costs per person. Those costs for parents are calculated as the cost multiplied by two.

(a) The data of basic living costs per person are the amounts of expenditures for foods, utilities, furniture, housekeeping equipments in a respondent's household divided by the number of household members. We exclude samples with zero basic living costs.

(c) The city dummy variable is the indicator of whether a respondent lives in one of the 13 largest cities or not. The survey questions in 2001 classify the 14 largest cities instead.

(d) We use the data on total floor area (in hundreds of m^2) of housing a respondent lives in order to obtain total floor area per person. We divide it by the number of household members when a respondent is single living with parents, by two if she is married living alone or married living with parents in the same lot but at different house, by four if she is married living with parents in the same house. The survey questions from 1995 to 2001 ask directly about total floor area in which a respondent's

family lives. The data in 1993 and 1994 are categorized into seven bins. We use the median value in each bin.

B.1.3 Net financial transfers from parents to a single respondent living alone

$$Transfer^F = 10 \cdot Qs2 - 12 \cdot Qs1$$

- $Qs1 \equiv$ amount of money a respondent handed to her parents out of her earnings(take-home pay, that is, total pay after taxes and social insurance), in thousands of yen per month (in September).

  1. Qs1= $-$ her earnings,
     if female handed all of her earnings to parents and received no money from parents for her own living expenses or allowances
  2. Qs1= amount of money from parents $-$ her earnings,
     if female handed all of her earnings to parents and received money from parents for her own living expenses or allowances
  3. Qs1= $-$ amount of money female handed to parents,
     if female handed a part of her earnings to parents
  4. Qs1= 0,
     if female has no earnings

- Qs2$\equiv$ amount of money female's parents gave to her as remittance or allowance/handed money, in ten thousands of yen per year
  =(remittance in the past one year) + (handed money in the past one year)

B.1.4 Net financial transfers from parents to a single respondent living with parents

$$Transfer^F = 10 \cdot Qs2 - 12 \cdot Qs1 + Qs4$$

The variable of $Qs4$ is basic living costs per person we explain above.

B.2 Housing rent

We exploit the information about observed housing rents from the micro data and regional variation in order to construct the data on housing rents. Conditional on a respondent's marital status, we regress rents for private housing on the average land price in the prefecture and on the city dummy variable. Then we construct the data on housing rents to each observation using the estimated coefficients and the corresponding regional variables. Hence, we assume that people living in the same region face the same housing market rents of r_s and r_m.

C Appendix

In the estimation, we assume that π=0.5.

	Parameter	Estimate
Preference of the daughter		
	α_{13}	2.42832
	α_2	-0.15341
	α_3	-2.38144
	α_4	-2.49500
	α^F	0.43804
	α_{14}	-0.00916
Preference of the parents		
	α_7	0.38136
	α_8	0.35875
	α_9	0.89906
	α_{10}	0.28540
	α^P	-0.18161
	α_{11}	-0.37142
	α_{12}	-0.00404
	μ^P	0.103259×10^{-2}
	μ^F	0.001559
	$\log \gamma$	-0.373415
		$(\gamma = 0.688379)$

Table 12: Parameter Estimates

Parameter	Estimate
z_0^F	0.60555
z_0^M	0.82132
z_1^F	0.61121
z_1^M	0.74586
z_2^F	0.62205
z_2^M	0.86163
α_{21}	-2.38339
α_{22}	4.40365
β_{M1}	0.30654
β_{M2}	0.02664
β_{M3}	0.01132
β_{M4}	0.64402
β_{M5}	0.07325
β_{M6}	0.78797
β_{M7}	0.23667
β_{M8}	1.86510
β_{r1}	-1.73367
β_{r2}	-0.27963
β_{r3}	0.13532
β_{r4}	0.00673

Table 13: Parameter Estimates (continued)

	Parameter	Estimate
Cholesky matrix of $\Omega_{\bar{\epsilon}^F_{xq}} = \begin{pmatrix} 1 & & & \\ a & 1 & & \\ b & d & 1 & \\ c & e & f & 1 \end{pmatrix}$		
	a	-0.09672
	b	-0.09797
	c	0.14378
	d	0.25183
	e	0.29483
	f	0.15805
Standard deviations of ϵ^P, y^M, and t^M		
	σ^P_{m0}	0.27443
	σ^P_{m1}	0.54751
	σ^P_{m2}	0.04181
	σ_{yM}	0.45189
	σ_{tM}	1.28016
	p^M_0	0.88142
	p^M_1	0.01631
	p^M_2	-0.00296
	p^M_3	0.00720
	p^M_4	-0.29469
	p^M_5	0.80649
	p^M_6	-0.03037
	p^M_7	-0.27884
	p^M_8	0.20215
	p^M_9	-0.21879
	$\underline{c}$	0.05053

Table 14: Parameter Estimates (continued)

D Appendix

D.1 Estimation results

	Data	Model
Less than - 5 % of parents' income	17.19	18.35
Between -5 % and 5%	67.21	68.42
More than 5 % of parents' income	15.60	13.23

Table 15: Net monetary transfers from parents: Single

	Data	Model
Less than - 5 % of parents' income	2.60	1.43
Between -5 % and 5%	53.25	58.07
More than 5 % of parents' income	44.16	40.49

Table 16: Net monetary transfers from parents: Married

D.2 Counterfactual experiments

Counterfacutual	Base (Model)	Value Change	Percent Change
Total			
0.49916	3.23516	-2.736	-84.6
Young/Old			
0.79897	3.60482	-2.80585	-77.8
0.28659	2.97307	-2.68648	-90.4
Low/High Rent S			
0.51232	3.03763	-2.52531	-83.1
0.48394	3.46371	-2.97977	-86.0
Low/High yf			
0.46938	2.4663	-1.99692	-81.0
0.53557	4.17502	-3.63945	-87.2
Low/High yp			
0.37552	2.67618	-2.30066	-86.0
0.61205	3.74552	-3.13347	-83.7
Low/High education			
0.48799	2.86049	-2.3725	-82.9
0.51369	3.72241	-3.20872	-86.2
No brother, eldest /At least one Brother or not eldest			
0.44955	3.24743	-2.79788	-86.2
0.51506	3.23124	-2.71618	-84.1

Table 17: Daughter's Welfare: Options to co-reside, but no strategic monetary transfers

Counterfacutual	Base (Model)	Value Change	Percent Change
Total			
0.38913	2.15934	-1.77021	-82.0
Young/Old			
0.57666	2.35999	-1.78333	-75.6
0.26836	2.0206	-1.75224	-86.7
Low/High Rent S			
0.40646	2.06406	-1.6576	-80.3
0.38447	2.27403	-1.88956	-83.1
Low/High yf			
0.45554	2.04793	-1.59239	-77.8
0.32381	2.30012	-1.97631	-85.9
Low/High yp			
0.19295	1.49535	-1.3024	-87.1
0.58189	2.76951	-2.18762	-79.0
Low/High education			
0.37978	1.964	-1.58422	-80.7
0.4177	2.41812	-2.00042	-82.7
No brother, eldest /At least one Brother or not eldest			
0.38224	2.20984	-1.8276	-82.7
0.40076	2.14589	-1.74513	-81.3

Table 18: Parents' Welfare: Options to co-reside, but no strategic monetary transfers

Counterfacutual	Base (Model)	Value Change	Percent Change
Total			
0.35739	3.23516	-2.87777	-89.0
Young/Old			
0.49161	3.60482	-3.11321	-86.4
0.26222	2.97307	-2.71085	-91.2
Low/High Rent S			
0.395	3.03763	-2.64263	-87.0
0.31387	3.46371	-3.14984	-90.9
Low/High yf			
0.32834	2.4663	-2.13796	-86.7
0.3929	4.17502	-3.78212	-90.6
Low/High yp			
0.28465	2.67618	-2.39153	-89.4
0.4238	3.74552	-3.32172	-88.7
Low/High education			
0.33851	2.86049	-2.52198	-88.2
0.38194	3.72241	-3.34047	-89.7
No brother, eldest /At least one Brother or not eldest			
0.34107	3.24743	-2.90636	-89.5
0.36262	3.23124	-2.86862	-88.8

Table 19: Daughter's Welfare: No options to co-reside, no strategic monetary transfers

Counterfacutual	Base (Model)	Value Change	Percent Change
Total			
0.43189	2.15934	-1.72745	-80.0
Young/Old			
0.6356	2.35999	-1.72439	-73.1
0.28745	2.0206	-1.73315	-85.8
Low/High Rent S			
0.44289	2.06406	-1.62117	-78.5
0.41916	2.27403	-1.85487	-81.6
Low/High yf			
0.49794	2.04793	-1.54999	-75.7
0.35116	2.30012	-1.94896	-84.7
Low/High yp			
0.21382	1.49535	-1.28153	-85.7
0.63099	2.76951	-2.13852	-77.2
Low/High education			
0.41566	1.964	-1.54834	-78.8
0.453	2.41812	-1.96512	-81.3
No brother, eldest /At least one Brother or not eldest			
0.41317	2.20984	-1.79667	-81.3
0.43789	2.14589	-1.708	-79.6

Table 20: Parents' Welfare: No options to co-reside, no strategic monetary transfers

Counterfactual	Base (Model)	Change	Elasticity
Young			
11.21	8.15	3.07	-0.75
Old			
23.01	18.52	4.50	-0.49
Low Rent			
18.93	17.11	1.81	-0.21
High Rent			
16.41	10.44	5.97	-1.14
Low yf			
17.51	14.89	2.62	-0.35
High yf			
18.05	12.79	5.26	-0.82
Low yp			
7.43	6.68	0.75	-0.22
High yp			
26.45	20.08	6.38	-0.64

Table 21: Impact of rent subsidy programs on percent net monetary transfers from parents more than 5% of parental income: Single living with parents

	Modern	Traditional	Difference
Single living alone	6.30	9.02	-2.72
Single living with parents	19.73	7.61	12.12
Married living alone	13.09	52.78	-39.69
Married living with own parents	3.56	0.00	3.56
Married living with husband's parents	1.82	48.55	-46.73

Table 22: Net monetary transfers from parents more than 5% of parental income (%)

References

[1] Altonji, Joseph G.; Hayashi, Fumio; and Kotlikoff, Laurence J. (1992). "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data," *American Economic Review,* vol.82, no.5, 1177–98.

[2] Becker, Gary S. (1974). "A Theory of Social Interactions," *Journal of Political Economy,* 82, 1063–93.

[3] Borsch-Supan, Axel (1986). "Household Fromation, Housing Prices, and Public Policy Impacts," *Journal of Public Economics,* 30, 145-164.

[4] Cox, Donald (1987). "Motives for Private Income Transfers," *Journal of Political Economy,* 95(3), 508–46.

[5] Cox, Donald (1990). "Intergenerational Transfers and Liquidity Constraints," *Quarterly Journal of Economics,* 187–217.

[6] Cox, Donald and Rank Mark R. (1992). "Inter-Vivos Transfers and Intergenerational Exchange," *Review of Economics and Statistics,* 74(2), 305–314.

[7] Ermisch, John (1999). "Prices, Parents and Young People's Household Formation," *Journal of Urban Economics,* 45, 47–74.

[8] Gallant, R. and G. Tauchen (1996). "Which Moments to Match?," *Econometric Theory,* 12, 657–681.

[9] Gourieroux, C., A. Monfort, and E. Renault (1993). "Indirect Inference," *Journal of Applied Econometrics,* 8, 85–118.

[10] Haurin, Donald R.; Hendershott, Patric H.; and Kim, Dongwook (1993). "'The Impact of Real Rents and Wages on Household Formation," *Review of Economics and Statistics,* 75(2), 284–293.

[11] Hayashi, Fumio (1995). "Is the Japanese Extended Family Altuistically Linked? A Test Based on Engel Curves," *Journal of Political Economy,* 103, 661–74.

[12] Heckman, J. and B. Singer (1984). "A Method for Minimising the Impact of Distributional Assumptions in Econometric Models for Duration Data," *Econometrica,* vol.52, 271–320.

[13] Hu, Wei-Yin (2001). "Welfare and Family Stability: Do Benefits Affect when Children Leave the Nest?," *Journal of Human Resources,* vol. 36, no. 2, 274–303.

[14] Horioka, Charles Yuji (1988). "Saving for Housing Purchase in Japan," *Journal of the Japanese and International Economies,* vol. 2, no. 3, 351–84.

[15] Horioka, Charles Yuji (1988). "Tenure Choice and Housing Demand in Japan," *Journal of Urban Economics,* vol. 24, no. 3, 289–309.

[16] Kochar, Anjini (2000). "Parental Benefits from Intergenerational Coresidence: Empirical Evidence from Rural Pakistan," *Journal of Political Economy,* vol. 108, no. 6, 1184–1209.

[17] Kotlikoff, Laurence J., Razin, Assaf and Rosenthal, Robert W. (1990) "A Strategic Altruism Model in which Recardian Equivalence Does Not Hold," *The Economic Journal,* 100, 1261–1268

[18] McElroy, Marjorie B. (1985). "The Joint Determination of Household Membership and Market Work: The Case of Young Men," *Journal of Labor Economics,* 3, no. 3, 293–316.

[19] McFaddem, Daniel (1989). "A Method of Simulated Moments for Estimation of Discrete Response Models without Numerical Integration," *Econometrica,* vol.57, no. 5, September 1989, 995–1026.

[20] Manacorda, Marco, and Moretti, Enrico (2005). "Why Do Most Italian Young Men Live With Their Parents? Intergenerational Transfers and Household Structure," CEPR Discussion Paper, no. 5116.

[21] Pakes, Ariel and Pollard, David (1989). "Simulation and the Asymptotics of Optimization Estimators," *Econometrica,* vol. 57, no. 5, September 1989, 1027–1057.

[22] Pezzin, Liliana and Schone, Barbara Steinberg (1999). "Intergenerational Household Formation, Female Labor Supply and Informal Caregiving: A Bargaining Approach," *Journal of Human Resources,* vol. 34, no. 3, Summer 1999, 475–503.

[23] Rosenzweig, Mark R. and Wolpin, Kenneth I. (1993). "Intergenerational Support and the Life-Cycle Incomes of Young Men and Their Parents: Human Capital Investments, Coresidence, and Intergenerational Financial Transfers," *Journal of Labor Economics,* vol. 11, no. 1, 84–112.

[24] Rosenzweig, Mark R. and Wolpin, Kenneth I. (1994). "Parental and Public Transfers to Young Women and Their Children," *American Economic Review,* vol.84, no.5, 1195–1212.

[25] Rosenzweig, Mark R. and Wolpin, Kenneth I. (1994). "Inequality among Young Adult Siblings, Public Assistance Programs, and Intergenerational Living Arrangement," *Journal of Human Resources,* 1101–1125.